Opportunity & participation for women mine workers in the Bolivian *Altiplano*

A thesis presented in partial fulfilment of the requirements for the degree of Master of Philosophy in Development Studies at Massey University, Manawatu Campus, New Zealand

Howard R Markland

16 March 2012

Abstract

Despite the range of research into mines and mining communities in the Bolivian *Altiplano* over the last 40 years, little attention has been paid to the role of women, despite their significant involvement in the sector for 500 years. Researchers have also tended to focus upon large, State mining operations, although in the last decade there has been growing interest in artisanal mine worker co-operatives, typically in the Department of Potosi.

Bolivia's 1952 socialist revolution significantly improved State sector opportunities for women in the mining sector, but many were made redundant following the 1985 Tin Crisis. Displaced workers subsequently joined artisanal mine worker co-operatives, where most earned a subsistence living by recovering mineral residues from waste rock, tailings piles and alluvial deposits, while few worked in underground roles.

This research aimed to characterise the current participation of women workers in the *Altiplano* mining sector, focusing upon artisanal tin mining activities in the Department of Oruro. The research methodology involved a combination of literature review and in-country data collection, with visits to 19 mine sites and interviews with 27 stakeholders representing a diverse range of sector interests.

Women mine workers in Bolivia are widely referred to using the collective term *Palliris*, although women involved in mining and reprocessing work perform at least 10 distinct occupational roles, each with its own title. Their participation in the mining sector has declined dramatically in the last decade, despite unprecedented access to employment opportunities and record tin prices. Indeed, women workers have all but disappeared from many *Altiplano* mine sites. These conclusions challenge recent research and official statistics, both of which indicate a sustained increase in female participation in artisanal mining.

The principal reasons for declining female participation are considered to be: declining mineral content of waste rock and tailings piles; more attractive employment opportunities outside the sector; and an overall decline in mining sector employment. It was also noted that female participation is likely to continue declining, as mining sector production is rapidly becoming dominated by large scale, mechanised operations, that have no need for labourers with artisanal mining skills.

Acknowledgements

I would like to acknowledge the contribution made by my family, friends and others, without whose support the content of this thesis would be much leaner. In particular, I would like to thank the following:

- My wife and son, who allowed me to escape family commitments for a month while I did my fieldwork in Bolivia.
- Family members in Oruro and Cochabamba, who provided all sorts of support while I did my fieldwork in Bolivia. I am particularly grateful to Nico and Ruben for guiding me around mine sites and helping me contact key people.
- Felipe Coronado Pando and Eloys Trujillo Lunario of the Technical University of Oruro, who provided an excellent introduction to key organisations, individuals and resources.
- The organisations and individuals that provided me with access to their information and sites.
- Those at Massey University who assisted me throughout, including my supervisor Prof Glenn Banks and the Human Ethics Committee which granted approval for my fieldwork.

The Author

Howard Markland has worked for over 25 years in environmental consulting, public health regulation and economic development policy. He was working with the Ministry of Economic Development in New Zealand while preparing this thesis. His academic qualifications include a Master of Science in Public Health Engineering, a Bachelor of Environmental Sciences, and Diplomas in Atmospheric Pollution Control and Occupational Safety & Health.

Key Words

Bolivia, Oruro, mining, artisanal mining, small-scale mining, women, indigenous, development, sustainable, co-operative, tin, *Palliri, Venerista, Relavera, Lamera, Barranquillera, Altiplano.*

Table of Contents

1. INTRODUCTION 1

1.1. Research Topic Selection 1

1.2. Research Approach 2

1.3. Document Structure 3

1.4. Bolivia: an Overview 4

1.4.1. Population 4

1.4.2. Landscape and Vegetation 4

1.4.3. History 5

1.5. Summary 10

2. METHODOLOGY 11

2.1. Introduction 11

2.2. Research Approvals 11

2.3. Regional Focus 11

2.4. Mine Site Targeting 13

2.5. Research Focus 14

2.5.1. Initial Focus 14

2.5.2. Revised Focus 15

2.6. Stakeholder Identification 15

2.7. Implementation 16

2.7.1. Site Visits 16

2.7.2. Stakeholder Interviews 17

2.7.3. Data Management 18

2.7.4. Analytical Method 19

2.7.5. Fieldwork Challenges 19

2.8. Thesis Structure 20

2.9. Summary 20

3. MINING & DEVELOPMENT – AN INTERNATIONAL PERSPECTIVE 21

3.1. Introduction 21

3.2. Mining Activity 21

3.3. Mining and Development 23

3.4. Impacts of Mining Activity 24

3.5. Mining Sector Organisations 25

3.6. Artisanal Mining 27

3.7. Women Mine Workers 27
3.8. Women in a Development Context 29
3.9. Summary 29
4. MINING & DEVELOPMENT IN BOLIVIA 30
4.1. Introduction 30
4.2. Overview of the Bolivian Mining Sector 30
4.3. History of the Bolivian Mining Sector 32
4.4. Mining in Oruro 37
4.5. Mining Methods in the Bolivian *Altiplano* 38
4.5.1. Industrial Methods 38
4.5.2. Artisanal Mining Methods 39
4.6. Impacts of Mining Activity in Bolivia 40
4.6.1. Occupational Health & Safety Aspects 41
4.6.2. Public Health Aspects 41
4.6.3. Environmental Aspects 42
4.6.4. Socio-Economic Aspects 43
4.6.5. Indigenous Groups 45
4.7. Mining Sector Stakeholders in Bolivia 46
4.7.1. Government Departments 46
4.7.2. Mine Worker Unions 47
4.7.3. Non-Governmental Organisations (NGOs) 48
4.7.4. Trans-National Corporations (TNCs) 49
4.7.5. Artisanal Mine Worker Co-operatives 50
4.8. Women Mine Workers in Bolivia 57
4.8.1. Occupational Roles 58
4.8.2. Women in State Mines 62
4.8.3. Women in Mine Worker Co-operatives 63
4.8.4. Women Mine Workers at Home 64
4.8.5. Women's Organisations 65
4.9. The Future of Mining in Bolivia 65
4.10. Summary 67
5. FIELDWORK FINDINGS 69
5.1. Introduction 69
5.2. Fieldwork Overview 70
5.3. Extraction Operations 71

5.3.1. State Extraction Operations 71
5.3.2. Private Extraction Operations 73
5.3.3. Mine Worker Co-operative Extraction Operations 73
5.4. Mineral Processing Operations 75
5.4.1. State Processing Operations 75
5.4.2. Private Processing Operations 76
5.4.3. Mine Worker Co-operative Processing Operations 76
5.5. Mining Sector Institutional Relationships 77
5.5.1. Government Departments 77
5.5.2. Artisanal Mine Worker Co-operatives 78
5.5.3. Non-Governmental Organisations (NGOs) 78
5.5.4. Mine Worker Unions 79
5.6. Women Mine Workers 79
5.7. Department of Potosi 80
5.8. Summary 81
6. ANALYSIS OF RESULTS 84
6.1. Introduction 84
6.2. Organisation of the Mining Sector 84
6.3. Mining Sector Activity 88
6.4. Occupational Roles in the Mining Sector 92
6.5. Opportunities for Women Mine Workers 101
6.6. Professional Recognition for Women Mine Workers 105
6.7. Participation of Women Mine Workers 106
6.8. Summary 110
7. CONCLUSIONS 112
7.1. Introduction 112
7.2. What institutions constitute the *Altiplano* mining sector? 112
7.3. What mining activity is currently taking place? 113
7.4. What occupational roles are available to women? 114
7.5. What factors influence women's participation? 114
7.6. What is the likely future for women mine workers? 116
7.7. Summary 117
7.8. Suggested Further Research 118
REFERENCES 119

APPENDIX A - MINING TERMINOLOGY AND ACRONYMS 145
APPENDIX B - BOLIVIA: CHRONOLOGY OF KEY EVENTS 149
APPENDIX C - MASSEY UNIVERSITY HUMAN ETHICS COMMITTEE APPROVAL 159
APPENDIX D – PROJECT INFORMATION SHEETS 160
APPENDIX E - STAKEHOLDER ORGANISATIONS 165
APPENDIX F - FIELDWORK PROGRAMME 168
APPENDIX G – RECORD OF SITE VISITS 170

List of Figures

Ref	Title	Page
1.1	South America	6
1.2	Vegetation Map of Bolivia	7
1.3	Topographic Map of Bolivia (showing the *Altiplano* region)	8
1.4	Mines in the Bolivian *Altiplano*	8
1.5	Cerro Rico at the centre of the Bolivian coat of arms	9
2.1	Administrative Regions (Departments) in Bolivia	12
2.2	Mining centres targeted for site visits	13
3.1	Industrial processing to produce Tin	22
4.1	Mine Revenue (US$ million)	34
4.2	Mining Sector Contribution to Total Exports (US$ millions)	35
4.3	Price trend for Tin (1900 – 2011)	36
4.4	Price trend for Silver (1975 – 2011)	36
4.5	Extract from a draft CEPROMIN publication for miner's wives	66
6.1	Stakeholder Relationships in the Bolivian Mining Sector	85
6.2	Mine Worker Co-operatives Affiliated to FENCOMIN	86
6.3	Membership of Mine Worker Co-operatives	86
6.4	Tin Mining & Processing Overview (Generic)	89
6.5	Comparison of State and Co-operative Sector Mining Operations in Oruro	90
6.6	Distribution of Mining Sector Occupational Roles	101
6.7	Role Availability Trends for Women Mine Workers	103
6.8	Occupational Status Trends for Women Mine Workers	106
6.9	Participation Trends for Women Mine Workers	107

List of Tables

Ref	Title	Page
1.1	Statistical Summary for Bolivia	5
3.1	World Tin Production: Major Exporters	21
4.1	Statistical Summary for Oruro	37
4.2	Mining Co-operatives & their Membership (1986 – 2010)	51
4.3	Metal Mining Co-operatives Affiliated with FEDECOMIN, Oruro (2007)	54
4.4	Metal Mining Co-operatives Affiliated with FEDECOMIN, Oruro (2011)	55
4.5	National Statistics for Mine Worker Co-operative Membership (2008 to 2010)	56
4.6	Age Distribution for *Palliris* working at Cerro Rico, Potosi	62
4.7	Female Membership of Mine Worker Co-operatives in Bolivia (2003 – 2008)	63
5.1	Mining Operations Visited (18)	70
5.2	Interviews Conducted (27)	72
6.1	Principal Occupational Roles for Labourers at Bolivian Mine Sites	93
Appendix E	Stakeholder Organisations	165

List of Photographs

Ref	Title	Page
1.1	Women workers recovering mineral from a stream below Mina Huanuni (2000)	1
1.2	Mine workers making offerings to El Tio (the devil) at Cerro Rico, Potosi	10
2.1	Researcher in Conversation with a *Palliri* (Mina Santa Rita, Oruro)	18
4.1	A mine tailings pile dominates the town of Atocha (2000)	33
4.2	Eighteenth Century Buddles at Consols tin mine in, St Ives, Cornwall, UK	41
4.3	*Palliri* re-working a waste rock pile, Mina Siglo XX (undated)	59
4.4	*Palliri* picking mineral from a conveyor	60
4.5	*Relavera* using a Buddle to recover tin from *ingenio* waste	61
4.6	*Locatorias* loading an ore car	61
4.7	*Locatorias* at Mina Atocha (2005)	62
5.1	Northern edge of the City of Oruro (with Mina Santa Rita in centre of picture)	69

6.1	*Barranquilleras* panning for gold residues in Bolivia's lowlands.	94
6.2	*Commercializadora* (mineral trader) operation in Oruro	94
6.3	*Lamera* panning *ingenio* waste to recover tin residues, Huanuni, Oruro.	95
6.4	*Lamera* using a filter box to concentrate tin residues, Uncia, Potosi.	95
6.5	*Lavadoras* (laundry workers) at Mina San Jose, Oruro	96
6.6	*Locatorias* (female mine labourers), Mina Itos, Oruro	96
6.7	*Palliri* concentrating mineral on waste rock piles, Santa Rita, Oruro.	97
6.8	*Perforista* (male driller) at Mina Pulucayo.	97
6.9	*Recolecteras* (miner worker assistants), location unknown, circa 1980	98
6.10	*Relaveras* using a buddle, Machacamarca, Oruro	98
6.11	*Sirena* monitoring a shaking table, *Ingenio* Machacamarca, Oruro	99
6.12	*Transportadoras* pushsing an ore car, Mina Poopo, Oruro	99
6.13	*Vendedora* with food for mine workers, Mina San Jose, Oruro.	100
6.14	*Veneristas* recovering mineral from alluvial deposits, Mina Unificada, 1997	100
6.15	*Palliris* working on waste rock piles	103
6.16	*Relaveras* using buddles	104
6.17	*Palliris* numbers working on waste rock piles	104
6.18	*Lameras* at Mina Huanuni, Oruro	105
G1	Mina San José, Oruro	172
G2	Miner workers with mineral in their backpacks	172
G3	Deteriorating infrastructure (Mina San José)	173
G4	Female laundry workers (Mina San José)	174
G5	Female labourers moving soil to re-vegetate the waste rock pile (Mina San José)	174
G6	*Palliri* working the upper waste rock pile (Mina Santa Rita)	175
G7	*Palliri* working the waste rock pile (Mina Santa Rita)	176
G8	Miners leaving the mine opening (Cooperativa Mina Nueva San José)	177
G9	Cooperativa Salvadora at Itos	178
G10	Abandoned *Ingenio* and Tailings Pile (Mina Itos)	178
G11	Baremsa SA remediation plant at Itos	179
G12	Lone miner washing his boots in acid leachate, Mina Siglo XX, Llallagua (Potosi)	181
G13	Abandoned *Palliri* and *Relavera* workings, Mina Siglo XX, Llallagua (Potosi)	181

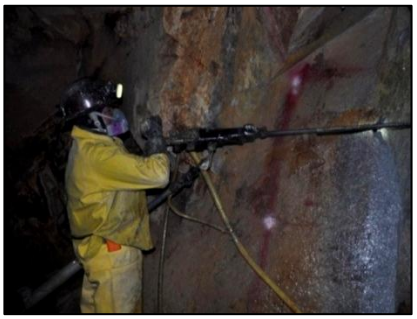
G14	Mine workers at Mina Siglo XX (upper entrance), Llallagua (Potosi)	182
G15	Female underground mine workers from Mina Siglo XX (Llallagua)	183
G16	Waste rock pile below Mina Siglo XX, Llallagua, Potosi	184
G17	*Palliri* working alone on the waste rock pile at Mina Siglo XX, Llallagua, Potosi	184
G18	Ex-COMIBOL *Ingenio* at Uncia (Cooperativa 20 Octubre Ltda), Potosi	185
G19	Shaking tables in the *Ingenio* Uncia, Potosi	186
G20	Crushing apparatus (*Trituradora*) at *Ingenio* Uncia, Potosi	186
G21	*Lamera* beside the river at *Ingenio* Uncia, Potosi	187
G22	*Ingenio* at Mina Huanuni (and discharge to river)	188
G23	Looking downstream from Mina Huanuni *Ingenio*	189
G24	*Relaver*s working immediately downstream from Huanuni	189
G25	Extensive *Relavera* workings appear as small lagoons beside the river	190
G26	Mina Huanuni (Aerial Photograph)	190
G27	Female worker maintains shaking tables (*Ingenio* Machacamarca)	191
G28	Mining Co-operatives recovering mineral from tailings waste at Machacamarca	192
G29	Mining Co-operatives recovering mineral from tailings waste at Machacamarca	193
G30	Co-operative mine workers at Mina Poopó	195
G31	Secondary mine entrance tunnel at Mina Poopó	195
G32	Mineral piles being graded *(Commercializadora* SRV, Oruro)	197
G33	*Commercializadora* Kori Sonko (Oruro)	197

Glossary

Spanish language terms are presented in *italics*.throughout this thesis, and the following provides an image and summary description for Bolivian mining sector terms which are widely used.

	***Barranquillera*** Person who pans alluvial deposits in rivers to recover gold residues. Source:
	***Buddle*** Shallow hole used to concentrate cassiterite from tailings waste using a batch sedimentary process. Source: Author
	***Cola*** Waste rock pile (coarse waste material from extraction activity), typically found below the mine opening. Source: Author
	***Commercializadora*** Person who acts as an intermediary between the mine and the smelter/exporter, exchanging mineral for money. Source: Author

	***Desmonte*** Tailings waste pile (fine grained waste material from mineral processing activity), typically found below the *ingenio.* Source: Author
	***Ingenio*** Processing facility using physico-chemical processes to remove mineral from run of mine. Source: Author
	***Lamero/a*** Man/woman who pans river sediment and *ingenio* waste to recover tin residues, typically working in rivers, drains and channels around mine processing areas. Source: CEPROMIN 2009
	***Lavadora*** Woman who washes clothes for mine workers. Source: Author

	***Locatorio/a or Minero/a*** Underground mine worker (general labour) using manual apparatus. Source: La Patria 2010b
	***Palliri*** Man/woman who selects and concentrates mineral by hand, using a lump hammer. Source: Author
	***Perforista*** Underground mine worker (driller) who uses a hydraulic or pneumatic drill to remove ore. Source: MiningTechnology.com 2011
	**R*ecolectera*** Person who carries tools and supplies for miners. Source: Unknown Author 2008

	***Relavera*** Person who concentrates mineral by batch sedimentation process, typically in a buddle. Source: Author
No image available (illegal activity)	***Rescatiri*** Person who is an unregistered (illegal) ore trader, buying mineral from individual miners and co-operatives.
	***Sirena*** Man/woman who monitors the mine opening or the status of important plant such as compressors, pumps and shaking tables. Source: Author
	***Transportadora*** Person who carries run of mine from the work face to the surface (in an ore car). Source: Author
	***Vendedora*** Woman who sells food and mine supplies (e.g. dynamite, detonators, coca leaf, alcohol or food) near the mine opening. Source: Author

	***Venerista*** Man/woman who recovers mineral by excavating alluvial deposits along river banks. Source: Courtesy of URS Corporation

1. Introduction

1.1. Research Topic Selection

When employed as an environmental consultant by URS Corporation Limited, I conducted environmental baseline investigations in the Bolivian *Altiplano* between 2000 and 2002. During this time, I visited numerous historic mine sites in the catchment of the Salar de Uyuni, to assess the nature, severity and extent of environmental contamination from historic mining operations. I also visited Mina Huanuni, entered artisanal mine workings at Cerro Rico in Potosi, and did an environmental assessment for a mining project to reprocess historic waste rock piles from around Cerro Rico. During my visits to *Altiplano* mining operations, I noted that women were reworking mine process residues at many mine sites (Photograph 1.1). I was also informed that women did not work underground at the mines due a belief that their presence would anger Pachamama (earth goddess) and cause bad luck for the miners.

Photograph 1.1 Women workers recovering mineral from a stream below Mina Huanuni (2000)

Source: Author

On revisiting Bolivia in 2009, I discovered that there was significantly less reprocessing activity taking place than in 2002, and that the number of women artisanal mine workers appeared to be in decline. At the same time, there was anecdotal evidence that women mine workers were now shifting to underground roles at some mine sites. What was not clear was the extent to which the decline in the number of surface workers was due to women taking on new roles underground.

On returning to New Zealand, I tried to investigate these trends further, but was surprised to find that women mine workers were not well represented in research literature and that most documented investigations focused upon a single occupational group *(Palliris)* at a single site (Cerro Rico) in the tourist town of Potosi. This led me to question the adequacy of some of the research conducted and its relevance to other significant mining regions across the Bolivian *Altiplano*.

I therefore chose to provide a characterisation of contemporary mining activity (especially tin mining) in a prominent part of the Bolivian *Altiplano*, with a specific focus on the roles of women involved in artisanal mine work, the opportunities available to them and factors that influence their participation. The following specific research questions were selected to frame this research:

1. What institutions constitute the *Altiplano* mining sector?
2. What mining activity is currently taking place?
3. What occupational roles are available to women?
4. What factors influence their participation?
5. What is the likely future for women mine workers?

This research was conducted with an element of urgency, as there was a real risk that some groups of women mine workers could disappear before the research was done.

1.2. Research Approach

There are many significant mine sites scattered across the Bolivian *Altiplano*. As it was not practicable to visit all these sites, I decided to focus upon tin mines in the Department of Oruro (see Figure 1.10), as this region has played a significant role in Bolivia's mining history, yet has received considerably less research attention than Cerro Rico in Potosi. The resulting research would provide a baseline characterisation for women mine workers in the Department of Oruro.

It was also considered important for the research scope to consider a range of contextural factors, such as mineral processing methods; customs and beliefs; mining history; the sector stakeholders; plus a range of other socio-economic and environmental considerations.

1.3. Document Structure

This thesis focuses upon characterising *Altiplano* mining activities and organisations, and the involvement of worker co-operatives and women workers in the mining sector. This structure was adopted in preference to one based on specific development themes, as it is more consistent with the existing research literature about women involved in mining activity in the Bolivian *Altiplano*.

The first three chapters of this thesis provide the reader with the background, context and other information necessary for them to gain sufficient understanding of the role of women in the Bolivian mining sector, and refine the research questions. The remaining chapters then specifically address the research questions, by comparing documented research with field observation and drawing conclusions.

The next section in this chapter provides the reader with essential background to Bolivia's geopolitical history, indigenous groups, mining sector and the organisation of labour. This background is relevant to the understanding of current day conditions, and the factors that have shaped the mining sector in general, and the involvement of women mine workers in particular. Chapter 2 (Methodology) then introduces the provisional and final methodologies adopted for field research in Bolivia, and the analytical framework adopted to evaluate findings. The literature review is split between chapters 3 and 4, with Chapter 3 summarises documented research into mining methods and occupational settings, as well as the socio-economic and environmental impacts of mining in an international context. Chapter 4 then does likewise, but focusing specifically on the Bolivian context, and also considering less formal sources of contemporary information, which describe recent changes in the sector and the involvement of women mine workers. Findings of the in-country data collection are then presented in Chapter 5 (Fieldwork Findings), and then considered in the context of the literature review in Chapter 6 (Analysis of Results), to identify significant issues, trends and relationships. Finally, Chapter 7 (Conclusions) attempts to provide a response to each of the research questions, and is followed by a list of 275 references which were consulted in the preparation of this thesis.

The Appendices provide supporting information, including a chronology of Bolivian history, a list of key organisations in the Bolivian mining sector, and a summary for each of the site visits conducted during the in-country data collection.

1.4. Bolivia: an Overview

The following sections provide an introduction to Bolivia, its people and the mining sector, to provide the reader with a basic understanding of the significant historic, political, social, economic, occupational and environmental factors of relevance to this research topic. These issues are revisited in greater details Chapter 3 (Literature Review), while a chronology of significant events in Bolivia's history is provided in Appendix B on page 149, providing further context regarding the Bolivian mining sector.

1.4.1. Population

Bolivia has a population of 10.4 million (INE 2009), three quarters of which live in the urban centres of La Paz, Santa Cruz and Cochabamba. Indigenous peoples represent 55% of the total population, which comprises 29% Quechua, 24% Aymara, 1% Guarani and 1% Chiquitano. The balance is made up of the descendants of African slaves, Spanish settlers and other migrants (US State Dept 2009). Bolivia is one of the lesser developed countries in the world (95th out of 169 countries), typified by low incomes, low life expectancy and high income inequality, as summarised in Table 1.1.

Two-thirds of Bolivians make their living in the informal sector, with trading in contraband, drug production and drug trafficking growing rapidly. There are also major disparities of income distribution; with the richest 20% of the population accounting for half the nation's income, while the poorest 20% receive less than 6% of total income. (Von Gleich 2000).

1.4.2. Landscape and Vegetation

Bolivia is a one million square kilometre land-locked nation at the heart of South America (Figure 1.1), comprising three main geographic zones. The *Altiplano* in the South West has an average altitude of 3,750 metres and occupies 28% of the country's land area. Sub-tropical jungle lowlands dominate the North and East, while the *Altiplano* and lowland are separated by a transitional zone of steep mountain slopes and valleys (UNICEF 2011).

Much of the country is vegetated (see Figure 1.2), with dense jungle in the north, extensive grasslands in the East and scrub woodlands to the South. However, the *Altiplano* (see Figure 1.3) is predominantly arid and barren, with vegetation limited to sparse tussock grass. Melt water from the mountains drains to the centre of this plateau, where it has evaporated over millennia to form two of the world's largest salt lakes. Mineral deposits abound in the *Altiplano* due to extensive volcanic and geothermal activity.

Statistic	2009 data
Population[1]	10,426,154 (1:1 ratio for male:female)
Indigenous groups[2]	62% of total population (age >15 years)
Life expectancy at birth[2]	66.3 years
Human development index value[2]	0.643
Human development index ranking[2]	95th out of 169
Gross Domestic Product per capita	2010: US$4,502[2] 2009: US$4,206[3]
Gross National Income (atlas method)	2011: US$1,790[5] 2008: US$1,460[4]
Gross National Income per capita (PPP)	2010: $4,560[7]
Mean annual income (2009)[1]	US$1,683
% of population living on <US2/day[6]	21.9% (2007) 30.4% (2005)
Income inequality ratio[3]	64.7:1
Literacy of population (age >5 years) [1]	95%
Total health expenditure per capita[2]	US$200
Annual population growth rate[2]	1.56 in 2004
Urban population[1]	6,922,107
Rural population[1]	3,504,047

Table 1.1 Statistical Summary for Bolivia

Sources:
1 - INE 2009
2 – UNDP 2010
3 - UNDP 2009
4 – World Bank 2010a
5 - World Bank 2011a
6 - World Bank 2011b
7 - World Bank 2010b

Most of Bolivia's mines were historically established in the mountainous East of the Bolivian *Altiplano* (Figure 1.4), in an area 1,000 Km long and 175 Km wide, representing 10% of Bolivia's total land area (Quiroga 2002). COMIBOL operated over 50 significant mining centres across the *Altiplano*, in the Departments of Potosi, Oruro and La Paz (Espinoza Morales 2011)

1.4.3. History

People first settled parts of the Bolivian *Altiplano* over 100,000 years ago, leading to the sophisticated Tiwanaku civilization that was established to the South of Lake Titicaca, but which disappeared in the thirteenth century following prolonged drought. The Aymara people controlled much of the area by the end of the fourteenth century, but were defeated by the Incas in the fifteenth century.

Figure 1.1 Bolivia, Land-Locked in the Centre of South America

Source: Latinfreight.com (2011)

The Incas ruled this region until the arrival of Spanish Conquistadores (Hudson & Hanratty 1989) in 1538, imposing their *Hacienda* system of forced labour in the mines and fields. The Hacienda system created great wealth for Spain and the head of each *Hacienda*, while reinforcing the poverty and dependency of indigenous peasant workers (Kohn 1982). The Bolivian people eventually won their independence from Spain in 1825, but by then Bolivia was a poor, volatile country; heavily dependent upon mineral export. In 1952, a peasant uprising led to a socialist revolution and a period of relative stability. However, Bolivia was plunged into crisis 33 years later when the US sold its strategic tin reserves, precipitating the 1985

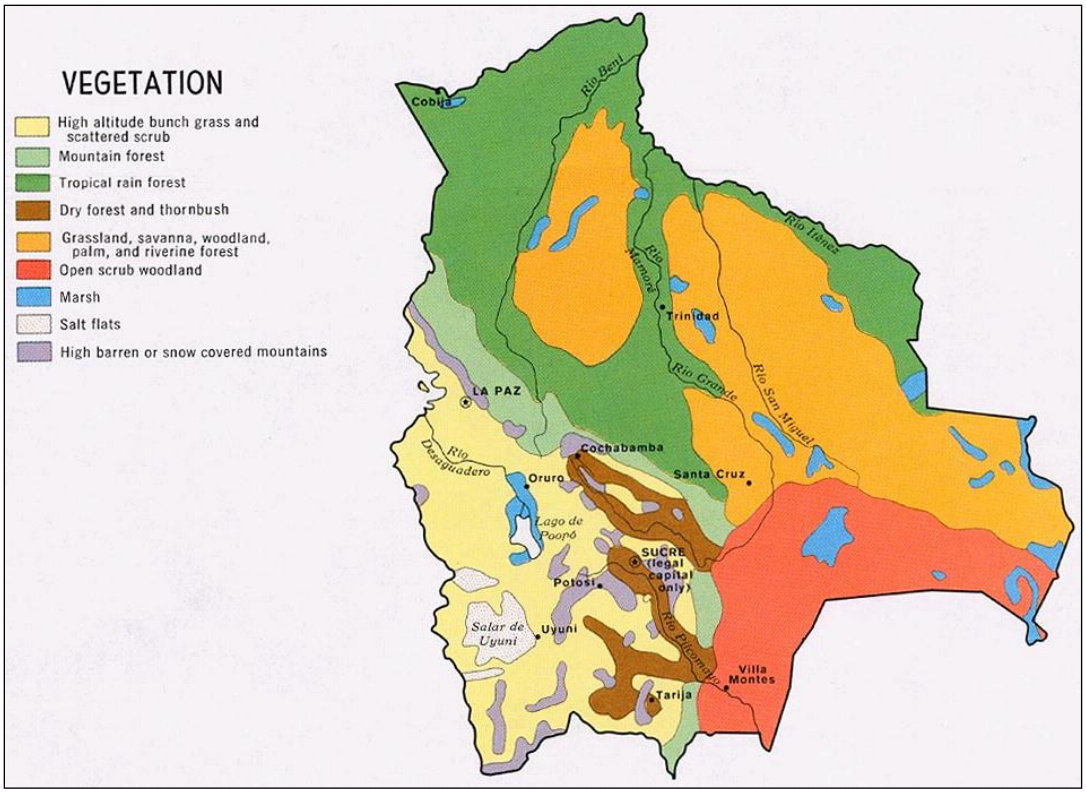


Figure 1.2 Vegetation Map of Bolivia

Source: University of Texas (1971a)

'Tin Crisis'. The resulting closure of many *Altiplano* mines made 80% of the mine workforce redundant and initiated a depression (Quiroga 2002). Many of those who failed to find alternate work joined artisanal mine worker co-operatives, to eke-out a subsistence living by working in abandoned mines and reprocessing historic waste piles.

Following the Tin Crisis, Bolivia became heavily dependent upon international aid, with debt servicing crippling its subsequent economic growth potential. Bolivia was classified as a Highly Indebted Poor Country from 1996 until 2002, with a Human Development Index ranking that was the third lowest in Latin America (UNDP 2010). However, conditions have improved markedly in Bolivia since the start of the new millennium, due to a combination of major gas discoveries in the lowlands, debt cancellation, record commodity prices for tin and silver, a period of political stability and major mining prospects. Despite the importance of mineral exports to the Bolivian economy, extraction and processing methods at many mines have remained relatively primitive. Bolivia has limited smelting and manufacturing capability, which means that exports are principally in the form of ingots and ores, rather than manufactured goods.

Figure 1.3 Topographic Map of Bolivia (showing the *Altiplano* region)

Source: InterCarto (2012)

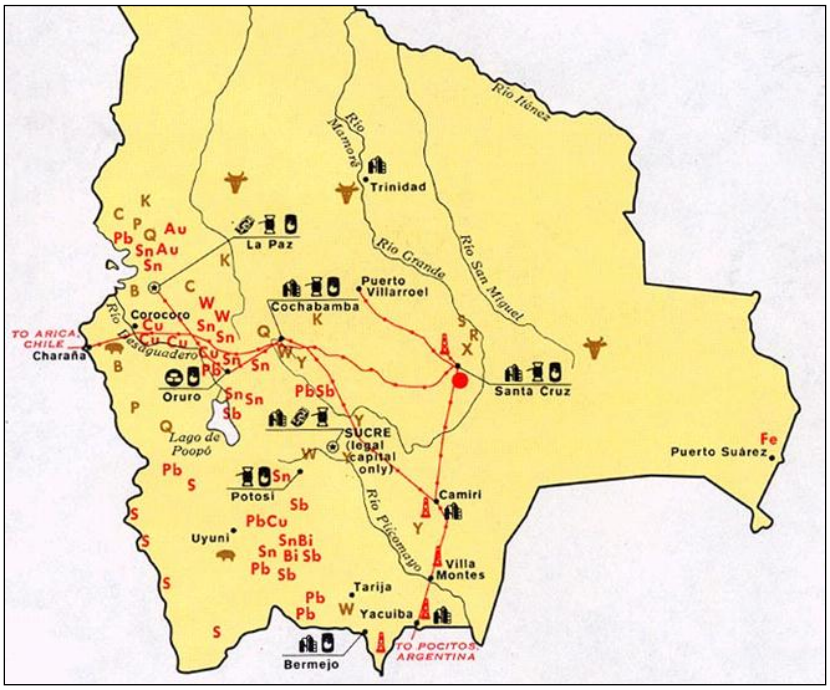


Figure 1.4 Mines in the Bolivian *Altiplano*

Source: University of Texas (1971b)

Worker exploitation, environmental contamination and a poor record for occupational health and safety have been defining characteristics of mining in the *Altiplano*. It has been estimated that 1-8 million slaves died during the operation of Cerro Rico alone, representing around 70% of those who worked there (Jones 2011). Environmental degradation and economic dependency are also common in mining communities, with significant public health and social consequences. Nevertheless, mining has maintained a prominent position in the national psyche, as demonstrated by the image of Cerro Rico in the centre the Republic of Bolivia's coat of arms and the national flag (Figure 1.5).

Figure 1.5 Cerro Rico at the centre of the Bolivian coat of arms

Source: Promocion Mutual La Paz (2011)

Miners have played a prominent role in Bolivian politics throughout the country's history, and have been referred to as '*Ministerios del Revolucion'* because of their militancy, and as *'Ministerios del Diablo'* due to their reverence to statues of the devil in the mines (Absi 2009), as illustrated in Photograph 1.2. Miners have believed that allowing women into the mine would anger the devil and bring bad luck, and for generations this superstition has barred women from working underground. Indeed, the strength of this superstition and mine worker reverence for the devil has even been the subject of prominent research work (Taussig 1980). During the last decade, tourism has grown significantly and female tourists have been allowed to enter the mines of Cerro Rico, challenging this long held belief. Ironically, this has provided a good source of supplementary income for artisanal mine workers (Absi 2009).

Photograph 1.2 Mine workers making offerings to El Tio (the devil) at Cerro Rico, Potosi

Source: Wren 2010

Although Bolivia's economy was heavily dependent upon mining until the Tin Crisis in 1985, the state failed to generate sufficient revenues to embark on a development programme to diversify exports, as the sector was already moribund (Maalderink 2009). Mining sector corruption, ore theft and illicit mineral sales have been a major problem for governments in Bolivia. The National Chamber of Exportation (CNEB) estimated that only 50% of mineral exported from Bolivia is officially registered in 2006, when black market exports were valued at US$1.07 billion. This represented a tax loss to the government of US$70 million. Losses are thought to occur across the sector, and some of the largest mines are implicated (Mineria de Bolivia 2007).

1.5. Summary

This thesis focuses upon mining activities in the Bolivian *Altiplano*, and in particular, the work opportunities and participation of women working with mine worker co-operatives. This chapter has provided a background to the geographic, political and economic forces that have influenced Bolivia's mining sector for the last 500 years. The next section introduces the research methodology used.

2. Methodology

2.1. Introduction

The research methodology was developed by giving due consideration to the research objectives, currently available information (via literature search, personal experience and feedback from in-country contacts). Further significant considerations were the likely logistical constraints, language difficulties and cultural barriers that would face a middle-aged Western male while researching women workers in poor communities across the Bolivian *Altiplano*.

In-country contacts Reuben Fuentes and Nicobar Laura (relatives of mine with experience in the mining sector in Oruro) provided valuable information for planning the in-country research, based upon information received from their extensive networks within the mining sector in the Department of Oruro. They assisted fieldwork planning by providing a status update on mine sites and made preliminary contact with sites and organisations to establish whether they would be amenable to a visit from an overseas researcher. Finally, they provided assistance with accommodation, logistical arrangements and appointments.

2.2. Research Approvals

Massey University applies a two-tier ethics approval process for research work of this nature, requiring formal approval from both the Department and the Human Ethics Committee. Any research is to be conducted according to requirements of the ethics approvals issued. Approval to commence this research work was obtained from the College of Humanities and Social Sciences on 16th December 2009. However, the Massey University Human Ethics Committee (MUHEC) declined ethics approval for planned fieldwork in March 2011 as a Ministry of Foreign Affairs and Trade travel advisory was in place for Bolivia at the time, which warned of the risk to personal safety in Potosi, Uyuni and La Paz and advised against all non-essential travel. A 'high-risk' application was subsequently submitted, and following an interview with the MUHEC, approval was finally granted on March 10th 2011. The MUHEC research approval letter is presented in Appendix C on page 159.

2.3. Regional Focus

The number of *Altiplano* mining communities, their geographic distribution and restricted access meant that it would only be possible to visit a small sample of mine sites during the three week in-country data

collection phase. It was therefore decided to focus upon mine sites in a single *Department* (administrative region) of the *Altiplano*. Many contemporary researchers have focused upon working conditions in the artisanal silver mining at Cerro Rico in the Department of Potosi, and to a lesser extent, artisanal gold mining in the Department of La Paz. It was decided to focus this research on tin mining activity in the Department of Oruro, to provide a complementary dataset which could be compared with other *Altiplano* Departments. Department boundaries within Bolivia are illustrated in Figure 2.1.

Figure 2.1 Administrative Regions (Departments) in Bolivia

Source: UNDP (2011)

Available research identified that there had been a long history of significant mining activity in the Department of Oruro, and that although many State mining operations closed down, activity remained significant. Mine sites in the Department range in size from internationally significant operations to artisanal activity on waste piles at closed mine sites. They also include several *ingenios* used to process mineral, and a large foundry at Vinto near Oruro. Most mines in the Department of Oruro focus upon tin extraction, although there are also two gold mines others that extract silver, zinc lead and wolfram.

2.4. Mine Site Targeting

The city of Oruro was selected as a base for fieldwork, as it was convenient to meet organisations based in the city and also to reach mine sites around the city fringe. It is also within a day-return road trip of several other significant *Altiplano* mine sites (see Figure 2.2) and only 4 hours by road from the main cities of Cochabamba and La Paz.

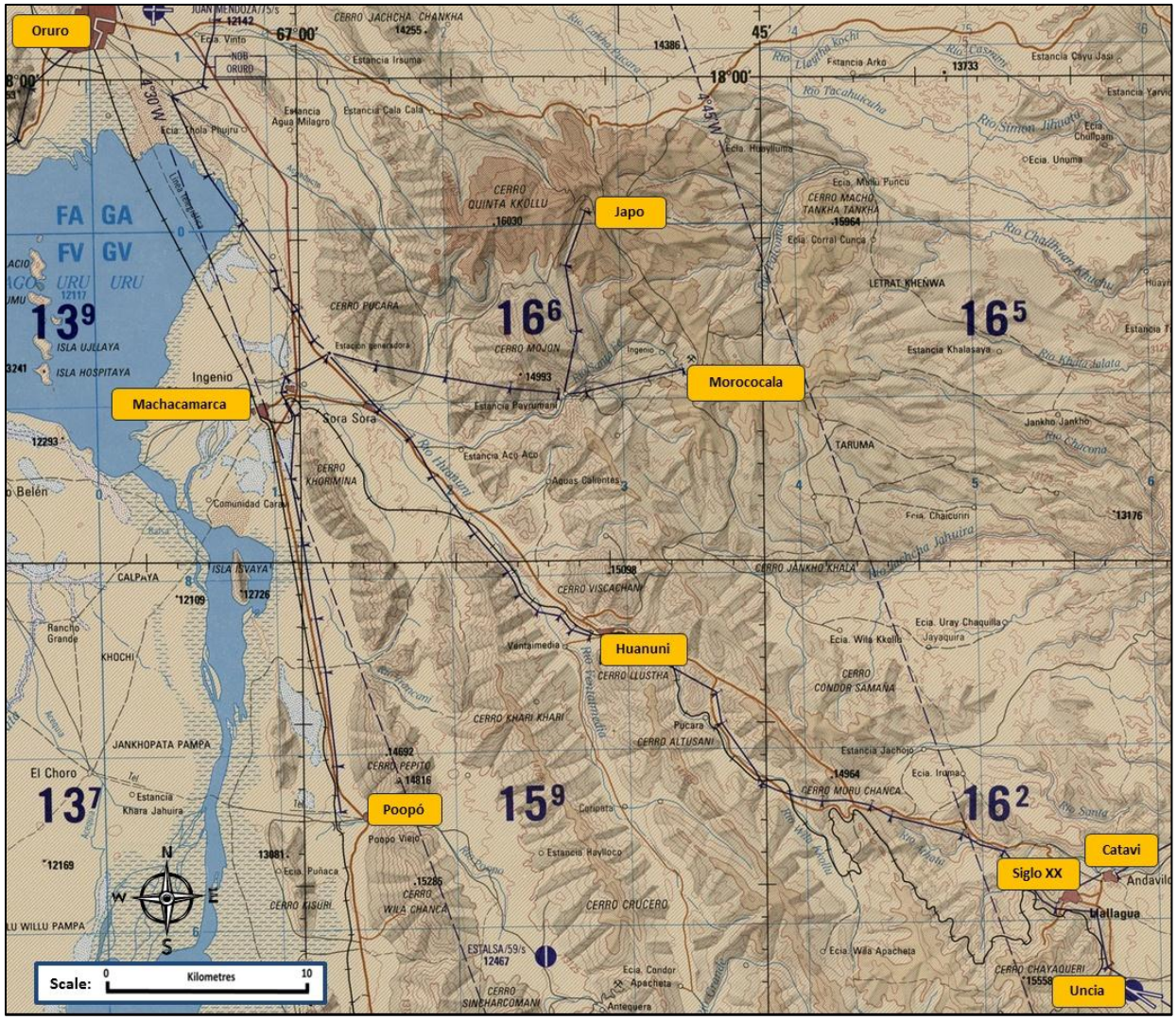


Figure 2.2 Mining centres targeted for site visits

Source (base map): US Government (1995)

The San José mine is situated in the heart of Oruro, while the mines of Santa Rita, Itos and Playa Iroco are distributed around the northern fringes of the city. Other major mine sites are located within 100

Km of Oruro by road (including Huanuni, Poopó, Machacamarca, Japo and Morococala). Three major ex-COMIBOL mining centres in the neighbouring Department of Potosi (Siglo XX, Uncia and Catavi) are also within a day return trip of Oruro, and could provide a useful insight into possible differences between mining operations in different Departments.

It was considered feasible to visit all these locations during the time available in-country. However, road travel can be difficult in the *Altiplano*, due to a combination of poor roads and variable weather conditions. There was a particular risk that it would not be possible to reach the mine sites at Japo and Morococala, as in-country contacts considered the road dangerous as it was narrow, winding, unsealed and subject to both landslides and fog. Another travel consideration was the likelihood of impromptu road blocks, which are commonly erected by protesting groups such as miners, transport workers and *Campesinos*. Although the road blocks themselves are easy to pass, it is dangerous to do so as the protesters may be intoxicated and often possess weapons or dynamite. Despite this risk, the Department of Oruro is relatively conservative by Bolivian standards, and in-country contacts considered it unlikely that roadblocks would be encountered between Oruro and target mine sites.

In addition to visiting mine sites in and around Oruro, trips to stakeholder organisations in Cochabamba and La Paz were also considered necessary. A visit to Cochabamba would provide an opportunity to meet a local environmental consultancy group with extensive experience of mine sites around Bolivia, and an NGO involved in employee rights and environmental protection in the mining sector. La Paz is the country's capital and administrative centre, and would provide an opportunity to meet a range of central government offices and NGOs with mining sector interests.

2.5. Research Focus

2.5.1. Initial Focus

The original research scope was to characterise the occupational lives of women recovering mineral from the river below the mine at Huanuni. The planned research method was to interview these women during their normal work, using pre-determined questions presented during an informal conversation, assisted by an interpreter (if required). Field notes would be supplemented by voice recording and photographs, subject to consent being obtained. Other organisations would then be interviewed to provide complementary information, using a structured questionnaire. All necessary questionnaires were prepared (in Spanish) in advance of the fieldwork. This data collection methodology focused on

characterising work activities, and was informed by the comprehensive toolkit for evaluating artisanal mining activities developed by the World Bank (Noetstaller et al. 2004 & 2005).

On visiting the mine site at Huanuni, it was immediately apparent that the women were no longer working in the river below the mine site. Their absence was confirmed by several people in the area, who indicated that the women had now either taken up other forms of work or left the area. This information essentially meant that it was not possible to proceed with the planned research. It was therefore necessary to develop a new research focus and methodology while in the field, to avoid the time in-country being wasted.

2.5.2. Revised Focus

Visits to mine sites in and around Oruro confirmed that women were still working in parts of the mining sector, but that their numbers were significantly lower than the impressions obtained from the literature review. It was therefore decided to re-focus the research topic upon the range of occupational opportunities available to women working in the mining sector, to evaluate their participation and to investigate why the number of women actively engaged in mining sector work appeared to be declining.

There was insufficient time available to revise the Spanish language questionnaires to reflect such a significant change in research focus. Consequently, the decision was made to take a less formal approach to data collection. Instead of questionnaires, the approach would involve conversations with as wide a range of stakeholders as possible in an attempt to gather information and perceptions about women in the mining sector. The information gathered would be supplemented by observations of conditions encountered during site visits.

2.6. Stakeholder Identification

It was possible to identify a large number of individual stakeholder organisations (see Appendix E on page 165) via a combination of literature review, internet search and discussion with in-country contacts. Key stakeholders considered for the in-country data collection included mine workers, mining companies, mine worker unions, mine worker co-operatives, central and local government departments, non-governmental organisations (NGOs) working in the mining sector, community groups, academics involved in mine sector research and environmental consultancy groups active in the sector.

Stakeholder groups were ranked according to their potential contribution to the research objectives, and the likelihood of them being available for a meeting during the period of in-country research. This enabled a shortlist of priority stakeholders to be identified, and in-country contacts were requested to arrange stakeholder meetings prior to the fieldwork commencing.

2.7. Implementation

In-country research was conducted over a 25-day period from 17 March to 11 April, 2011, which involved the following:

- 16 days in Oruro to visit mine sites and workers, co-operatives, academics, NGOs, & unions.
- 1 day in the Department of Potosi to view historic mine sites and meet a key stakeholder.
- 3 days in Cochabamba to meet a consultancy group and prepare for interviews in La Paz.
- 2 days in La Paz to meet with central government departments, NGOs and union organisations.

A research base was established in central Oruro, which proved to be an ideal location for mine site research. In-country contacts arranged a car and driver for all site visits, and most visits proceeded according to plan. By the conclusion of in-country data collection, research activity had included a total of 18 site visits and 27 interviews across Oruro, Potosi, Cochabamba and La Paz. All in-country research activities conformed to Massey University ethical requirements at all times, and participants were presented with a Spanish language version of the project information prior to visits or interviews (see Appendix D on page 160).

2.7.1. Site Visits

Due to weather impacts on site accessibility and the difficulty in getting telephone contact details for officials at mine sites, visits were made to mine sites without an appointment, although authorisation to access each site was sought on arrival.

At each site, attempts were made to contact the most senior person possible who could co-operate with me, and to be accompanied while on site by somebody familiar with operations, personnel and hazards at the site. I was accompanied by mine personnel at sites operated by COMIBOL and private mining companies, and at *ingenios* where mechanical plant was operating. However, no guide or supervision was available at abandoned COMIBOL mines and outdoor reprocessing operations managed by mine

worker co-operatives. At no time did I enter underground mine areas or attempt to interview those involved in illegal activity, as this would have infringed ethics approval.

At each site, particular emphasis was made to identify and characterise female participation in work activities. However, the vast majority of people encountered at the sites visited were male, and only a handful of women mine workers were actually encountered during the site visits. Several interviewees referred to the fact that women did work at the site but were not present at the time, but again the numbers concerned were rarely higher than five women at any given site, with the exception of mining and reprocessing activities at Huanuni.

Information was collected via a combination of observation and conversation with labourers or those accompanying me. Most participants were happy to provide information, but were typically vague or uncertain when discussing specific figures (dates, costs and quantities). Photographs were taken to supplement field observations, subject to prior consent. Where people were identifiable in the photographs, the subject was shown the photograph and asked for their permission to potentially use in in a published thesis. All subjects gave their consent when requested, although none was willing to provide their consent in writing. Voice recordings were not taken, following suggestions by in-country contacts that doing so would cause undue suspicion and may lead to the involvement of local police of mine site security personnel.

2.7.2. Stakeholder Interviews

All interviews with key stakeholders were by prior appointment. Each interview began with a brief introduction of the research project, presentation of the project information sheet (see Appendix D on page 160) and an indication of information that could possibly be contributed by the interviewee, and a request that they allow a record to be taken. Following their consent, a general conversation was held, followed by questions and answers. Interviews generally ended with a request to the interviewee regarding other possible stakeholders and information resources (such as publications, databases and videos).

All interviews were conducted in Spanish (I am a fluent Spanish speaker) on a one-to-one basis during normal working activities, as illustrated in Figure 5.3. As a token of appreciation, all interviewees were offered a New Zealand pen in a display case, while the *Palliris* were also offered a bag of coca leaves, as

each spoke for almost an hour while working. At the recommendation of in-country contacts, mine sector labourers were not asked to identify themselves during on-site conversations. However, it was considered appropriate to request (and record) the name and position of all officials, academics and consultants who participated in structured interviews.

2.7.3. Data Management

Observations in the field were collated in a notebook, while photographs were taken using a digital camera. Field notes and photographs were transferred to a password-protected laptop each evening to ensure data security and participant confidentiality. All digital data files were backed-up on a daily basis and a copy held on a memory stick that was held in a secure location separate from the netbook. Once digital copies had been transferred to the laptop, photographs were deleted from the camera memory card and all paper documents were destroyed.

Photograph 2.1 Researcher in Conversation with a *Palliri* (Mina Santa Rita, Oruro)

Source: Author

2.7.4. Analytical Method

There were two main phases of data analysis. Firstly, information collected from the literature review was condensed and collated under general themes consistent with the research questions, to develop a general understanding of issues, identify data gaps, and to plan in-country data collection in an attempt to update information and fill gaps. Then, following the fieldwork in Bolivia, in-country research findings were evaluated to characterise conditions encountered and identify significant issues and relationships, conflicting information and data gaps. In particular, fieldwork findings were compared to the information collated via the literature review, in an attempt to identify similarities, trends and inconsistencies. Significant issues identified were then evaluated, bearing in mind relevant historic and socio-economic contexts, to enable conclusions to be drawn.

2.7.5. Fieldwork Challenges

A number of challenges were encountered during fieldwork implementation, the most significant being that on reaching Mina Huanuni, it was evident that, contrary to assurances, women that represented the original research focus were no longer working in the nearby river to recover mineral. Although the research focus was subsequently broadened to all women in the *Altiplano* mining sector (following anecdotal evidence of women working underground in Oruro's mines), only two women mine workers, three *Palliris* and a handful of others were encountered during the site visits.

Other challenges included prolonged rainfall which prevented access to the mine sites at Japo and Morococala, and interview refusals from officials of the Chamber of Mining (CANALMIN) in Oruro and senior officials of regional and national mine worker co-operative bodies (FEDECOMIN and FENCOMIN respectively). Protest action by mine workers also disrupted the fieldwork scope and schedule, with road blocks by protesting miners in Oruro, street marches by managers from Mina Huanuni, and violent protests between police and miners in central La Paz which prevented me reaching the offices of the Vice-ministry of Mining and Metallurgy, the Bolivian Mining Corporation (COMIBOL) and the national mine workers union (FSTMB). Despite these challenges, it was possible to adjust the research scope, timetable and method to ensure the in-country data collection was not wasted effort.

2.8. Thesis Structure

The thesis structure was designed to provide an insight into relevant literature, and to compare documented research to in-country observations, enabling conclusions to be drawn from any similarities, differences and trends identified. The relative absence of women mine workers and limited research into their role in the mining sector in Oruro made it difficult to structure this thesis according to development themes relevant to women mine workers (such as gender, inequality and empowerment). Instead, the approach used has been to structure sections around mining sector stakeholders and mining activities, and then to examine the role that women play in these organisations and activities. This approach has been applied consistently throughout the literature review, fieldwork findings and analysis of results, and provides a sound basis from which to evaluate the occupational role of women mine workers, and respond to the research questions.

2.9. Summary

Although initial intentions were to focus upon the declining number of women recovering mineral from the river below Mina Huanuni, in-country research confirmed that they were no longer present. The research focus was therefore broadened to evaluate the occupational roles available to women working in the mining sector, and trends in their participation.

Fieldwork was conducted over a 25 day period between 17th March and 10th April 2011, and focused upon mine sites in the Department of Oruro. Although mining in Oruro has a significant place in Bolivia's past and present, it has received substantially less attention than mines in the neighbouring Department of Potosi, notably the Cerro Rico silver mine and the large tin mining operations at Siglo XX and Catavi. The data collection methodology used a combination of site visits and interviews with mining sector stakeholder groups, including mining companies, mine worker unions, mine worker co-operatives, central and local government departments, non-governmental organisations, community groups, academics and consultancy groups.

Outcomes of the in-country data collection activities are presented in Chapter 5 (Fieldwork Findings), and are analysed in Chapter 6 (Analysis of Results). The next two chapters present the findings of the literature review, which Chapter 3 focusing upon the international context, and Chapter 4 focusing upon the Bolivian situation.

3. MINING & DEVELOPMENT – AN INTERNATIONAL PERSPECTIVE

3.1. Introduction

This chapter describes the findings of a review of the international literature, conducted on the themes of tin mining and mineral processing methods; the impacts of mining activity; organised labour in the mining sector, and female involvement in mining and mineral processing work. The findings of the literature review were used to develop a broad understanding of the relationship between mining activity and development, with a particular focus on women mine workers. The next chapter then goes on to review literature specific to the Bolivian context, using the same themes. This provides the basis for a comparison between conditions encountered in Bolivia today and historic and contemporary conditions encountered elsewhere in the world.

3.2. Mining Activity

The first real demand for tin arose in the Bronze Age which began around 3,000 BC, as bronze is principally an alloy of copper and tin. World demand for tin grew dramatically with industrialisation, when it became widely used as a protective coating for steel cans and as a component of solder for electronic commodities. It also has many uses in pharmaceutical manufacture (Encyclopaedia Britannica Online 2011). World tin production has become dominated by Indonesia and China in recent years, with Bolivia's contribution shrinking from 19% of world supply in 1935, to just 6% in 2006 (see Table 3.1).

Producer	1935[1]	1950[1]	1980[1]	2006[2]
Indonesia	25%	19%	13%	37%
China	7%	6%	6%	36%
Peru	-	0%	0%	12%
Bolivia	19%	18%	11%	6%
Russia	-	-	15%	2%
Thailand	6%	6%	14%	0%
World Total	135,037 tons	169,304 tons	246,247 tons	321,000 tonnes

Table 3.1 World Tin Production: Major Exporters

Sources: 1. Baldwin 1983, 2. Heatherington el al 2008

A booming world economy during the first decade of the 21st Century has led to dramatic growth in mineral exploration and extraction in developing countries (Bebbington et al. 2008a). This growth was particularly strong in Latin America between 1990 and 2001, during which time total mining investment

in developing economies tripled (de Echave 2007). Tin mining and processing methods have improved dramatically since the industrial revolution. Figure 3.1 provides an overview of the typical industrial process by which ore is processed to produce tin.

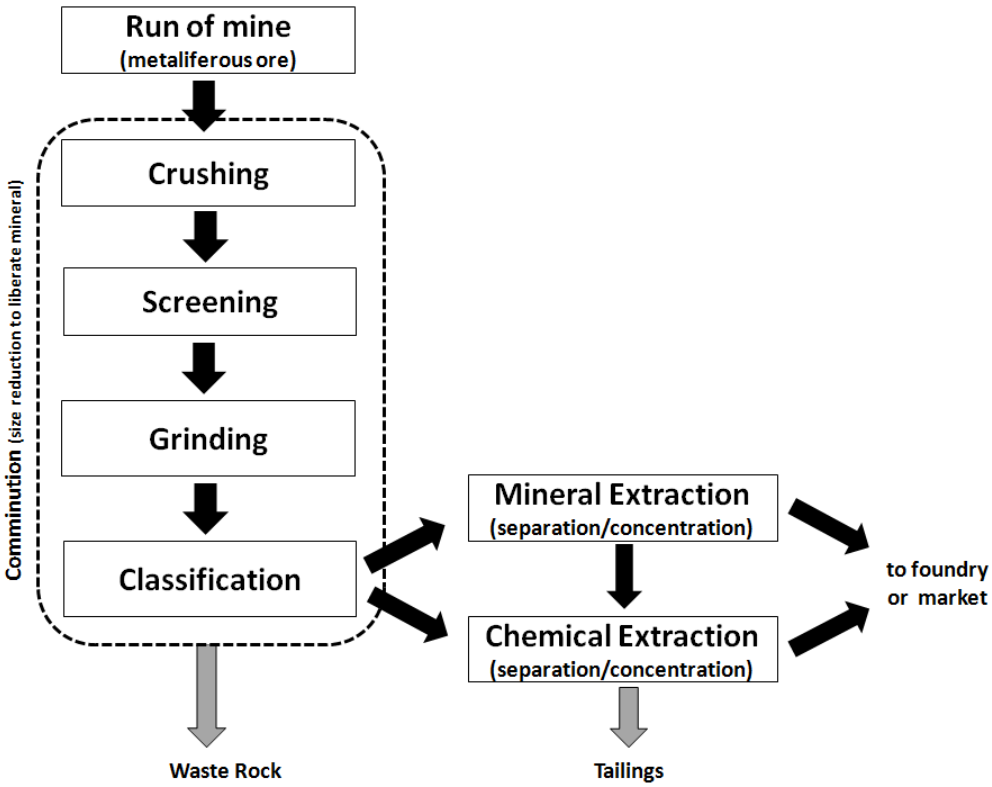


Figure 3.1 Industrial processing to produce Tin

Source: Author

Early mining activity involved digging underground shafts into rock that contained cassiterite (tin oxide). Underground mining methods are labour intensive and only economically viable where concentrations are high and localised. As demand has grown and mining become more mechanised, it is often more profitable to use open-cast mining of hard rock deposits, excavation of historic wastes or dredging of tin-rich alluvial deposits (Thoburn 1977, Wills & Napier-Munn 2006). Mechanisation and chemical methods have enabled greater extraction and processing rates, but do not necessarily achieve greater recovery rates. There has also been a trend away from manual extraction from shaft mines in favour of highly mechanised open cast and dredge methods (Grewal 2011). Modern mining technologies require mechanisation, energy and finance which may not be available in some areas, so tin mining operations range from primitive manual extraction methods (referred to as artisanal or small scale mining) to highly mechanised large scale operations applied by multi-national mining enterprises.

3.3. Mining and Development

Mining activity generates local employment and export revenues, and mine site development can bring roads, water and power supplies to remote communities. Consequently, mining can be considered to present opportunities for development. However, there are also a number of negative aspects associated with mining, which have led to coining of the term 'resource curse' (as described in the next section). Hence mining activities can often polarise communities, give rise to protest action and in extreme cases, destabilise countries and economies (Bebbington et al 2008b) and exemplifies the negative social and environmental effects that can be caused by industrialization and globalization (Bridges 2004).

Mining and resource extraction has been grasped by many governments as a vehicle for national development. Governments in over 90 countries have rewritten their mining and investment codes since the 1990's in an attempt to benefit from the growth in mining and extraction activity (Bridge 2004). However, the macro-economic benefits from large royalty payments are not without adverse effects elsewhere in the economy. In particular, the rapid expansion of large scale mining operations during the 1980's brought into focus the conflict between mining interests and indigenous communities, with regard to both territorial rights and cultural values. The negative effects of mining have even been referred to as a 'resource curse' (Auty 1994), and are frequently a major source of conflict (Collier & Hoeffler 2005). There has also been a proliferation of legislation attempting to protect the environment and indigenous peoples, and a corresponding growth in non-governmental organisations willing to challenge mining corporations and governments (Ballard & Banks 2003). National governments and mining companies typically benefit from the proceeds of mining activity, while local communities often suffer the adverse effects. This has created both contention and ambiguity in the 'mining for development' debate, and resulted in a polarisation of views regarding mining as a vehicle for development (Bebbington et al 2008).

Much international development literature focuses upon the aspects of mining activity that undermine development at a local, community or regional level, such as the adverse effects on worker health and safety, on the environment, on the economy and on people living in areas impacted directly or indirectly by mining operations. A synopsis of these impacts is provided in the next section.

3.4. Impacts of Mining Activity

Studies in Latin America have shown that mining can have a range of adverse impacts on the environment and communities, although the service infrastructure required for mining operations can also benefit local community and economic activity. Examples include roads that open up previously inaccessible areas, and power or water supplies for mines that are also available to local communities. However, there are also many examples of corresponding negative impacts associated with mining infrastructure (CIPMA & IDRC 2002), such as the damage caused to the ecosystem and indigenous groups in the Brazilian jungle following construction of a gas pipeline (The Economist, August 2008). Government corruption is also not uncommon in association with natural resource extraction projects worldwide, particularly where a weak and underpaid civil service administers the allocation of a nation's mineral wealth (Hollender & Shultz 2010). Even after mines have closed, the adverse socio-economic and environmental effects can continue to be significant for many years (World Bank & International Finance Corporation 2002).

In developing countries, mining operations are often associated with hazardous work, worker exploitation and child labour. Such conditions have existed throughout the history of the tin mining industry. They were documented in the first English tin mines in 15th Century Cornwall (Mayers 2008), and are evident today in developing economies around the world (ILO 2004). Mining operations of all scales can be life threatening to mine workers, by virtue of the risk posed by toxic gas, flammable gas, use of explosives, unguarded machinery, atmospheric contaminants and structural failure (Nash 1988a).

Mining methods have evolved over centuries to manage these risks by the use of equipment for shoring shafts, ventilating work areas, monitoring atmospheric conditions and reducing inhalation of hazardous materials. Emergency rescue services have also evolved a range of techniques for responding to emergency situations. Despite these significant advances, the provisions for occupational health and safety are ultimately dictated by the economics of production. Where health and safety provisions would make a mining operation uneconomic, the choice for mine operators is often either to stop extraction or to relax health and safety provisions. The more economically vulnerable a mine operator is, the more likely that health and safety provisions will be neglected (Godoy 1985).

Open cast mining can significantly affect local water resources (Pinto 2000), while pollution of rivers by acidic mine waste piles and mine drainage water can contaminate rivers and water supplies. The adverse effects of open cast mining can extend over 75km downstream of mine sites (Rojas &

Vandecasteele 2007). Observations in the Amazon basin in the 1980s first revealed the environmental problems associated with mercury release from mining activity. Mercury amalgamation has since been replaced by cyanide leaching technology in large scale mining operations, but as this is a more expensive process, it is unlikely to be commercially viable for artisanal operations, and has its own toxicity risks (Spiegel 2009a).

In many countries, natural resource wealth can be a major source of conflict, commonly arising from disputes over territorial rights, revenue distribution, governance and environmental degradation (Collier & Hoeffler 2004). Mining demands land, which may affect indigenous peoples and others whose livelihood depends on access to the land for agriculture or hunting etc. (Downing et al. 2002, Galeano 1973). Indigenous interests and beliefs often conflict with mining company agendas, particularly with respect to the preservation of natural wealth (Fokkelman 2009). The capitalist model is based on market value, resource accumulation, unequal exchange and a rigid division of labour, while by contrast, the model used by indigenous groups is based on reciprocity, value, a loose division of labour and a need for satisfaction (Godoy 1990). Indigenous peasants are also likely to be displaced from their lands by mining activity. They are also likely to riot following a breach of their notions of right or wrong (Scott 1976).

Despite the adverse impact mining can have on indigenous communities, government intervention is often lacking or ineffective, and so the main vehicle for change is the way in which the mine operator deals with conflicts (Hilson 2002). Non-regulatory approaches are evolving to reduce the adverse effects of mining on indigenous peoples. For example, the International Council on Mining and Metals was established in 2001 to (amongst other things) improve the relationship between mining activities and indigenous communities (Render 2010). The organisation currently comprises 18 mining and metals companies and 30 national and regional mining associations and global commodity associations (ICMM 2011. Government initiatives to manage mining can be counterproductive as economic returns decline due to growing illegal activity (Spiegel 2009a).

3.5. Mining Sector Organisations

Governments generally regulate mining exploration, extraction, mine safety and environmental impacts. Governments also typically require mining companies to pay royalties, although royalty regimes vary from one country to another. Some governments choose to be actively involved in mining activity, with state companies operating mines and processing plant. Others choose only to administer access and

royalties, leaving private sector organisations or international companies to conduct the exploration, extraction and processing work (World Bank & the International Finance Corporation 2002).

The evolution of workplace organisation is also country-specific, although in many cases mine workers have some form of collective representation, such as via mine worker unions. It is not unusual for mine worker unions and the mine owner to develop an antagonistic relationship over time, due to conflict between their respective agendas of worker rights versus profit maximisation. A contemporary example is the decade long conflict between the British government and the National Union of Mineworkers, culminating in a year-long strike in 1984-85 and the loss of 20,000 jobs when union resistance was overcome and many mines were closed (Winterton & Winterton 1989).

In some countries, worker co-operatives arose in response to worker oppression and exploitation, such as that experienced by labourers in Western Europe during the industrial revolution. The term 'co-operative' is defined as 'a society formed by producers and consumers to buy or sell in common', and worker co-operatives have become an integral part of many socialist societies around the world (Downie 1933). The first worker co-operative was the Rochdale Supply Co-operative, which was established in England on 21 December 1844 upon the 'Rochdale principles' of open membership; democratic control; a dividend on purchase; limited interest on capital; political and religious neutrality; cash trading and the promotion of education (BBC 2010).

The scale of modern mining activities and the sophisticated technology they require mean that major mining operations demand significant technical, logistical and investment resources, which often can only be provided by trans-national mining corporations linked into international financial institutions. Although developing countries may initiate and manage their own mining operations, their governments often need to collaborate with trans-national mining corporations to expand operations (World Bank & the International Finance Corporation 2002). The gains of modern mining typically go to overseas corporations and their investors, while adverse effects are suffered locally. This has resulted in widespread social mobilisation and resistance against mining projects, and significant changes in the relationship between mining and the forces of political and economic change (Bebbington et al. 2008a). However, there are indications that some corporations are beginning to adopt more collaborative approaches, with active involvement of affected communities (Bury 2008, Hemphill 2008).

Many NGOs support developing country governments, community groups and sector groups to better manage the adverse socio-economic and environmental impacts of mining activities. However, the

capability, resources and agendas of some NGOs mean that their involvement may not always have the best outcome for those receiving from their services (Botin 2009).

3.6. Artisanal Mining

Artisanal (or small scale) mining refers to mining that is conducted by individuals, groups, families or co-operatives, using little no mechanization and is often conducted without the necessary permissions to do so (Hentschel et al. 2003). It has been estimated that there are 13 million artisanal miners operating worldwide, with up to 100 million people dependent upon artisanal mining for their livelihood (ILO 2008). The number of people involved in artisanal mining increased 20% in the decade to 2003, as a result of growing rural poverty.

Artisanal mining is the world's largest source of mercury pollution from intentional use (Swain et al. 2007) and researchers have concluded that the use of safer alternatives to mercury amalgamation is undermined by poverty in artisanal mining communities (Spiegel 2009b). This caused the United Nations Industrial Development Organisation to establish its Global Mercury Project, and the UN Environmental Programme to develop mercury control guidelines (UNEP 2006).

Studies into small and medium size enterprises in other sectors across Latin America revealed that many choose unethical strategies to survive and compete, which may manifest themselves via illegal activity such as tax evasion and corruption (Coutinho de Arruda 2009). Micro enterprises employ the largest number of employees in Latin America, and Bolivia tops the rankings for entrepreneurial activity in Latin America (Global Entrepreneurship Monitor 2008). Many small and medium size enterprises operating in the informal sector have limited access to credit and are exposed to exploitation (Perry et al. 2007).

3.7. Women Mine Workers

It has been estimated that approximately 30% of artisanal mine workers are women (ILO 2008, IIED 2002), although participation varies by region. Studies into women's involvement in mining operations indicate that women's direct participation in artisanal mining (as a percentage of the workforce) varies widely, from 10% in Asia, to 10-20% in Latin America and 40-50% in Africa (Hinton et al 2003). However, in most instances, mining is portrayed as a male profession, underpinned by male solidarity (Lahiri-Dutt & Macintyre 2006). Women typically play a much larger role in artisanal mining than in the large scale mining sector (WMMF 2000), which involves dangerous working conditions and seldom leads to economic security (Labonne 1996).

There is widespread consistency in the roles of women involved in artisanal mining around the world. They are most commonly involved in transporting ore and water, washing, panning, amalgamation and amalgam decomposition, and working in support roles such as cooks, sex trade workers and shop owners. They are not often involved in actual digging or drilling work (Sauapu & Crispin 2001). Women's direct participation in artisanal mining is inversely proportional to the scale of operation, and their involvement in decision making is inversely proportional to the product value (Hinton, Veiga & Beinhoff 2003). However, it is also apparent that there are significant discrepancies between the estimated and actual numbers of women involved in artisanal mining (Wasserman 1999).

Women artisanal mine workers around the world face similar issues of prejudice, discrimination and exploitation (Lahiri-Dutt & Macintyre 2006). There are many instances of women mine workers suffering exploitation in countries as diverse as Burkina Faso (Guire 2000), Zimbabwe (Mabenge 2000), South Africa (Voyi 2000), India (George, Kalluri & Jonko 2000), Indonesia (Simatauw 2000) and Peru (Lujan 2000). Privatisation and liberalisation have also discriminated against women miners, as they tend to be hardest hit by retrenchment (Moody 2007), despite being seen as less demanding than their male counterparts (Neff 1929). The invisibility of women in the mining industry is an international phenomenon and contributes to discrimination against them (Echavaria et al. 2008).

Today's advanced economies have a history of female involvement and exploitation in their mines, but a backlash against women's labour in the nineteenth century significantly restricted women's underground work (Laslett 1996). In particular, an 1842 investigative commission into women's underground labour in Britain shocked the public and drove reform in the sector (Neff 1929). Some countries now ban women from working in their mines, while others restrict them to above-ground roles.

Many groups have been established to help women mine workers demand their rights and gain recognition, including the Network for Responsible Mining (RESPOMIN) the International Women and Mining Network (IWMN 2000 & 2004) and the Latin American Mining Monitoring Programme (LAMMP 2010). Although these groups work to empower women, there is also evidence that women may actually suffer deterioration in their quality of life due to empowerment. For example, in Suriname, women's empowerment in the mining sector has led men to feel displaced and women to feel they are neglecting their domestic commitments (Heemeskirk 2003).

3.8. Women in a Development Context

Early recognition of women's needs in a development context came to prominence around 1975 with the first international women's year and world conference on women (United Nations 1976), and introduction of the concept of 'Women in Development' (WID). The United Nations went on to establish its Division for the Advancement of Women, while the World Bank began to acknowledge the need for gender specific development policies to improve conditions for women (Collier 1988). Over time, WID evolved into the more holistic Gender and Development (GAD) approach (Østergaard 1992) which became well established. By 2010, the United Nations established UN Women, to further its objectives for gender equality and the empowerment of women (UN Women 2010).

The excesses of colonialism led Latin America to become an early focus for development thinking, resulting in the establishment of the United Nations Economic Commission for Latin America (ECLA) in 1948 (Bethell 1994) and contributions by Latin American authors on themes of women's engagement (Campillo & Fauné 1993, Bose & Acosta-Belén 1995, Cardoso & Faletto 1961 & 1979).

3.9. Summary

This section reviews international literature regarding the history of tin mining, extraction and processing methods, and the impacts of mining activity upon communities, public health and the environment. It also touches upon the involvement of governments, trans-national mining corporations, unions, artisanal mining operations and women mine workers. It reveals that mining activity can have a range of positive and negative socio-economic and environmental impacts, but that its negative impacts typically fall disproportionately on poor communities around mining operations. The adverse effects particularly impact women and indigenous groups, who suffer prejudice, discrimination and exploitation. Unions and non-governmental organisations often strive for improved working conditions, better control of environmental contamination, and greater respect for mining communities.

Mining methods in many countries operate at two levels. Larger operations run by governments or multi-national mining corporations tend to be well resourced, while small scale artisanal mining operations typically use primitive methods to recover mineral that larger operations cannot remove cost-effectively.

The next section reconsiders the same themes, but from a Bolivian perspective.

4. MINING & DEVELOPMENT IN BOLIVIA

4.1. Introduction

This chapter presents the second part of relevant literature, focusing upon the Bolivian situation. For consistency, it is structured around the themes used in the international literature review presented in the previous chapter, namely: mining and mineral processing methods; the impacts of mining activity; mining organisations; and female involvement in mine sector work.

Several significant research works describe conditions in Bolivia's mines in the latter half of the twentieth century, although the majority focus upon the working conditions of male miners at large underground State mining operations, with little mention of women mine workers. More contemporary information (i.e. less than five years old) about women mine workers was available via journals, news media and the websites of a range of organisations with mining and development links to Bolivia. However, much of the more contemporary information lacked the academic rigour that characterises published research works.

The most significant resource encountered in Bolivia were publications from government departments, mining companies and NGOs, most of which were only available as hard copy from the organisation's office. These ranged from simple brochures and newsletters, to substantive research works, reports, statistics, newsletters and photographs. Other key research works were sourced from researchers at the University in Oruro, and a mining supplement in the regional newspaper (La Patria), which contained many articles about contemporary mining sector issues of national and regional significance. Individuals encountered during the fieldwork also provided or referred to miscellaneous websites, documents, photographs and videos, and mentioned NGO activities that they were aware of.

4.2. Overview of the Bolivian Mining Sector

Bolivia's mines have enjoyed extensive attention from researchers throughout their long and productive history, made all the more interesting by the backdrops of stunning geography, grinding poverty and Dickensian working conditions. Spanish colonial rule was particularly exploitative in Bolivia, where generations of slaves and indigenous people worked and died in the mines which underpinned the Spanish empire (Kohn 1982). However, Bolivia's independence from Spain did little to address worker exploitation in the mines, as revealed by contemporary researchers who portray the hardship and persecution experienced by Bolivian miners and indigenous groups, and the volatility that has

characterised the mining sector and Bolivian politics over the last century (Barrios de Chungara 1978, Nash 1979, Rojas 1997and Kohl and Farthing 2006).

Early research into the Bolivian mining sector largely focused upon geological promise (Lindgren & Abbott 1931), with the main exception being a report to the US Congress of Industrial Organisations, which identified exploitative working conditions (Kyne 1943). By the late 1970's, research had broadened to address the working conditions for underground labourers (child labour, occupational hazards, worker exploitation) following serious conflicts between miners and the military, and seminal publications by June Nash (Nash 1979) and a delegation of miner's union members from Britain (British Mine Workers Union 1977). This provided those outside Bolivia with their first insight into the beliefs, working conditions, family situation, dependencies, economic influence and political power of Bolivian mine workers.

After the mid-1980's, researchers began to consider the environmental and socio-economic aspects of mining activities in Bolivia (Godoy 1985 & 1990, McMahon 1999, Ribera 2008, Escobari 2003), particularly following the 1985 Tin Crisis. The subsequent collapse of the tin mining sector caused a dramatic decline in the contribution of mining to total employment in Bolivia, falling from 4.43% in 1990 to 1.16% by 2003 (Absi 2009). It also contributed to a 27% fall in GDP during 1986 (Nash 1995) which further compounded social, economic and political problems (Espinoza Morales 2011, Webber 2008).

In the 1990s, a significant autobiography by a Bolivian miner further highlighted the challenging conditions faced by Bolivian mine workers (Rojas 1997). This stimulated research interest which in turn led to greater recognition of the importance of women and mining communities (Hinton et al. 2003, CEPROMIN 1995 & 1996, Van Hoecke 2006, Berdeja Hurtado 2008), child labour (Bocangel 2002, UNICEF 2004) and the socio-economic consequences of neo-liberal economic reforms (Bebbington et al. 2008a). By the end of the 20th Century, researchers started to investigate mining sector employment, including the socio-economic consequences of mining sector unemployment (Gill 1997, Anderson 2004) and the growing prominence of artisanal mining (Evia & Molina 1997, McMahon 1999, Quiroga 2002). In recent years, there has been an increased focus on the hardship caused by neoliberal reforms and changing government policies. Indeed, it has been said that Bolivia has been: *"...the testing ground for just about every kind of political programme in Latin America"* (New Internationalist 2007).

The new millennium has seen a new focus on Bolivia's mining sector. Growing demand for industrial minerals has renewed interest in exploration and raised growing concerns about the economic viability

of Bolivia's mineral reserves, its mining infrastructure and the risk of political instability (Quiroga 2002, Bebbington et al. 2008a). The Water War in Cochabamba also led to a flurry of interest in the role and intentions of trans-national corporations operating in Bolivia and the consequences for indigenous rights (Strijdonck 2009), while the growing influence of the indigenous rights movement encouraged by President Evo Morales also re-ignited research interest in the relationship between indigenous rights and mining concessions (Bonilla 2006, McCall 2009). Growing Western interest in Bolivia has been fuelled by improving conditions for tourists and documentaries such as The Devil's Miner (Polar Star Films 2005) which has led to significant growth in tourism since 2000, in particularly in La Paz and Potosi.

4.3. History of the Bolivian Mining Sector

A recent Bolivian publication (Espinoza Morales 2011) attempts to provide a comprehensive history of the Bolivian mining sector, and addresses the perspectives of the government, mining companies and worker organisation. However, it pays little attention to the significance of either artisanal mining or women mine workers. Mining has been the most important sector in Bolivia's economy for almost 500 years, mineral export dominating export revenues from Spanish Colonial times (Widerkeh, 1980) and silver, zinc, tin and gold representing 75% of the value of national production since Spanish colonial times (UDAPE 2006). The history of mining in Bolivia effectively began with the discovery of Cerro Rico at Potosi in 1546, which was once the world's most productive silver mine (UNESCO 2000). It had 'bonanza' veins of 40% pure silver, and produced over 2 billion ounces of silver and 100,000 tonnes of tin between 1544 and 1985. By 1650, Potosi had over 160,000 inhabitants and was one of the world's largest and richest cities.

By the mid-17th Century, silver represented 99% of all exports (by value) from Latin America, most of which came from Cerro Rico in Potosi (Galeano 1973). It is estimated that between 1503 and 1660, the Spanish exported over 16,000 tonnes of silver and 185 tonnes of gold from Latin America (Garcia-Guinea & Harffy 1988). Other mines were subsequently discovered across the Bolivian *Altiplano*, with the most significant silver and tin mines situated within a region of *Altiplano* bounded by Oruro to the North, Uyuni to the South and Sucre to the East (see Figure 1.4). The sustained economic significance of mining in Bolivia led most of the *Altiplano's* significant communities to develop at or near mine sites and mineral processing plant. Indeed, many *Altiplano* communities are still dominated by mine waste piles (see Photograph 4.1).

Photograph 4.1 A mine tailings pile dominates the town of Atocha (2000)

Source: Courtesy of URS Corporation (Bolivia)

By the end of the 19th century, the combination of declining ore grades and growing Western industrialisation had shifted the focus of Bolivian mine output from silver toward industrial metals such as tin, lead, copper, antimony and zinc. Potosi and Oruro rapidly became the focus of poly-metallic ore mining activity in South America (Garcia-Guinea & Harffy 1988). Following 1910, growing demand for tin solder in electro-domestic items, food cans and cinema equipment significantly increased the value of tin (Honorable Gobierno Municipal de Huanuni, 2005) and contributed to the growth of the 'tin barons'. The most successful tin baron was Simon Patiño, who owned Mina Huanuni in Oruro and established the first multinational tin mining corporation in Latin America (Gall 1974a). By 1950, mining generated 95% of Bolivia's foreign exchange earnings, 70% of which came from tin (Gall 1974b).

Bolivian mines were nationalised following the 1952 socialist revolution, with the state's *Corporación Minera de Bolivia* (COMIBOL) taking ownership of all mineral resources and administering concessions for state mining companies, mining co-operatives and private mining companies (Michard 2008). However, the 1985 Tin Crisis led to the closure of marginal and uneconomic mines (McMahon 1999), with the government divesting itself of many tin mine assets. COMIBOL's declining influence since the Tin Crisis is illustrated in Figure 4.1, which also shows a corresponding growth in export revenues for

small[1] mining operations since 2001. Following the Tin Crisis, zinc dominated Bolivia's non-fuel mineral exports (Anderson & Velasco 2004).

Poly-metallic mining has also declined relative to gas exports since 1998, when major reserves of natural gas were found in Bolivia (BG Group 1998). Natural gas exports have now displaced minerals as Bolivia's dominant source of export revenue (see Figure 4.2).

In 2006, the government launched its plan to reactivate the mining sector, in response to growing overseas demand and depletion of reserves at many of Bolivia's mine sites. The resulting *Plan de Reactivacion Minera* relaxed regulatory requirements on investment, making it easier for foreign companies to access mining resources in Bolivia, and led to several major mine developments by overseas mining companies (UDAPE 2006). It is interesting to note that some of these projects focus on reprocessing historic mine waste piles, which are an economically viable source of tin and silver when world prices are high.

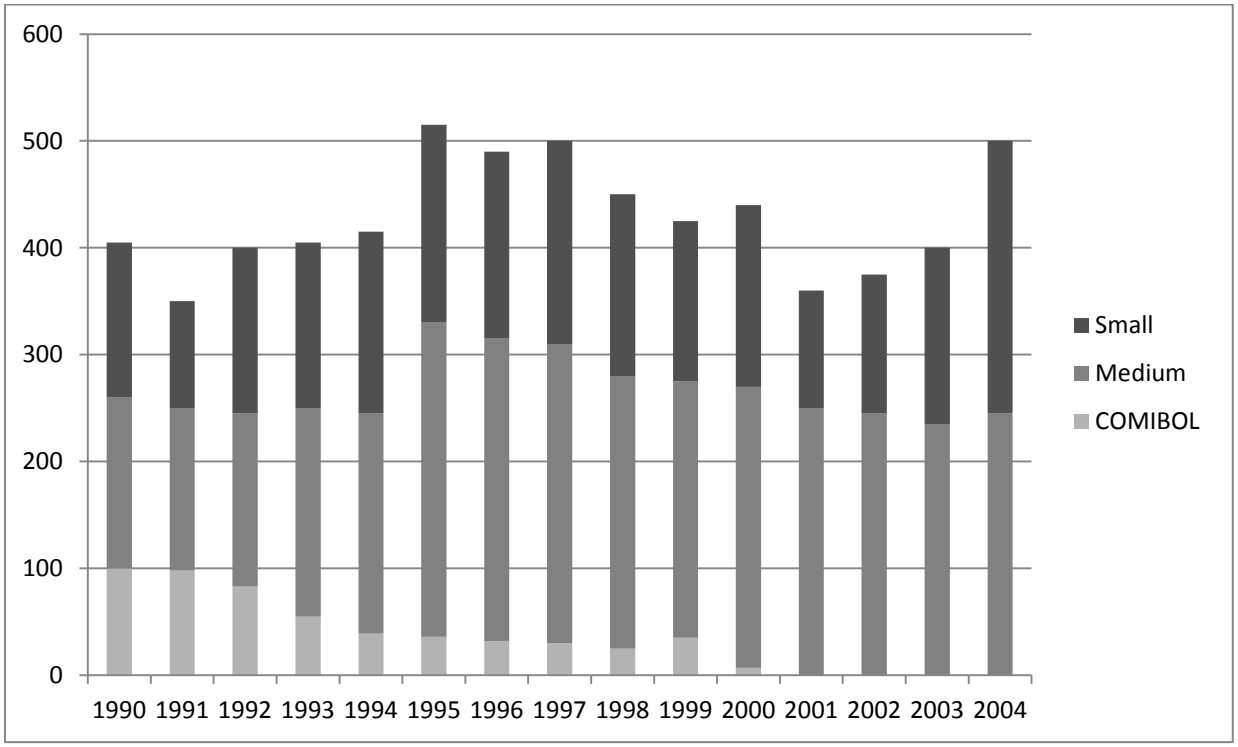


Figure 4.1 Mine Revenue (US$ million)
Source: UDAPE 2006

[1]Small mines are defined as those with annual production value of less than US$0.5 million, or production of less than 100 tonnes/day (UDAPE 2006).

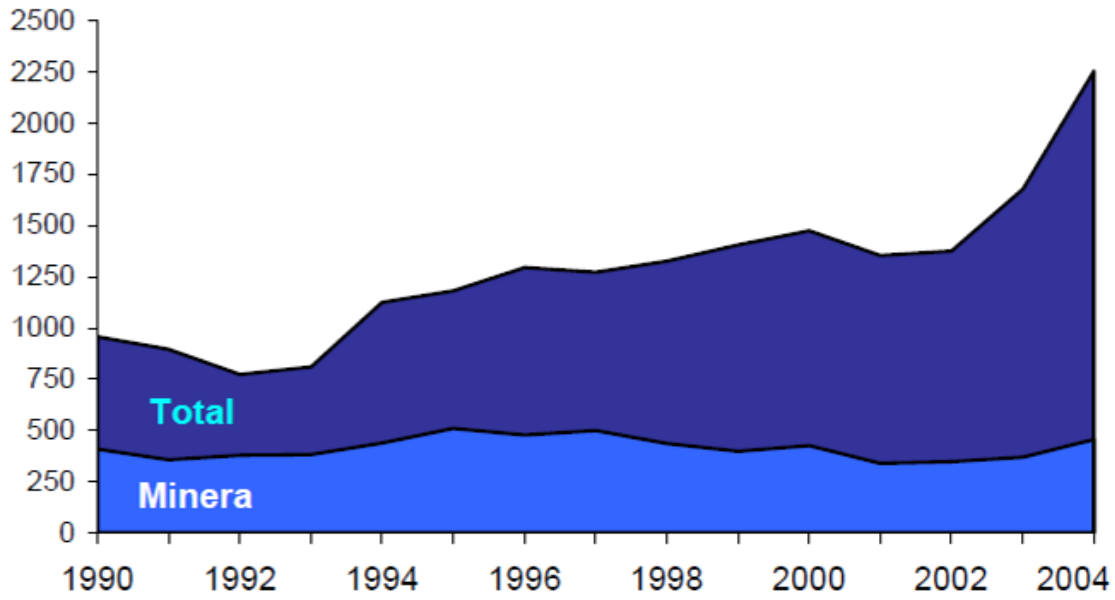


Figure 4.2 Mining Sector Contribution to Total Exports (US$ millions)

Source: UDAPE 2006

Since 2003, a strong and sustained growth in demand for industrial metals has led to a significant increase in the price of tin since (see Figure 4.3) and silver (see Figure 4.4), with tin prices now at a record high of over US$3,000 per tonne, or more than three times the value before Bolivia's Tin Crisis (Kelly & Matos, 2011). This trend has boosted the economy, rejuvenated interest in mining activity in the *Altiplano* and provided a new lease of life for some *Altiplano* mines and mining communities. However, demand is mainly being met by a few large mechanised mining operations run by foreign investers. The artisanal mining sector operating at ex-COMIBOL mines is struggling to respond to current demand, due to a combination of decaying infrastructure, skill shortages, wary investors, resource depletion and declining ore grades. Additionally, in the absence of significant processing capacity in Bolivia, raw material export remains the main model for mineral exploitation (Anderson 2004).

Although mineral reserves at Cerro Rico are now very depleted, the region is undergoing significant growth in tourism. Miners escort tourists into the mines in return for supplies of dynamite, detonators, coca leaves and alcohol, and the growth in tourist numbers means that in some cases, tourists have replaced mineral sales as the miner's main income source. Despite long held restrictions on women entering Bolivia's mines, female tourists are not restricted.

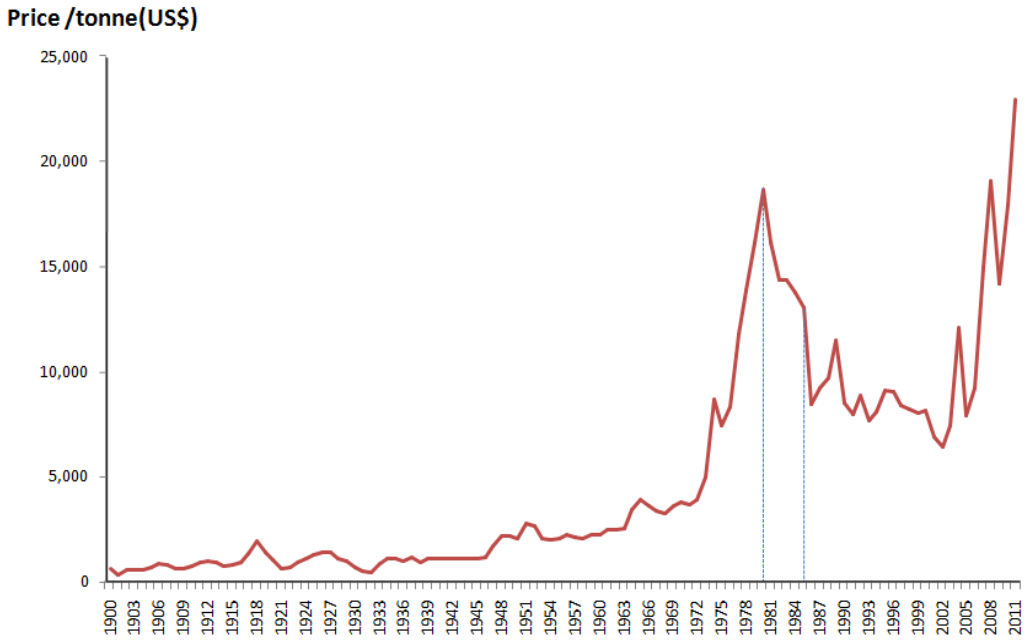


Figure 4.3 Price trend for Tin (1900 – 2011)

Source: Kelly & Matos 2011

Figure 4.4 Price trend for Silver (1975 – 2011)

Source: Silverprice.org 2011

4.4. Mining in Oruro

Oruro is an historic mining centre at 3,700 metres altitude in the Bolivian *Altiplano*, and mines in the area have produced silver, tin, zinc and gold for centuries. The Department of Oruro has 15% of Bolivia's population, 5% of its land area (Velasco 2000) and around 6% of national economic output (INE 2011). Formal employment is dominated by male workers, who earn significantly more than their female counterparts, although conditions are slowly converging (INE 2009). By 2004, 33.76% of the male population of the Department of Oruro was involved in mining work (INE 2004). In 2004, mine workers represented 4% of total employees in Oruro. Table 4.1 provides a statistical summary for the population of Oruro, and their engagement in work.

Statistic	2010 data
Oruro population as % of Bolivian population	15.3%
Urban population	157,365 in 1976, 221,854 in 1992, 235,851 in 2001
Rural population	150,766 in 1976, 118,031 in 1992, 155,715 in 2001
Unemployment	2.26% in 1976, 1.97% in 1992, 1.67% in 2001
Male unemployment	1.47% in 1992, 1.35% in 2001
Female unemployment	2.68% in 1992, 2.09% in 2001
Male workers	45% of total
Female workers	33% of total
Rural male mine workers as % of popn (2004)	3.44% (working 46.87 hours per week @ 1,213Bs/m)
Rural female mine workers as % of popn (2004)	0.23% (working 24.57 hours per week @ 626Bs/m)
Workforce participation (male:female ratio)	1976 - 1:0.45 in 1976, 1:0.52 in 2001
Male workforce participation	60.02% in 1992, 59.61% in 2001
Female workforce participation	37.52% in 1992, 43.07% in 2001
Females working in production co-operatives	12.82% in 1992, 12.19% in 2001
Females as owners, employers or socias	27.53% in 1992
Urban male mine workers as % of 2004 popn	3.99% (working 50.87 hours per week @ 2,076Bs/m)
Urban female mine workers as % of 2004 popn	0.3% (working 38.36 hours per week @ 1,913Bs/m)
Average income	1,036Bs/m for men, 702Bs/m for women
Urban Average income	1,321Bs/m for men, 824Bs/m for women
Rural Average income	580Bs/m for men, 384Bs/m for women
Average work hours	45.02 hrs/wk for men, 39.42 for women
Urban Average work hours	48.79 hrs/wk for men, 41.77 for women
Rural Average work hours	40.07 hrs/wk for men, 36.49 for women

Table 4.1 Statistical Summary for Oruro

Sources: INE 2004 & 2010

The San José mine was opened by the Spanish in 1595, and led to the establishment of the city of Oruro around the mine. The mines of Santa Rita and Itos were subsequently established around the same deposit. Mining in Oruro reached its peak in 1678 when there were 32 large mines and 258 smaller

operations. At this time, Oruro became the centre of the *Altiplano* mining network. Following independence from Spain in 1877, all mines in the region fell under the control of the *Compania Mineria de Oruro*. The start of the 20th century marked the shift in mining output from silver to tin. San José became uneconomic in 1946, but was kept operating by subsidy from the *Banco Minera* de Oruro until 1952 (Nash 1979).

The Huanuni tin mine is situated 50 Km to the South East of Oruro. The discovery of a rich vein in 1898 led to the mine being recognised as an internationally significant cassiterite deposit, and it subsequently developed into Bolivia's largest tin mine and a major provider of tin to the world market. The name Huanuni is derived from the Quechua phrase *'Huanuchi Huankanku'*, which means 'they are going to kill me'; possibly indicating the sentiment of indigenous peasants who were forced to work there (Empresa Minera Huanuni, 2009). Simon Patiño owned Mina Huanuni from 1912 until it was nationalised in 1952. COMIBOL subsequently transferred its management to Allied Deals SA in 2000, but it was re-nationalised in 2007 following fraud allegations (Empresa Minera Huanuni, 2009). This mine is currently operated by the COMIBOL company *Empresa Mina Huanuni* and remains an internationally significant exporter of tin.

4.5. Mining Methods in the Bolivian *Altiplano*

4.5.1. Industrial Methods

Silver and tin mining has dominated *Altiplano* mining activity for centuries, despite the fact that in comparison to other countries, Bolivia's mines have small metal lodes while the tin ores are relatively low grade. Transportation costs are also relatively high due to Bolivia's lack of coastline and poor transportation networks. Bolivian tin is competitive on world markets because of low labour costs and minimal investment in equipment and infrastructure. Consequently, many Bolivian tin mines are characterised by antiquated equipment, worker resistance to non-traditional methods, and lack of investment capital due to commodity price volatility and frequent changes in government policies (Godoy 1990, Anderson & Velasco 2004).

Larger underground mines use heavy mechanical equipment to extract and transport ore, and have large scale physico-chemical processes on site to convert the 'run of mine' material into mineral concentrates. Mina Huanuni is the most significant mine site in the Department of Oruro. The mine employs 5,000 employees and has a projected production life of 30 years. Mineral processing capacity in

the on-site *ingenio* was upgraded to 3,000 tonnes/day in 2010 (Empresa Minera Huanuni, 2009), and the company has plans to double current output (ITRI Limited 2009).

4.5.2. Artisanal Mining Methods

Artisanal mining is also referred to as small-scale mining, peasant mining or the Pirquin system[2] in Bolivia (Moeller 2002a). It differs from industrialised mining methods in that it lacks long term planning, uses rudimentary extraction techniques and miners may not have a legal right to extract mineral. Artisanal miners typically work for mine worker co-operatives which have secured (from COMIBOL) the legal right to access mineral. However, artisanal miners have been known to work illegally on other COMIBOL concessions (Quiroga 2002) and steal mineral which they then sell back to COMIBOL (Canelas 1966).

It is estimated that half a million Bolivians make their living directly or indirectly from artisanal mining operations (Quiroga 2002). In Bolivia, artisanal mining is not limited to small scale operations, as some large mines use labour intensive, low technology methods. Most medium and small mines rely on a combination of manual labour and dynamite for extraction, manual labour for excavation and transport, and minimal use of chemicals and mechanical plant for concentration. Artisanal mining groups typically have little management capability, poor training and limited knowledge of regulatory requirements. They also dislike government interference and are no strangers to conflict (Hinton et al. 2003).

Artisanal mine worker co-operatives generally only have access to marginal or abandoned COMIBOL sites. However, their small scale manual methods can extract otherwise un-exploitable mineralisation (International Labour Organisation 1999). Artisanal mining efficiency is highest where workers are paid piece rates and have minimal demand for resources such as carbide, timber props and personal safety equipment. Mine owners also benefit from piece rates, as they do not need to employ foremen or guards, invest in tools and machinery, or provide facilities such as stores, hospitals, schools, accommodation or roads (Godoy 1985).

Men typically control artisanal mining operations in Bolivia, particularly digging and extraction activities, while women focus on the less physical roles of sorting, washing, panning and transportation. However, women may have greater involvement in digging or reprocessing operations which involve large

[2] Pirquin system involves groups (cuadrillas) of up to 12 labourers working under a single foreman, who distribute their revenues equally between participants (Quiroga 2002).

volumes of low value commodity, which are readily accessible at the surface. Artisanal mine operations generally do not have an *ingenio* available, and so rely on small mechanical crushing machines *(chancadoras)* or manual rollers (*trituradoras*) to crush the mineral to a size which is suitable for concentration in basic filtration and sedimentation processes. They may also mine historic tailings piles or take present day tailings waste for reprocessing. This reprocessing is conducted in a batch process using buddles, which are typically rock lined holes of 1m diameter and 0.7m depth (Webster 2011). As water drains from the buddle perimeter its velocity decreases, so heavier (cassiterite) fractions concentrate near the centre, while the lighter ones do not settle out until the edge. Once the buddle is full of sediment, the flow is stopped and the cassiterite-rich core is manually dug out for further processing, passing through the same process up to three times. Where further concentration is required, oil may be used to provide rudimentary flotation, while xanthate and sulphuric acid may be used to dissolve the pyrite. In some cases, sulphuric acid is replaced by *copajira* (acid mine water of pH 1.5 -2) to reduce costs. The entire concentration process can take 8-14 days (Trujillo 2005).

One of the earliest documented references to the use of buddles (also referred to as 'puddles') in tin mining is the Mineralogia Cornubiensis (Pryce 1778), which describes use of a pit to concentrate metal in a batch process. Mechanised buddles were invented in Germany in 1858 (Priester & Hentschel 1991) and by the late nineteenth century, tin mines in Europe (see Photograph 4.2) and Australia had developed continuous flow and mechanised buddles (Brough Smyth, 1869). Apart from a few minor details, the buddles used in Bolivia have used the same design for 130 years (Priester, Hentschel & Benthin 1993).

Advances in mining and mineral processing technology have enabled mineral to be recovered from ores of reduced grades. However, such advances also mean that new technologies can reduce the mineral resources available to artisanal mine workers, who previously represented the only economically viable means of extracting mineral from low grade ores and mine waste (Godoy 1990).

4.6. Impacts of Mining Activity in Bolivia

Many consider that artisanal mining in Bolivia is not sustainable as, with the exception of artisanal gold mining, revenues do not cover operating costs while operations do not comply with regulatory requirements for health, safety and environmental protection. Despite this, artisanal mining is tolerated by the Bolivian government as it has provided much needed employment (McMahon et al. 1999).As in

Photograph 4.2 Eighteenth Century Buddles at Consols tin mine in, St Ives, Cornwall, UK

Source: Mayers 2008

many other developing countries, mining activities in Bolivia have had significant adverse impacts upon mine workers, mining communities and the wider environment, as summarised below.

4.6.1. Occupational Health & Safety Aspects

The provisions for occupational health and safety in the mining sector are ultimately dictated by the economics of mineral production. The more economically vulnerable a mine operator is, the more likely that health and safety provisions will be neglected (Godoy 1985). The average life expectancy in Bolivia is 63 years, but is only 48 years for those in *Altiplano* mining communities. This difference can be explained by a combination of occupational risk exposures (such as mine accidents and endemic silicosis) and dietary deficiencies (Quiroga 2002). Those who work in rivers below mine sites are also exposed to extreme ultraviolet radiation (Moeller 2002a), air temperatures that range from -7^{o}C to +20^{o}C during the day (Meoweather.com 2011) and highly acidic water, with a pH as low as 2 (Van Ryckeghem 1997).

4.6.2. Public Health Aspects

Highly acidic mine wastewater can contain heavy metal contaminants that have adverse health effects for those downstream who touch or drink the water (Rojas & Vandecasteele 2007, Spiegel 2009a).

People in mining communities may be exposed to cyanide residues and heavy metals (such as lead, cadmium and arsenic) from waste rock and tailings piles, either via leachate, surface run-off or wind-blown dust (Hinton et al. 2003). Heavy metals can also contaminate soils via mine run-off, leaching or atmospheric fall-out, while soil contamination may affect crops, grazing animals and the people who consume them (Hinton et al. 2003). Although miner's and their families have access to a national medical insurance scheme *(Caja Nacional de Seguridad)*, medical facilities at mine sites are very limited and poorly staffed and few miners can afford the necessary medical insurance contributions (Berdeja Hurtado 2008).

4.6.3. Environmental Aspects

The *Altiplano* was once covered by thick woodland in Inca times, but forests were felled to fuel smelters, manufacture pit props and build houses (Godoy 1990). The widespread loss of vegetation cover resulted in soil erosion and degradation across the *Altiplano* (Aranibar 2003). Mercury amalgamation was first used in Bolivian silver mines by the Spanish in 1545, and until the mid-eighteenth century, approximately 1.5kg of mercury was lost from the process for each 1kg of silver produced. It is estimated that between 1570 and 1900, mercury amalgamation at Bolivia's silver mines discharged 196,000 tonnes of mercury into the environment (Garcia-Guinea & Harffy 1998).

Rivers at mine sites are used for disposal of process wastewaters, which are typically highly acidic (pH2) and have high concentrations of heavy metals. In addition, stormwater run-off and untreated sanitary wastes and garbage from mine sites may also be discharged into adjacent rivers (PSAC Social Justice Fund 2010, Dames & Moore 1997 and 2000b). The lakes *Poopó* and *Uru Uru* near Oruro exhibit elevated levels of contaminants (Beveridge 1983, Dames & Moore 2000a, La Patria, 2010b), and the Santa Elena *Ingenio* at Mina Huanuni causes serious contamination of the nearby river (Pinto 2000). Groundwater abstracted for mining processes has lowered local water tables and caused lakes to disappear in Oruro (Garcia-Guinea & Harffy 1998). In 1996, researchers further characterised environmental problems in the catchment of *Lago Poopó* near Oruro, which included acidic leachate, heavy metal pollution of water resources, reduced groundwater levels, atmospheric contamination from the Vinto foundry, soil and crop contamination by heavy metals and hazardous waste residues at mine sites (Van Rykeghem 1997). Mining areas around Oruro and Potosi are considered some of the most contaminated in the world, with concentrations of copper, zinc, cadmium, lead and nickel in mine-affected rivers sufficient to affect species diversity (Van Damme et al. 2008).

Over 18% of Bolivia's land area is protected by the government (UNDP 2010), and environmental protection legislation was introduced in 1992. Bolivian law now requires an environmental impact assessment and proposed methods for managing significant environmental aspects identified (McMahon et al. 1999). COMIBOL and the Ministry of Mining and Metallurgy have been accused of 'turning a blind eye' to the adverse effects of mineral exploitation projects. The Ministry of the Environment and Water has also been widely criticised for not performing an effective regulatory role (Hollender & Shultz 2010). Furthermore, under-investment and technological obsolescence in Bolivian mines meant that many mining operators are unable to meet the required standards (Altamirano 1995).

4.6.4. Socio-Economic Aspects

At the end of the 17th Century, Bolivian miners worked 14-hour days, with only a 30 minute break for food, yet their salary was not sufficient to meet the basic need of their families (Enriquez 2009). Although conditions today have improved, poverty is still prominent in many of Bolivia's mining communities. Studies by the World Bank concluded that although long term decline of the mining sector was not the primary cause of poverty in *Altiplano* mining communities, it had played a significant part (World Bank 1999).

During the boom times of Cerro Rico in the Department of Potosi, around 13,500 *mitayos* (conscripted labourers) and their families moved to the mines from the countryside. This migration depopulated 16 provinces and adversely affected agricultural production (Aranibar 2003). Even when conscription (*La Mita)* ended, agricultural labourers continue to move into mining communities when their labour was not required in the fields. The influx of seasonal agricultural labourers to mine sites benefits both mine operators and communities, but also generates tension due to their invasion of societal space without leaving behind community benefit (McMahon et al. 1999). The transfer of land use from agriculture to mining has also resulted in thousands of people in the *Altiplano* without access to land or the means to support their livelihood (Pinto 2000). Mining communities also have a historic dependency upon the mine operator, who has often historically operated the subsidised company store (*Pulperia*), and provided housing, education and health care (Nash 1988a).

The mass redundancies of 1985 led to dramatic depopulation in many parts of the *Altiplano* (Bolivian Information Forum 2011). Many miners moved to the cities to find work in the informal sector, or moved to the tropical forests of Chapare, where they found work cultivating coca. However, thousands of displaced workers (*Relocalizados)* were unable to find work, and so returned to their mines to join

mine worker co-operatives and eke-out a living by recovering mineral from marginal mines and historic waste piles (Aranibar 2003).

Mining communities are typically very remote, with poor vehicular access, limited housing and basic amenities. Potable water and electricity supplies may be barely sufficient, while sanitation and refuse disposal services may be absent (Berdeja Hurtado 2008). Approximately 95% of mine workers live in adobe homes, and a 2002 survey revealed that 95 % of homes had electricity and 59% had running water, although conditions varied significantly between different mines (Moeller 2002a).

Mining communities have traditionally been very strong, by virtue of the collective risk faced by miners and their families, reinforced by collective rituals. They have also been united in their resistance to oppression from the government and mine owners (Nash 1979). A combination of worker solidarity and economic influence made them a dominant force in Bolivian politics for many years. However, the miners unions and mining communities were decimated by industry restructuring in 1986 which caused widespread unemployment, led former comrades to compete for available work and resulted in the breakdown of established support networks (Gill 1997).

From the middle of the 17th Century, there have been many instances of rebellion against the authorities and mining companies, particularly in provinces to the North of Potosi, which eventually led to a civil war (Ordonez 2007). Community resistance to mining operations is now growing due to the government distancing itself from the sector (Quiroga 2002). A recent example is growing tension between the community and the large open cast mining operation at San Cristobal. This large scale mine provided limited employment opportunities, yet has lowered groundwater levels (Hollender & Shultz 2010), displaced the community and leaches heavy metal contaminants into the local environment. This has led locals to set fire to company offices, blockade rail tracks and derail rolling stock (Social License in Action 2009, Sumitomo Corporation 2010). Instances of historic social unrest have significantly impaired overseas investment in Bolivia (Whitehead 1972, Contreras 1985).

Families have been involved in mineral extraction and processing in Bolivia since the 16th Century (Trujillo 2005), although in recent times there has been a significant growth in the number of mine workers under 18 years of age and child labour is widespread at many mine sites in all aspects of production, in both surface and subterranean work, and particularly since 1985 (CEPROMIN 2009, Absi 2009). A study in Oruro in 2002 revealed that children as young as 6 years old were working with their

miner parents for an average of 60 days per year, and consumed alcohol and cigarettes while working (Moeller 2002b).

Since 2005, conditions have improved markedly for Bolivia, with a combination of debt cancellation (Rivera 2006, IMF 2009), growing political stability, a dramatic increase in revenue from gas exports and mineral exports. Consequently, Bolivia is now developing at a rate far greater than under past governments and has the opportunity to set itself on a solid development trajectory (Weisbrot 2007, UNDP 2009). However, the Tin Crisis left a lasting legacy, as it has been estimated that those working in *Altiplano* mines are currently poorer than they were before 1985 (PSAC Social Justice Fund 2010). Interestingly, one researcher postulated that artisanal mine workers struggle less with the poverty that follows economic crisis than with the sudden wealth they enjoy in boom times (Absi 2010). International governments have developing concerns about Bolivia's strengthening alliance with left-leaning governments in Venezuela, Ecuador and Cuba; it's growing role in supplying international drug markets; and lack of respect for foreign investors and industrial groups (Eaton K, 2007, Dangl, 2007, Lupu 2004).

4.6.5. Indigenous Groups

Bolivia's population has the largest proportion of indigenous people in Latin America, with 62% of the total population considering themselves to be of indigenous descent (Government of Bolivia, 2001). There are 36 distinct indigenous groups in Bolivia, dominated by the Quechua and Aymara peoples, who represent 30% and 25% of the total population respectively (UNDP 2010). Indigenous peoples were forced to work in the Spanish colonial mines in the *Altiplano*, and suffered terrible working conditions (Nash 1979). Many were forced to work as slaves, while many also lost their tribal lands to mine development. It has been estimated that 70% of the slaves working in the Cerro Rico silver mine in Potosi (many of whom were indigenous) died through their work, representing up to 8 million fatalities over 300 years (Galeano 1973). In 1638, Fray Antonia de la Calancha commented on the price indigenous groups were paying for Bolivia's mining boom: *"....every peso coin minted in Potosi has cost the lives of 10 Indians who have died in the depths of the mines."*(UNESCO 2000).

Indigenous peoples of the *Altiplano* believe in three 'planes' of existence: *hananpacha* (the world above); *kay pacha* (this world) and *urin pacha* (the world below). They also worship the sun god (*Inti)*, the earth goddess (*Pachamama*) and revere the devil (*Supay*) who they believe controls the underworld. Mountains are sacred to indigenous peoples of the Andes, who consider that mining activity violates their holy places, particularly if no compensation is provided to their gods for what was taken. Miners

working below ground therefore offer gifts to *Supay* in return for the mineral they take. They periodically sacrifice a llama and make regular offerings to underground images of *Supay*, such as coca leaves, cigarettes and alcohol (Bonilla 2006, Eckstein 2001, Harris 1983).

Religious belief has changed since Spanish colonialism, as indigenous cultures have absorbed and transformed Christian mythology and the symbolism of commodity production and capitalism. For example, miners have evolved the cult of *El Tio* (the uncle) from their belief in *Supay*, which is used to translate miner resistance to alienation and exploitation by the rich Tin Barons (Bonilla 2006). Following independence from Spain, the Bolivian state showed little interest in preserving Indian communities, and privatised their land for agricultural modernisation. Mining concessions also forced indigenous peoples from their land, and exhausted their timber resources, fuelling conflict between indigenous groups and mining interests (Godoy 1990). Some even hypothesised that this conflict gave rise to indigenous beliefs in the devil throughout Bolivia and Peru, stating that: *"The religion of the oppressed can assuage that oppression and adapt people to it, but it can also provide resistance to that oppression."* (Taussig 1980).

Although the use of slave labour ended with colonialism, indigenous people continue to dominate the mining sector labour force in the *Altiplano*. They are no longer forced to labour in the mines, but many have little alternative due to the absence of other work opportunities in rural and urban Bolivia.

4.7. Mining Sector Stakeholders in Bolivia

In line with my research focus on institutions that make up the Bolivian mining sector, this section identifies the key stakeholder groups and outlines their roles and relationships. The main stakeholders are the government, mine worker unions, non-governmental organisations (NGO's), trans-national corporations (TNC's) and artisanal mine worker co-operatives. The following sections consider each of these stakeholder groups, with significant emphasis upon mine worker co-operatives, given their recent significance in the sector and because women mine workers have traditionally engaged in organised labour via mine worker co-operatives.

4.7.1. Government Departments

The *Ministerio de Mineria y Metalurgia* is responsible for the development and implementation of Bolivia's national mining sector policy, while the *Superintendente de Minas* regulates mine site activity via the Mining Code. COMIBOL administers mining concessions, funding and services (COMIBOL 2011),

while the *Servicio Geologico Tecnico de Minas* (SERGEOTECMIN) provides specialist information to help with mineral exploration and mine development (UDAPE 2006).

The *Ministerio de Trabajo, Empleo y Previsión Social* (Ministry of Labour, Employment and Social Services) is responsible for regulating employee rights, with the *Viceministrio de Cooperativas* (Vice-ministry of Co-operatives) responsible for the country's diverse range of worker co-operatives. Several other central government departments have interests in mining sector development, environmental impacts and women's employment, but tend to work through COMIBOL and the *Ministerio de Mineria y Metalurgia*. These include the *Ministerio de Desarrollo Sostenible y el Medioambiente* (Ministry of Sustainable Development and the Environment), the *Viceministerio de Desarrollo Productivo* (Vice-ministry of Productive Development) and the *Viceministerio de la Mujer* (Vice-ministry of Women).

Since 2003, the government of Evo Morales has re-written the constitution, nationalised key assets, established political and economic alliances with socialist nations, relaxed controls on narco-trafficking, purchased military hardware and empowered the indigenous majority (Madrid, 2005). Sustainability and indigenous values figure prominently in his party's policies, including: *"Living well means harmony between the material and spiritual worlds, and between humans, communities and the environment"* (Bilaterals.org 2008). Indeed, one author suggests that Bolivia has embarked on a new development model which emphasises focused on communitarian welfare and a harmonious relationship with nature (Pellegrini 2011).

In 2009, approximately 50% of Bolivians were satisfied with their democracy, compared to less than 20% in 2001 (the Economist 2009). However, a 2010 democracy index ranked Bolivia in 80th place out of 167 countries. This represents a decline from 75th position in 2008, principally due to deteriorating media freedom, consolidation of power within the ruling party, misuse of public funds for political purposes and forced redundancy for public officials that do not support the ruling party (The Economist 2010).

4.7.2. Mine Worker Unions

During the 1950's, Bolivia's mine worker unions were amongst the most potent forces for political change of the 20th Century (Bebbington et al. 2008a), and significantly influenced government policy following the 1952 revolution (McCracken 2011). Mine workers were originally affiliated to the national workers union *Centro Obrera Boliviana* (COB), but in the mid-1960's, salaried miners working for COMIBOL joined the left-wing *Federación Sindical de Trabajadores Mineros de Bolivia* (FSTMB). In 1968, independent miners working for co-operatives established the *Federación Nacional de Cooperativas*

Mineras (FENCOMIN) as a national co-ordinating body, which had 65,000 members in 2008 (FENCOMIN 2008). FENCOMIN comprises 11 regional subsidiaries operating under the title *Federación Departamental de Cooperativas Mineras* (FEDECOMIN) in the *Altiplano* and Cochabamba (Andean Information Network 2007). Those working in the mining sector as contractors to private mining companies are not represented by either FSTMB or FENCOMIN, although some may be affiliated to COB. There have been significant tensions between FSTMB and FENCOMIN mine workers since 1985, sometimes resulting in armed clashes.

4.7.3. Non-Governmental Organisations (NGOs)

A survey in November 2011 revealed that a total of 2,175 NGOs were active in Bolivia, over 140 of which were overseas agencies. These organisations are involved in a broad range of development work related to health, education, housing, agriculture, welfare, employment and industry (CELDA 2011). There have also been many national development programmes delivered via the European Union, plus Western NGOs from Norway, Denmark, Germany, Spain, Sweden and Canada (Aranibar 2003, Anderson 2004). NGOs in Bolivia are typically funded by overseas development aid organisations, and actively support mining communities and ex-miners. Key initiatives have included environmental investigations and remediation projects; the establishment of housing, sanitation and micro-finance schemes for mining communities, and support for women in mining communities.

The most prominent Bolivian NGO currently active in the mining sector is CEPROMIN, which provides information and support to Bolivia's mining organisations (CEPROMIN 2009) and supported the development of a national organisation for women mine workers (IWMN 2000, PSAC Social Justice Fund 2010). Cumbre Sajama is another Bolivian organisation which actively works to improve women's rights in mining communities (Aranibar 2007). Another prominent Bolivian NGO is CONCOBOL (Confederación Nacional de Cooperativas de Bolivia), which is funded by sector-based co-operative federations around the country to provide them with information, training and support (CONCOBOL & SOCODEVI 2011).

There are also several major international NGOs operating in mining sector initiatives in Bolivia. The European Union funded the APEMIN I and APEMIN II projects, which helped artisanal miners learn new trades in working precious and semi-precious stones (Aranibar 2003), and is currently funding the US$17 million EMPLEOMIN project over 5 year, to provide drills and crushing plant to 15,000 women in mine worker co-operatives (Viceministerio de Cooperativas Mineras 2011). Other European nations have bilateral aid projects with Bolivia. The Spanish NGO *Agencia Espanola de Cooperacion Internacional para*

el Desarrollo (AECID) funded Project Sajama, which developed information resources for women in *Altiplano* mining communities, focusing upon the control of intra-family violence and abuse sexual and reproductive health and leadership techniques for women (Red de Mujeres y Mineria 2009b). The Danish NGO DANIDA also funded training to improve the awareness of occupational health, environmental contamination and worker rights in the mining sector (Aranibar 2003).

Other major international donor agencies include the International Labour Organisation which funded training of female miners in Potosi to use sewing machines (PSAC Social Justice Fund 2010), and the World Bank and Nordic Development Fund, which financed environmental baseline investigations into environmental contamination from *Altiplano* mining activities (Dames & Moore 2000b).

4.7.4. Trans-National Corporations (TNCs)

In recent years, large international mining companies have returned to invest in Bolivia, with several major projects underway to mine gold, zinc, tin and iron resources. These projects are using highly mechanised open cast mining methods to maximise productivity, which contrasts starkly with the labour intensive shaft mining method that has been practiced for over 500 years in Bolivia's tin and silver mines. Although this transition promises obvious benefits in terms of export revenues and worker safety, there is also evidence of negative consequences, including reduced employment opportunities, environmental contamination and community dissatisfaction. The most significant TNC mining initiatives in the last decade are *San Cristobal, San Bartolome, San Vicente* and *El Mutún*. *San Cristobal is a* US$600 million investment at the third largest silver mine in the world, which produces 1,300 tonnes of silver/zinc/lead concentrate per day (Minera San Cristobal SA, 2011). *San Bartolome* is a major open-pit silver mine operated by a subsidiary of the US company Coeur d'Alene Mines Corporation. It reprocesses waste rock and tailings around Cerro Rico at Potosi, and has proven reserves of 107 million ounces (Coeur d'Alene Mines Corporation, 2011). The *San Vicente* open cast silver and zinc mine is a joint venture project between COMIBOL and the Canadian mining company Pan American Silver Corporation, covering 8,000 hectares. Proven reserves stand at 0.6 tonnes of silver and 40 tonnes of zinc (Pan American Silver Corp 2011). *El Mutún* is a US$2.1 billion investment by India's Jindal Steel and Power Limited, to extract 20 billion tonnes of iron ore reserves over 40 years (Jindal Steel and Power 2011, Minera de Bolivia 2011). Finally, a US$9 million plant is proposed for the river flats below Mina Huanuni, which will recover tin and zinc from sediments at a rate of 5,000 tonnes per day (Zamora et al. 2010, La Patria 2010b). Many TNCs are still wary of investing in Bolivia, given its recent history for nationalising

company assets, and the high level of corruption within Bolivia's government, which recently ranked as number 120 out of 180 countries worldwide (Transparency International 2009).

4.7.5. Artisanal Mine Worker Co-operatives

Almost all artisanal mine workers operate as part of mine worker co-operatives, which were first established to provide food for workers, but later evolved to provide vehicles for worker savings, credit and means of production (CEPROMIN 1989a). The first mine worker co-*operatives (Sindicatos-Cooperativas and Cooperativas de Kacchas Libres)* were established in Potosi, in response to widespread unemployment resulting from the great depression in the United States between 1929 and 1933, and the Chaco War of 1932-35 (FENCOMIN 2008). Co-operatives were institutionalised in 1958 with the *Ley General de Sociedades Cooperativas* and the *Instituto Nacional de Cooperativas* (Absi 2009).

Continued growth in mineral exports from 1930 meant that mining co-operatives were very profitable, and membership grew rapidly, particularly following post-revolutionary agrarian reform in 1953 which led peasant labourers to migrate to mining centres from the countryside (Absi 2009, McMahon 1999). After the 1985 Tin Crisis, many *Relocalizados* joined artisanal mine worker co-operatives (Andean Information Network 2007). COMIBOL was sympathetic to the plight of displaced miners, and helped them by providing power, technical support and engineering assistance, setting production goals and marketing the mineral they produced. In return, co-operatives paid a portion of their revenue to COMIBOL, maintained the mine, kept financial records and reported to COMIBOL (Widerkehr 1980). In 1986, Supreme Decree 21377 ceded control of eight state-owned mines[3] and the Machacamarca foundry to mine worker co-operatives (CEPROMIN 1989a). Mine worker co-operatives have since represented a growing proportion of Bolivia's mining sector workforce, and by the 1990's were the most influential players in the sector, displacing mine worker unions (Anderson & Velasco 2004).

After 1994, the number of artisanal mine workers began to decline due to a combination of economic growth and mineral depletion (McMahon et al. 1999). Indeed, the iconic Cerro Rico silver mine has been mined so intensively that the hill itself shows signs of collapsing (Friedman-Rudovsky 2011). Despite this decline, the structure of the mining industry in Bolivia was dominated by co-operative mining companies at the start of the 21st Century (Aranibar 2003). By 2009, mine worker co-operatives represented 10% of the 2.28 million people registered with all worker co-operatives in Bolivia *(Direccion General de*

[3]The mines were: Catavi, Colquiri, Colquechaca, Chorolque, Japo, Morococala, Santa Fe & Viloco.

Cooperativas 2009). However, approximately 30% of members are involved in gold production (Michard 2008), and in 2010 it was estimated that 40% of registered mine worker co-operatives were inactive (La Patria 2011b). Recent trends in the number and membership of mine worker co-operatives are shown in Table 4.2, which illustrates strong growth in the number of co-operatives and their membership since 1986. However, it also illustrates marked inconsistencies between different sources of statistics.

Most mine worker co-operatives lack funds for investment and have little interest in maintaining mine infrastructure or investing in features that improve safety or reduce pollution (Altamirano 1995). They operate on the premise that the operation is viable if revenue from mineral sales exceeds the cost of resource extraction, processing and transport. However, this does not take into account the externalities associated with environmental contamination, infrastructure deterioration and adverse socio-economic consequences (Vizcarra & Barrios 1997) and undermines the long term economic viability of the mine (Heemskerk 2002, Quiroga 2002). Indeed, the growth of artisanal mining in Bolivia has been described as inefficient, unproductive, exploitative and environmentally damaging (Widerkehr 1980, Quiroga 2002, UDAPE 2006) and has been shown to have a negative effect on agricultural production (Absi 2009).

Year	Co-operatives	Members *(Socios)*	% of mine workforce
1986[1]	-	52,775	66%
2002[2]	100	15,500	-
2002[3]	-	60,000	-
2004[4]	-	-	82%
2006[5]	560	43,000	-
2006[4]	-	60,000	90%
2011[7]	419	-	-
2009[6]	-	60,000	90%
2009[7]	500	-	-
2010[6]	3,500	-	-
2011[7]	596	-	-

Table 4.2 Mining Co-operatives & their Membership (1986 – 2010)

Source:
1 - CEPROMIN 1989a
2 - Hentschel et al. 2002
3 - Hinton et al. 2003
4 - Michard 2008
5 - UDAPE 2006
6 - Absi 2009
7–Penaloza 2011

The NGO CEPROMIN viewed mine worker co-operatives as a vehicle to transition the mining sector from capitalism to socialism (Moeller 2002a). However, this transition was not without conflict between mine worker co-operatives, the unions and the government. Mine worker co-operatives have developed an antagonistic relationship with COMIBOL since 1985, as *cooperativistas* resent the benefits enjoyed by state miners and the revolutionary politics of COMIBOL, while state miners considered *cooperativistas* to be uneducated and irrational (Absi 2009). In some cases there have been violent clashes between state mine workers and *cooperativistas,* most recently at Mina Huanuni in 2006 (Cajias de la Vega 2008).

In 2004, Bolivia's Director for Prevention of Conflicts and Internal Affairs declared that mining co-operatives represented the third most significant socio-political problem in Bolivia (after gas and land rights) and that they were undermining economic development (Michard 2008). Mining co-operatives were strongly opposed to the 2007 re-nationalisation of Bolivia's mines by Evo Morales, as this meant that they would reap little benefit from rising mineral prices, despite having suffered 20 years of low revenues (Andean Information Network 2007). The government acknowledges that there are a number of shortfalls with the way co-operatives are established and run, and in 2009 revealed a strategy focusing on their legal establishment, regulatory compliance, worker education and mine financing (*Direccion General de Cooperativas,* 2009). The government is currently preparing a new legislative framework for the mining industry in Bolivia *(Ley Minera),* which acknowledges the productive and social role performed by mining co-operatives, and is attempting to strengthen the co-operative mining system (*Viceministerio de Cooperativas Minaras*2011).

In mine worker co-operatives, there are two main levels of association. A *socio* is a fully-fledged member with voting rights and a reserved place of work in the mine, while a *peon* is a person with a restricted work role under the direction of a *socio*. Support roles may also be available to contract workers at mine sites operated by mining co-operatives, including guards, drivers, security guards, caterers, laundry workers and administrative staff; none of whom have voting rights in the co-operative (Michard 2008). The transition from *peon* to *socio* varies significantly between co-operatives, ranging from completing an apprenticeship, working for a prescribed period, or nomination by a *socio* (Michard 2008). As each *socio* is allocated a workstation *(paraje)*, there is a natural limit to the number of *socios* that can exist in a co-operative. Many co-operatives currently have their full complement of *socios*, and so a *peon* can only become a *socio* if an existing *socio* dies, retires or relinquishes their position. Approximately 40% of *socios* have been in co-operatives for over 8 years, with most of the remainder having been members for over 6 years (Trujillo 2005).

Workers in mining co-operatives are paid piece rates (as opposed to a fixed salary), minus a financial contribution to maintain the co-operative. Consequently, their income is directly linked to commodity price fluctuations (Berdeja Hurtado 2008). This fosters competition between members and encourages a focus on short term gain, at the expense of mine maintenance, occupational health and safety, and environmental protection (Widerkehr 1980). Some co-operatives provide their *socios* with access to credit to purchase equipment (Michard 2008). Several co-operatives may work the same ore deposit, working in teams *(cuadrillas)* of up to 10 workers, responsible for their own extraction, processing and trading (McMahon 1999). Some mining co-operatives were known to steal mineral from sections of the mine outside their concession, and sell this back to COMIBOL (Canelas 1966), while others purchase mineral from ore thieves*(jukus)* and claim it as their own production (Widerkehr 1980).

Bolivian mining co-operatives deviate from the international model for co-operatives, as there are different classes of membership and individuals organise production and have defined work stations. Some co-operatives also have less than democratic internal processes and policies. Established members of co-operatives dominate decision making and there are limited rights to challenge decisions (Chavez 2011). Women and indigenous peoples suffer more discrimination than others (Michard 2008).

Two sets of FEDECOMIN statistics describe the membership of mine worker co-operatives involved in metallic ore extraction in the Department of Oruro. Table 4.3 shows male (*socio)* and female (*socia)* participation in Oruro's mine worker co-operatives in 2007, while Table 4.4 shows that total membership for mine worker co-operatives in Oruro in 2011. National statistics for mine worker co-operative membership are also presented in Table 4.5, and illustrate that the period between 2008 and 2010 saw a dramatic growth in both the number of mine worker co-operatives affiliated to FENCOMIN, and a corresponding growth in their membership. The statistics also show that *Altiplano* mining operations accounts for 86% of mine worker co-operatives and 95% of their membership, and that the average co-operative size is growing in the *Altiplano*. Oruro has 7.6% of the *Altiplano's* mine worker co-operatives and 9.9% of the *Altiplano's* mine workers, but has less new mine worker co-operatives than elsewhere in the *Altiplano.* Less formal statistics abound in Bolivia. One local newspaper in Oruro reported that there are five mining co-operatives operating at Mina San José in Oruro, which employ a total of 1,000 miners (La Patria 2010c).

This section reveals that mine worker co-operatives have been an essential contributor to socio-economic survival in the *Altiplano* since the 1985 Tin Crisis. Despite their significance, they remain poorly understood.

Mining Co-operative	Location	Mineral	Socios	Socias	Total
San José	Oruro - ciudad	Pb, Ag, Zn	61	0	61
Nueva San José	Oruro - ciudad	Pb, Ag, Zn	238	0	238
10 de Febrero	Oruro - ciudad	Pb, Ag, Zn	216	15	231
Iroco 10 de Febrero	Oruro - ciudad	Pb, Ag, Zn	16	0	16
Multiactiva Corazón de Jesús	Oruro - ciudad	Pb, Ag, Zn	527	0	527
La Salvadora Oruro	Oruro - Itos	Pb, Ag, Zn, Sn	207	23	230
San Francisco de California	Iroco	Au	30	0	30
Machacamarca	Machacamarca	Sn	18	17	35
Unificada	Machacamarca	Sn	12	0	12
Puente Grande	Machacamarca	Sn	26	0	26
Poopó Ltda	Poopó	Pb, Ag, Zn	229	1	230
San Francisco de Poopó	Provincia Poopó	Pb, Ag, Zn	89	0	89
23 de Marzo	S de Garci Mendoza	Pb, Ag, Zn	33	0	33
El Moko	S de Garci Mendoza	Pb, Ag, Zn	39	0	39
Maria Luisa	S de Garci Mendoza	Pb, Ag, Zn	43	0	43
Paco Collo	S de Garci Mendoza	Pb, Ag, Zn	18	0	18
Antequera	Caňando Antequera	Pb, Ag, Zn	10	0	10
Aurífera Nueva La Joya	Localidad La Joya	Au	465	25	490
Chicote Grande	Lapinani	Sn, W	52	0	52
Colon	Antequera	Sn	16	0	16
El Carmen	Callipampa	Pb, Ag, Zn, Sn	56	4	60
El Porvenir	Japo	Sn	63	0	63
Japo	Japo	n/a	n/a	n/a	n/a
La Tormenta	Localidad Japo	Sn	17	0	17
Morococala	Morococala	Sn	85	0	85
Nueva Fuerza	Canton Paria	Pb, Sb, Fe	26	0	26
Nuevo Amanecer Juan del Valle	Canton Venta y Media	Pb, Ag, Zn	81	0	81
Santa Bárbara	Sora Sora	Sn	16	0	16
Santa Fe	Santa Fe	Pb, Ag, Zn	42	0	42
Tamiñani	Chicote Grande	W	31	0	31
Total			**2,762**	**85**	**2,847**
Proportion			**97%**	**3%**	

Table 4.3 Metal Mining Co-operatives Affiliated with FEDECOMIN, Oruro (2007)
Source: CISEP 2007

Location	Co-operative	Socios	Mineral
Oruro	Iroco 10 de Febrero Ltda	235	Gold
	San Fransisco de California Ltda	n/a	
	10 Febrero San José Ltda	1000	
	Nueva San José	1100	
	San José Ltda	400	
	Multiactiva Corozon de Jesus Ltda	900	Complex*
	La Salvadora Ltda	600	
Poopó	Poopó Ltda	550	
	El Carmen Ltda	250	
	San Fransisco Ltda	n/a	
	Olguita Ltda	n/a	
Machacamarca	Huanuni Ltda	100	Silver
	Machacamarca Ltda	n/a	
	Unificada Ltda	n/a	
	Puente Grande Ltda	150	
Antequera	Colon Ltda	n/a	Tin
Morococala	Morococala Ltda	250	
Sora Sora	Santa Barbara Ltda	n/a	
Soracahi	Cala Cala Ltda	135	
Negro Pabellon	Santa Fe Ltda	900	Complex*
Pazna	Antequera Ltda	n/a	
Corichaca	California Ltda	200	Silver
Total		**6,770**	

*Complex is a mixture of tin, silver and zinc

Table 4.4 Metal Mining Co-operatives Affiliated with FEDECOMIN, Oruro (2011)

Source: FEDECOMIN 2011

		Number of Mine Worker Co-operatives			*Number of Members (Socios)*		
Federation	**Department**	**2008**	**2009**	**2010**	***2008***	***2009***	***2010***
FEDECOMIN	Oruro*	28	32	39	*3,750*	*4,390*	*5,650*
FEDECOMIN	Potosi*	57	65	69	*13,800*	*14,840*	*17,840*
FERECOMIN	N Potosi*	14	16	18	*6,650*	*6,850*	*7,140*
FEDECOMIN	La Paz*	128	130	149	*8,700*	*9,140*	*11,260*
FERRECO	La Paz*	60	91	110	*3,080*	*4,450*	*5,270*
FECOMAN	N La Paz*	66	81	95	*2,650*	*3,050*	*3,880*
FERECOMIN	Atocha*	12	13	18	*3,280*	*3,460*	*4,390*
FERECOMIN	Uyuni*	10	12	15	*1,580*	*1,690*	*1,870*
FEDECOMIN	Cochabamba	38	48	62	*3,500*	*3,860*	*4,850*
Coop Minera el Progreso	Kami	1	1	1	*1,620*	*1,150*	*1,260*
FERECOMIN	Beni	8	11	14	*250*	*560*	*1,060*
Cooperativa Mineras	Pando	9	12	19	*250*	*360*	*550*
Cooperativa Mineras	Santa Cruz	12	14	17	*320*	*410*	*530*
Cooperativa Mineras	Chuquisaca	3	4	6	*120*	*155*	*230*
Cooperativa Mineras	Tarija	1	2	3	*35*	*76*	*110*
	National Total	**419**	**500**	**596**	***45,835***	***50,051***	***60,240***
	***Altiplano* Total**	**375**	**440**	**513**	***43,490***	***47,870***	***57,300***

* denotes *Altiplano* Departments

Table 4.5 National Statistics for Mine Worker Co-operative Membership: FENCOMIN Affiliates (2008 to 2010)

Source: Penaloza 2011

4.8. Women Mine Workers in Bolivia

Women were involved in mining activity in Bolivia as far back as Inca times, when payment was made to *Parejas* (husband and wife teams) working in Inca gold and silver mines. Women have continued to play a prominent role in ore transport and processing activities in Bolivia since Spanish colonial times (Berdeja Hurtado 2008, Barrios de Chungara 1978, Bonilla 2006). Wives and children often accompanied their *Mitayo* husband inside colonial mines, to help them with mineral selection and transport (CEPROMIN 1996). However, a combination of law, cultural barriers and superstition largely prevented women from working underground for 450 years. Women labourers have, however, dominated above ground activities throughout the history of mining in Bolivia (Bonilla 2006).

By the 16th Century, women's involvement in mining included carrying fuel and ore (Eich 1872), while by the late 17th Century, they helped their miner husbands by carrying ore, tools and supplies; selecting and concentrating ore, and also trading mineral and running businesses that supported mining activity (Trujillo 2004, Mitre 1981). Mine operators preferred to contract women labourers as they were able to pay them at lower rates than their male equivalent (Pinto 2000). Women's involvement in the mining sector grew dramatically since the late 19th Century, principally as a result of male mine workers being conscripted in the army and sent to fight in the War of the Pacific between 1879 and 1884 (Aranibar 2003). The Chaco War of 1932-35 also resulted in conscription for male miner, and 4,000 women worked underground during this period (Nash 1979). By the end of the 19th Century, women represented 43% of the mine workforce at Pulucayo mine near Uyuni, and 11.6% of the mine workforce for the mines *Mina Sioux* and *Mina Hernandez* in Potosi in 1917. However, many women involved in manual roles lost their jobs following industrialisation, when mechanical crushing and sorting plant became more widespread (Trujillo 2005). Displaced women mine workers often turned to informal work on the waste rock and tailings piles, or to panning river sediments to recover mineral residues (Nash 1979).

Women's role in the mining sector changed markedly following the socialist revolution of 1952, when the left wing ideology of the newly formed COMIBOL was that men and women should have equal opportunity. Despite this, women were still prohibited from working inside its mines, restricting their equal opportunities to concentration work in the *ingenios* and rock piles, and making explosives for use in the mine. By contrast, some of the artisanal mine worker co-operatives let women work underground, and some women even did drilling work (Absi 2009).

The Tin Crisis dramatically reduced employment opportunities for women in the mining sector, and the only legal option available to many women was to join artisanal mine worker co-operatives. Inside the co-operatives, gender discrimination was more marked than in State employment and women were only able to access menial roles, such as recovering mineral from waste piles cleaning and manual transport roles. However, as surficial resources became depleted, women began to demand work inside the mine (Aranibar 2003).

4.8.1. Occupational Roles

Over the last five centuries, a combination of machismo, tradition, superstition and discrimination by male mine workers has largely barred women from working underground at Bolivia's mine sites. Consequently, the only types of work traditionally available to women in mining communities have been in transport, processing and support roles, as illustrated in Photographs 4.3 to 4.6. In 2008, Bolivia was ranked 80th out of 130 countries in terms of gender equality, principally due women's lack of access to education, political positions and enterprise leadership roles, and because female salaries were less than half the male evquivalent (Hausmann et al 2008). In addition to these institutional barriers, husbands in Bolivia have until recently been legally able to restrict their wife's access to employment (Dollar & Gatti 1999).

Bolivian feminists live in deep poverty and face structural inequality, which makes it difficult for them to achieve change, but began organising themselves in the 1960's in response to military dictatorship. Domitila Barrios de Chungara was a housewife whose publication 'Let me speak!' (Barrios de Chungara 1978) gained widespread recognition amongst Western feminists, and encouraged Bolivian women to protest against structural adjustment policies of the 1980's and 1990's. The author also went on to become a prominent feminist activist in Bolivia, fighting for greater acceptance of single women, unmarried mothers and lesbians in Bolivia (Lind 2003).

Many women in mining communities have both domestic and occupational work roles, as they support their husband (by providing food), look after any children they may have, and work to recover and process mineral from waste piles (Berdeja Hurtado 2008). Their participation in mining and processing work is typically driven by lack of alternatives, and they have largely been restricted to manual labour due to chronic lack of investment and limited energy supplies at mine sites (Choque 2000). Following the socialist revolution of 1952, women across the economy were able to access work roles previously unavailable to them. In particular, women in the State mining company COMIBOL were able to access

opportunities previously only available to their male counterparts, including underground work (see Figure 4.7).

Bolivian researchers (Aranibar 2003, Trujillo 2005) have identified that women mine workers perform several distinct occupational roles at mine sites, and may work as *Palliris* (who recover mineral from waste rock piles); *Veneristas* (who recover mineral from alluvial deposits along river banks); *Lameras* (who pan sediments and *ingenio* waste to recover mineral); *Relaveras* (who refine *ingenio* waste using buddles); *Barranquilleras* (who pan river sediments to recover gold); and *Rescatiris* (black market ore traders, who buy mineral from miners). Although these roles are not exclusive to women mine workers, very few men work as *Palliris*, *Lameras* or *Rescatiris*.

Photograph 4.3 *Palliri* re-working a waste rock pile, Mina Siglo XX (undated)

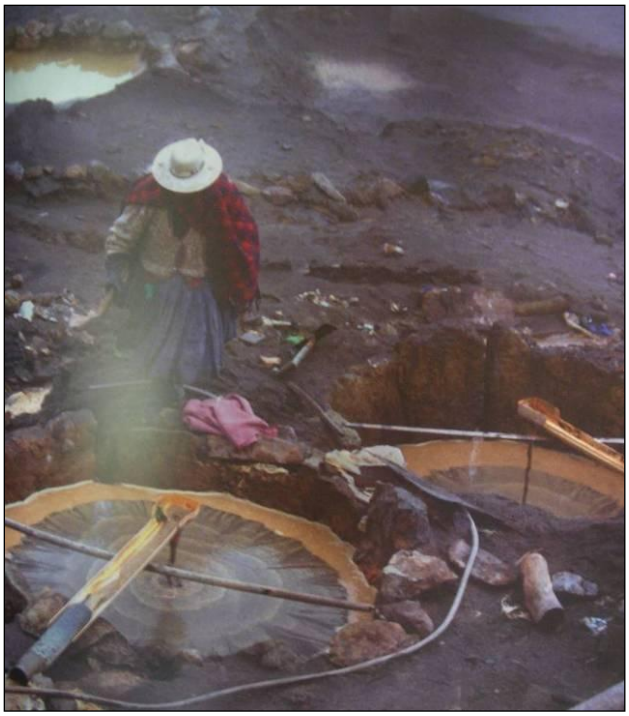
Source: Wicky 2002

Most women work 8-10 hours per day, six days per week (PSAC Social Justice Fund 2010), but despite their long hours they have a very low income. Women mine labourers at Mina Poopó earned less than 150 Bolivianos (US$22) per month in 2002 (Aranibar 2003), while women mine workers in Potosi received 300-600 Bolivianos (US$44-88) for each 10kg of mineral they produced (Bystrowicz & Unamuno, 2010).

The heavy work of women miners commonly results in back pain and gynaecological problems, while exposure to contamination and cold can cause kidney problems. They also commonly experience discrimination and cursory attention when seeking medical attention (Berdeja Hurtado 2008), particularly in the artisanal mining sector, where: *"…while the positive impacts (of artisanal mining) are*

Photograph 4.4 *Palliri* picking mineral from an *ingenio* conveyor

Source: Unknown Author, 2008



Photograph 4.5 ***Relavera*** **using a Buddle to recover tin from** ***ingenio*** **waste**

Source: Trujillo 2011

Photograph 4.6 ***Locatorias*** **loading an ore car**

Source: Unknown Author, 2008

hardly felt by women, they are hard hit by the negative impacts" (Traore 1997). Table 4.6 illustrates that in 2003, the majority of women working as *Palliris* at Cerro Rico in Potosi were middle aged or older, with none younger than 30 years old.

4.8.2. Women in State Mines

The existing literature provides many superficial references to the work of women in state mines prior to the Tin Crisis, indicating high participation rates in labour intensive classification and concentration roles. However, it failed to find much published research to the contemporary role of women in state mines. Even Bolivian media publications made little reference to women in COMIBOL mines, while

Photograph 4.7 *Locatorias* at Mina Atocha (2005)

Source: Viceministerio de la Mujer

Age Range	% of Total
30-40 years	16.7%
41-50 years	48.9%
51-60 years	22.2%
61-70 years	12.2%

Table 4.6 Age Distribution for *Palliris* working at Cerro Rico, Potosi
Source: Aranibar 2003

information and images available in COMIBOL publications suggested that women did not have a significant presence in the organisation.

By the end of the 19th Century, there were 5,000 women worked in the national mine labour force, representing approximately 50% of the mining sector workforce (Trujillo 2005), but their participation declined markedly following the 1985 Tin Crisis. By 1998, there were only three women working in 'men's roles' in Potosi's underground mines. In 2005, it was estimated that there 500 women were working at Mina Huanuni, with 50 other women workers distributed between the mines of Morococala, Poopó and Machacamarca (Trujillo 2005). A local newspaper estimated that more than 200 women were working inside mines in Oruro, and that they did exactly the same work activity as male miners, but lacked appropriate equipment (La Patria, 2010b).

4.8.3. Women in Mine Worker Co-operatives

Several studies have attempted to estimate female membership of Bolivian mine worker co-operatives, and the results of studies undertaken between 2003 and 2008 (see Table 4.7) do not show much consistency, particularly given the underlying strong growth in overall membership over this time. However, it does remain clear that membership of mine worker co-operatives is predominantly male, and that their proportion of women members remains well below the 18% national average for all worker co-operatives (CONCOBOL & SOCODEVI 2009).

Year	Women Members *(Socias)*	% of mine workforce
1950[1]	4,000	10%
1993[1]	5,000	-
2003[2]	10,000	-
2003[3]	7,500	8%
2007[4]	10,305	15%
2008[5]	-	10%
2008[1]	3,000	-

Table 4.7 Female Membership of Mine Worker Co-operatives in Bolivia (2003 – 2008)

Source: 1 –Trujillo 2005
2 - Aranibar 2003
3–Hinton et al 2003
4–CONCOBOL/SOCODEVI 2009
5 - Michard 2008

Until recently, women experienced discrimination in mine worker co-operatives (Aranibar 2003), where they were given access to low grade *parajes*, received a reduced share of revenues, or were prevented from becoming *socios* or from joining the management team. However, in more recent times women have achieved greater equality in mine worker co-operatives (CEPROMIN 1996), particularly since 2001 when they gained formal recognition as partners and shareholders (Chavez 2011). Most co-operatives currently offer female *socios* rights equal to those of their male counterparts (Michard 2008) and are generally accepted as equals (La Patria, 2010d). A recent initiative to avoid discrimination has been the growth of women-only mine worker co-operatives, such as one for 200 women members in Chorolque, Potosi (Chavez 2011). In 2009, COMIBOL and the Departmental Network of Women and Mining collaborated to develop a publication for mining co-operatives, which explained their social and environmental responsibilities. The text and Illustrations in this publication emphasised the rights and roles of women and, to a lesser extent, responsibilities to the family and the environment (Red de Mujeres y Mineria 2009a).

4.8.4. Women Mine Workers at Home

Although women in mining communities make a critical contribution to mine site productivity as unskilled labourers, they also make an important contribution to community cohesion and stability, and have been primary agents for positive social change (Hinton et al. 2003). Housewives *(Amas de Casa)* work hard to support their miner husbands and their families of up to 10 children (Trujillo 2005). Around 90% of housewives at mine sites start their day at 4-5am, preparing food in the home. Then they are involved in mining support work from 8am until 1pm, after which they return home to prepare the evening meal (Aranibar 2003).

Despite their contribution to the family and community, women often suffer discrimination and violence in the home and in their communities, much of which is under-reported. Domestic violence may arise if women mine workers bring home more money than men in the family (Aranibar 2003). Wife beating and rape are reportedly widespread in mining communities, yet government policies and international conventions to control domestic violence have been ineffective (Berdeja Hurtado 2008). Prostitution is also rife in many mining communities, which has consequences for family livelihoods as miners spend much of their income outside their family. Several projects have been implemented to help women to get a better understanding of their rights and how to combat abuse in the home (Aranibar 2008). Violence against women is moderated to some extent by the church; by the security of fixed accommodation; female support networks and the nuclear family (Nash 1988b).

Studies of women mine workers at Cerro Rico in Potosi revealed that 24% cannot read or write, and that they were less likely to own their home than other women in the community. Of those interviewed, 56% owned the home in which they lived, while 34% rented and 10% stayed with family. Most of their homes had electricity, but did not necessarily have a water supply or wastewater disposal service. Overall, researchers conclude that there had been significant improvement in their livelihood between 1950 and 2000 (Aranibar 2003).

4.8.5. Women's Organisations

Women were quick to support their miner husbands in past struggles for worker rights and in the resulting conflicts with mine owners and government forces. Indeed, women played an active role in supporting union protests at many mine sites. However, it was not until 1961 that women formally established their own National Housewives Committee *(Comite Nacional de Amas de Casa)*, which enabled them to communicate their own specific needs and interests (Aranibar 2003). Despite the success of housewives in achieving national recognition, women mine workers were less fortunate as their attempts to create a national body were strongly opposed by senior figures in the mining industry and government. Consequently, the only national representation currently available to women mine workers is via the mine workers union (FSTMB). Some women have suggested a partnership between women mine workers and housewives, to create a stronger presence at a national level *(Federacion Nacional de Mujeres de las Minas)*. However, to date, this has not occurred (Aranibar 2003).

The first national meeting ('*encuentra nacional*') of women mine workers was held in 1994 in Llallagua, Potosi. It was organised by Radio Pio XII and was attended by over 200 *socias* (Aranibar 2003). This group has subsequently held ten further annual national encounters and also participated in international meetings of women workers. CEPROMIN and FENCOMIN organise the national encounters and publish their proceedings. CEPROMIN also publishes summaries in cartoon form to make the proceedings more accessible to those with low literacy levels. Figure 4.5 shows how effective this approach can be for those with limited literacy (it illustrates how housewives came together to challenge State oppression and free their miner husbands).

4.9. The Future of Mining in Bolivia

It has been estimated that only 10% of Bolivia's readily accessible mineral wealth has been exploited to date, and the country still has globally significant reserves of copper, gold, iron silver, tin and zinc. There is also on-going exploration and development interest in antimony, boron, copper, gold, lead, lithium,

Figure 4.5 Extract from a draft CEPROMIN publication for miner's wives

Source: CEPROMIN

potassium, nickel, semi-precious stones, sulphur, tin and zinc. Bolivia also has 0.6% of the world's reserves of uranium (La Patria, 2010a), and approximately half the world's lithium resource.

National mineral exports rose more than five-fold between 2000 (US$929 million) and 2010 (US$5,094 million), representing over 20% of total exports in 2010 (La Patria 2011a) In 2011, record mineral exports of US$2,149 million were predominantly attributed to silver and tin (La Patria 2011a), much of which is now sourced from the San Cristobal open cast mine in Potosi (La Patria 2010c). Inti Raymi is also becoming a prominent contributor to exports as gold prices rise, exporting 8.4 tonnes of gold in 2009 (La Patria 2011a).

Booming mineral demand from the newly industrialising economies of India and China is increasing mine revenues and revitalising the Bolivian mining sector (Andean Information Network 2007), while Chinese investment in Latin America is growing strongly (Dreyer 2006). Large scale mining operations are starting to dominate mineral exports from Bolivia and the government is making mining mega-projects a priority

in 2011 (La Patria, 2011c) and has tripled its investment in the mining sector since 2010 (La Patria, 2010b). The government has established large mining projects in partnership with a range of international mining companies from the United States, India and Japan, and is now planning the exploitation of its lithium (Hollander & Shultz 2010).

Despite the rosy prospects for Bolivia's extractive sector, international financial institutions remain concerned about Bolivia's deteriorating investment climate, limited capacity and antiquated technology. Furthermore, the US has cut-off trade access to its markets in response to nationalisation of the hydrocarbons sector by Evo Morales (Verbeek 2009, Vargas Suárez 2009). The new constitution (Government of Bolivia 2009) provides the government with greater control over the use and exploitation of natural resources, and there are signs that exploration and production are accelerating. However, some observers consider that activists and anti-mining groups are now sufficiently integrated into government in Bolivia and aim to undermine future growth in the mining sector (Bebbington et al. 2008a).

New initiatives are also emerging that challenge the worker exploitation that has tarnished Bolivia's mining sector for centuries. In December 2010, Bolivia's Cotapata gold mining co-operative was the first mining organisation in the world to be certified 'Fairtrade' and 'Fairmined', which is scheme designed to provide sustainable livelihoods for mine workers and communities (Alliance for Responsible Mining 2010). Although the scheme is currently only applicable to gold mining operations in developing countries, there are proposals to extend it into other aspects of artisanal and small scale mining (Barreto 2011).

4.10. Summary

This chapter has shown that research work produced by the international community in the latter part of the twentieth century (Widerkehr 1980, Godoy 1985 & 1990, Altamirano 1995, Gill 1997, McMahon et al 1999) and during the last decade provided a good insight into Bolivian history and politics, and a reasonable insight into working conditions in large state mines in the *Altiplano* (Quiroga 2002, Anderson 2004, Bebbington et al 2008, Bury 2008). Although some research into the mining sector acknowledged women workers (Nash 1978, Hinton et al 2003), most researchers focused upon mining operations and the occupational lives of male miners. By contrast, contemporary literature has a greater emphasis on the role of mine worker co-operatives and women mine workers (Aranibar 2003, Trujillo 2005, Berdeja Hurtado 2008). Much of the available literature focuses upon the major historic mining centres of Cerro

Rico in Potosi (silver), and to a lesser extent, Mina Huanuni in the Department of Oruro (tin). However, there are many other significant mining operations scattered across the *Altiplano,* which have received little or no attention from researchers.

Mining has been the dominant form of economic activity in the *Altiplano* for almost 500 years, and mines in the Department of Oruro have made a significant contribution to national production of tin, zinc and gold. The lack of attention to the protection of workers, the environment and mining communities has led Bolivia's *Altiplano* mines being acknowledged as notoriously dangerous for workers, while mining operations have displaced local and indigenous communities. Environmental contamination associated with some of Oruro's mine sites has been described as amongst the worst in the world (Van Damme et al. 2008).

The Bolivian government divested itself of most *Altiplano* mine assets after the 1985 Tin Crisis, which decimated industry in the *Altiplano*, while the impact of neo-liberal reforms that followed led to artisanal mine worker co-operatives becoming the only viable employment option for many mine workers. Mine worker co-operatives have since become the dominant form of employment in the mining sector, and a significant proportion of their members were women, typically involved in waste reprocessing roles at the surface. However, the easily accessible mineral reserves have become depleted in recent years, making their work harder, less productive and more dangerous. This has resulted in some women entering underground labouring roles, although others are leaving the sector. NGOs are also starting to become involved in resolving the labour, environmental and gender issues that face *Altiplano* mine workers and their communities. However, the government is currently more focused upon attracting trans-national corporations to establish large scale high technology mining operations in Bolivia.

The next chapter (Fieldwork Findings) presents the results of the in-country data collection, much of which was designed to validate and update information presented in the Bolivia literature review. Chapter 6 (Analysis of results) then goes on to compare information generated by the literature review and fieldwork, to identify agreement, inconsistency, trends and emerging issues.

5. Fieldwork Findings

5.1. Introduction

This section presents the findings of my fieldwork conducted in Bolivia from 16th March to 10th April, 2011, during which time I was based in Oruro (see Photograph 5.1) and conducted a range of site visits and interviews as per the schedule presented in Appendix F (page 168). It should be noted that this section simply reports observations, information and quotations obtained during the fieldwork, while the interpretation and analysis of these findings is presented in the next chapter (Analysis of Results).

The fieldwork was intended to characterise contemporary mining activity in the Department of Oruro, with a specific focus on the roles of women involved in artisanal mine work, their opportunities and factors influencing their participation. The remainder of this chapter introduces the scope of fieldwork conducted, and presents findings about extraction and mineral processing operations (i.e. those conducted by the State sector, private companies and artisanal mine worker co-operatives). It then goes on to review the main institutions operating within the mining sector, and presents findings about the roles and participation of women mine workers. Finally, conditions encountered at mine sites in the adjacent Department of Potosi are discussed, to provide context for the observations.

Photograph 5.1 Northern edge of the City of Oruro (with Mina Santa Rita in centre of picture)
Source: Author

5.2. Fieldwork Overview

Site visits were made to a total of 18 mining sector operations (see Table 5.1), comprising seven mines, four mineral recovery facilities *(ingenios)*, two ore traders *(Commercializadoras)* and five reprocessing operations for tailings and waste rock. The site visits provided a good insight into current working conditions, operations and infrastructure, much of which was consistent with that reported in research literature. Site visits also enabled confirmation of the current scale and intensity of activity at mine sites, and the participation of women mine workers. Further detail about observations made during individual site visits are presented in the record of site visits in Appendix F (see page 168).

#	Mine Sites Visited in Bolivia
Underground Mining Operations	
1	*Mina* Huanuni, Oruro (31 March 2011).
2	*Mina* San José, Oruro (23 March 2011).
3	*Mina* Santa Rita, Oruro (23 March 2011).
4	*Mina* Itos, Oruro (23 March 2011).
5	*Mina* Kori Chaca, Oruro (29 March 2011).
6	*Mina* Poopó, Oruro (31 March 2011).
7	*Mina* Siglo XX, Llallagua, Potosi (24 March 2011).
Mineral Processing Operations	
8	*Ingenio* Itos, Oruro (23 March 2011)
9	*Ingenio* Machacamarca, Oruro (31 March 2011).
10	*Ingenio* Tiwanaku, Poopó, Oruro (31 March 2011).
11	*Ingenio* Uncia, Potosi (24 March 2011).
12	*Commercializadora* SRV, Oruro (1 April 2011).
13	*Commercializadora* Kori Sonco, Oruro (1 April 2011).
Surfacial Waste Reprocessing Operations	
14	Tailings piles, Machacamarca, Oruro (31 March 2011).
15	Tailings piles, Itos, Oruro (23 March 2011).
16	Waste rock piles, Mina Santa Rita, Oruro (23 March 2011).
17	Waste rock piles, Mina Siglo XX, Llallagua, Potosi (24 March 2011).
18	River banks below Mina Huanuni, Oruro (31 March 2011).

Table 5.1 **Mining Operations Visited**
Source: Author

A total of 27 interviews were also conducted during the fieldwork. Some interviews took place during site visits, while others were arranged at the offices of organizations involved in the mining sector. Interviewees included mine labourers, mining company management, central and local government departments, national and regional organizations representing mine worker co-operatives, and senior academics (see Table 5.2). Most interviews were conducted using a 'one on one' format, although several involved the interviewer talking with a small group of mine workers. The interviews provided a valuable insight into attitudes, issues and historic conditions, with many providing suggestions for sources of further information and contacts.

5.3. Extraction Operations

Mining operations visited included active mines at San José, Itos, Poopó and Kori Chaca, and the closed mine site at Santa Rita. Mining operations visited were conducted by State, private and co-operative mining organisations, as described in the following sections. It was not possible to visit mine sites at Colquiri or Japo due to a combination of dangerous roads and bad weather.

5.3.1. State Extraction Operations

The State organisation COMIBOL continues to administer mining and mineral processing operations across the *Altiplano* (see Figure 2.2 on page 13). COMIBOL controls all mining activity at Mina Huanuni, while at Mina Poopó, COMIBOL administers production via a combination of private mining companies and mine worker co-operatives.

Mina Huanuni is operated by Empresa Mina Huanuni and is the most significant State operation in the Department of Oruro, with levels of activity, infrastructure and employment significantly greater than that evident elsewhere. The mine extracts cassiterite from multiple levels within the hill *Cero Posokoni* and processes run of mine in an on-site *ingenio*. Excess is also sent to *Ingenio* Machacamarca for processing. It was not safe to view site operations due to the confined nature of the site, high level of activity and access restrictions. However, operations appeared highly mechanised and infrastructure appeared to be reasonably maintained. Interviews with senior management at Mina Huanuni revealed that the 5,000 workers at the site were either State employees or contractors. Few women (including the interviewee) had achieved senior management positions within the company, while a handful of other women worked in administrative roles at the surface, or in support roles inside the mine. The interviewee stated that: *"Women working in the mine do not do any drilling or carrying work, but do cleaning, security, and equipment maintenance. Only one is a driller"* (interview #8). This was

#	Interviewees
Mining Sector Workers	
1	*Palliri*, Mina Siglo XX, Llallagua, Potosi (24 March 2011).
2 & 3	*Palliris*, Mina Santa Rita, Oruro (31 March 2011) – 2 interviews
4	*Relaveras* alongside the river below Mina Huanuni (31 March 2011).
5	*Relaveras* alongside the river at Machacamarca (31 March 2011).
6	*Mineras*, Mina Siglo XX, Llallagua, Potosi (24 March 2011).
7	*Mineros*, Cooperativa La Salvadora, Mina Itos, Oruro (23 March 2011).
Mining Sector Companies	
8	Empresa Mina Huanuni, Oruro (31 March 2011).
9 & 10	URS Corporation, Cochabamba (7 April 2011) – 2 interviews
11	Plant Superintendant, *Ingenio* Tiwanaku, Poopó (31 March 2011).
12	Ex-COMIBOL senior mining engineer, Oruro (20 March 2011).
13	Empresa SEOMIN (Servicios Operativos Mineros), Oruro (31 March 2011).
Government Departments	
14	COMIBOL, La Paz (8 April 2011).
15	Viceministerio de Cooperativas, La Paz (8 April 2011).
16	Gobierno Autonomo Departmental de Oruro (28 March 2011).
17	Alcaldia de Oruro (31 March 2011).
Mine Worker Co-operative Representatives	
18	FENCOMIN, La Paz (8 April 2011).
19	FEDECOMIN, Oruro (28 March 2011).
NGOs	
20	CEPROMIN, La Paz (9 April 2011).
21 & 22	CEPA, Oruro (18 March 2011) – 2 interviews
23	CAEP, Huanuni, Oruro (22 March 2011).
24	Red Mujeres y Mineria, Llallagua, Potosi (24 March 2011).
25	EMPLEOMIN, Oruro (30 March 2011).
Academics	
26 & 27	Oruro Technical University (27 on 18 March, 28 on 21 March 2011)

Table 5.2 **Interviews Conducted while in Bolivia**
Source: Author

consistent with comments received from other interviewees elsewhere, who commented that: *"There are only a handful of Perforistas in the country"* and: *"I only know of one female driller. She is at Huanuni."* (interview #20). The small number of women mine workers was surprising given that the literature review indicated that up to 500 women worked at the mine in 2005 (Trujillo 2005).

The visit to Mina Poopó revealed that COMIBOL had no fixed presence at the site, with all mine workers belonging to either private mining companies or artisanal min worker co-operatives. The deteriorating condition of mine infrastructure at this site was consistent with findings of the literature review and comments from a retired senior COMIBOL engineer who stated: *"…lack of investment has been holding back mining in Bolivia for at least a hundred years."* (interview #12).

5.3.2. Private Extraction Operations

The most significant private mining operation in the Department of Oruro is the Kori Chaca gold mine, operated by Inti Raymi SA. Although the site was visited (see Site Visit 10, Appendix F, page 187), permission to access this site or interview management was declined. However, from the perimeter fence it is obvious that this large open cast operation is a highly mechanised, high technology operation, with modern equipment and few employees.

Private operators also provided support services for mining operations. At Mina Poopó, Empresa Sinchi Wayra has installed and operates plant for pumping and ventilation, enabling miners to safely access lower levels of the mine.

5.3.3. Mine Worker Co-operative Extraction Operations

Several mine worker co-operatives were seen to be operating in COMIBOL-owned mines at San José, Itos and Poopó (see site visits 1, 3 and 15 in Appendix F). Surface infrastructure at all these sites was in an advanced state of deterioration, and the co-operatives had installed modern compressors, pumps and crushing plant amongst the ruins of existing mine infrastructure. However, they had done little to repair damage to rail tracks, ore cars, mine openings and non-essential equipment.

The most significant mining activity by *cooperativistas* was witnessed at Mina Poopó, where several mine worker co-operatives were operating at different levels of the mine, using separate mine openings. Ore was removed from the mine in manually operated ore cars and deposited in a chute for transfer to an *ingenio* by truck. At all other artisanal mining operations witnessed, miners brought out small quantities of concentrated mineral using backpacks, despite the presence of (dilapidated) rails and ore

cars. Miners at Mina Poopó reported that up to five women worked in support roles *(Sirenas)*, but they were not evident at the time of visit.

At Mina Itos, two mine worker co-operatives were operating in ex-COMIBOL workings. Miners working with *Cooperativa La Salvadora Ltda.* confirmed that of their 213 members, 22 were women. The miners said that women worked underground at Mina Itos and that some were *Perforistas*, using small Chinese YT25 drills. However, no women were encountered during the field investigation, so this could not be verified. An interesting comment was made by one of the artisanal mine workers interviewed at Mina Itos, which challenged the assumption made by some that *Palliris* were leaving the waste piles to work in underground roles. He stated that: *"None of the women miners had worked as Palliris before"* (interview #7), indicating that women mine workers in underground roles were joining the sector without prior experience.

Five mine worker co-operatives were found to be operating at Mina San José, again using mine entrances abandoned by COMIBOL. The co-operatives had installed new compressors, although it was not possible to determine how the co-operatives agreed to install and fund this shared plant. Of the 1,000 mine workers registered with FEDECOMIN in these co-operatives, 15 were reported to be women.

One interesting observation from the site visits was that, in marked contrast to the malnourished miners that have been reported throughout much of the history of mining in Bolivia, the artisanal mine workers encountered appeared well nourished, and in some cases, overweight. This change correlates well with statistics that suggest living standards, life expectancy and incomes in Bolivia have increased markedly in recent years.

Growing female influence in mine worker co-operatives was a recurring theme encountered during the fieldwork interviews. The Director of CEPROMIN stated that: *"The first mine worker co-operatives were only for men."* (interview #20), while the *Assessora* of the *Red Mujeres y Mineria* indicated that women are now more integrated into mine worker co-operatives, and are even evolving their own ways of working within their organisations: *"Although male miners in co-operatives do not like women working in the mines, most accept that they do not have an alternative and that they are desperate to earn a living"; "Some women mine workers also have positions of authority at both local and regional level, and some head their co-operatives." and "Women mine workers tend to sell their mineral to Commercializadoras, and divide their income equally, although drillers earn a premium. Male mine*

workers sell their mineral via the co-operative and split their income according to miner skill and experience." (interview #24).

5.4. Mineral Processing Operations

Mineral processing facilities visited during the fieldwork included active *ingenios* at Machacamarca and Poopó, waste rock piles at Santa Rita, San José and Poopó, and tailings reprocessing operations at Huanuni, Machacamarca and Itos. Two *commercializadora* operations were also visited to the Southern fringe of the Oruro urban area.

5.4.1. State Processing Operations

Managers at Mina Huanuni confirmed that *Veneristas and Palliris* working with mining co-operatives ceased waste reprocessing activities outside Mina Huanuni in 2007, when the government re-nationalised the mine and re-assigned them to other work as employees. Most remained working in surface reprocessing roles as *Relaveras*, although some took on manual roles inside the mine. Those working as *Relaveras* earn significantly more than many of their counterparts elsewhere. Of the 5,000 mine employees, 100 women work as *Relaveras* outside the mine, reprocessing *ingenio* waste along the local river. There is no reprocessing of waste rock at the mine.

A visit to the riverbank downstream of the mine confirmed that a large number of *Relaveras* work in small, mixed-sex teams *(cuadrillas)* alongside the river for a distance of 2 Kilometres below Mina Huanuni (see Site Visit 11 in Appendix F). The *Relaveras* receive deliveries of *ingenio* waste from the mine, which they mix with water and feed it into buddles, to recover cassiterite. Most *Relaveras* were women, and all had overalls, sun hats, gloves and gumboots, and were the only *Relaveras* encountered during the fieldwork with protective clothing issued by their employer. The *Relaveras* were more reluctant than other workers to provide comment, but during a short conversation, two confirmed that: *"Most of us used to be Palliris or Lameras with the co-operatives, but this work is now banned by the owner."* (interview #4).

Ingenio Machacamarca is operated by Empresa Mina Huanuni, and processes run of mine from Mina Huanuni. A guided tour of the site (see Site Visit 12 in Appendix F, page 191) revealed that 30 staff were employed at the site, including three women ex-*Palliris* who maintain the shaking tables and two other women who work in administrative roles. Much of the apparatus in the *ingenio* appeared to be very old, with no guarding or worker protection features installed. Several concrete buddles had been built on the

outside of the *ingenio*, but were disused. Process wastewater was discharged into a new tailings lagoon, rather than directly into the local stream as occurred in the past.

5.4.2. Private Processing Operations

COMIBOL mining and processing operations at Itos were closed after the Tin Crisis. However, a private company is reprocessing tailings waste below the old *ingenio*. This work is being conducted by Baremsa SA (see Site Visit 5 in Appendix F), which is a Canadian joint venture operation with the Bolivian government, to recover valuable metal from tailings waste and stabilize the resulting waste products. This operation involves a series of a high technology mechanised processes, and has very few employees. There was no evidence that *Relaveras* had been reprocessing the tailings prior to Baremsa SA starting its operations.

Ingenio Tiwanaku near Mina Poopó provides mineral processing options for small mines and *Commercializadoras* (see Site Visit 16 in Appendix F, page 194). Interestingly it does not serve the adjacent mine, as it does not have the capacity to cope with current production.

Visits were made to operations at two *Commercializadora* sites in Oruro (see Site Visits 17 and 18 in Appendix F). Both operations were broadly similar, in that they operated as intermediaries between the mine worker co-operatives and the foundry or exporter, and provided a prompt means of providing mineral suppliers with payment. Incoming mineral loads were removed from trucks manually, categorised, graded and re-packaged on site. Mechanical plant was available for crushing and screening, but all loading and unloading work was manual. Staff at these sites were exclusively male, with the exception of two female administrative assistants at one site, neither of whom had any prior experience of the mining sector.

Major works were also underway on the waste rock piles at Mina San José, in a remediation project funded via the European Union's APEMIN II project. The waste rock piles had been profiled and compacted. At the time of visit, the works were being completed, with perimeter drainage and a soil covering being applied. This was manual work conducted by a workforce of approximately 20 contractors to the project, five of whom were women.

5.4.3. Mine Worker Co-operative Processing Operations

The most significant reprocessing activity by artisanal mine worker co-operatives was encountered outside *Ingenio* Machacamarca (see Site Visit 13, Appendix F, page 192). Three co-operatives were

working the historic tailings waste from the nearby COMIBOL *ingenio.* They used primitive buddles to reprocess the tailings, which had a design almost identical to those viewed below Mina Huanuni. Only a handful of the 90 workers in these co-operatives were women.

Three *Palliris* were seen working on the waste rock piles below Mina Santa Rita (see Site Visit 2 in Appendix F, page 175). Two were women and one was a man. The male *Palliri* left before he could be interviewed but the women revealed that they were sisters, and that they worked on the waste piles because they were too old to work inside the mine with their co-operative. The two female *Palliris* made very similar statements about their work options: *"I am too old to work inside the mine, but my co-operative lets me work on waste piles."* (interview #2), and *"We are too old to work inside the mine so we have to work on the waste rock piles"* (interview #3).

During the site visit to Mina San José, several women members of mine worker co-operatives were encountered doing mining sector support work, such as selling food and doing laundry work. None of these women were willing to comment, other than to tell me the work they did.

5.5. Mining Sector Institutional Relationships

When evaluating conditions and developments in the mining sector, it is important to understand the main institutions and their interaction, as their agendas, policies and resources can significantly impact upon those involved in mining activities. The key institutions within the *Altiplano* mining sector are central and local government agencies, mining companies, mine worker co-operatives, NGOs and the mine worker unions. The following sections summarise the findings of interviews conducted with these organisations, while their interrelationship is described in the next chapter.

5.5.1. Government Departments

Although street riots prevented interviews with the Vice ministry of Mining and Metallurgy, COMIBOL, SERGEOTECMIN, and the national mine workers union FSTMB, an interview with the *Viceministerio de Cooperativas* suggested that the government still supports the day to day operations of artisanal mine worker co-operatives, and is beginning to recognise women's needs in the sector. This was confirmed by similar comments made by the *Assessora* of the Women's Mining Network, who said: *"The Viceministry of Co-operatives is now developing policy for women mine workers."* (interview #24).

According to an interview with a recently retired senior administrator from the Alcaldia de Oruro (interview #17), local government departments in Oruro employed many *ex-Palliris* to assist with

government funded civic construction and maintenance projects funded by national government tax revenues for gas exports. However, this funding has declined in recent years and fewer women are now employed in civic works.

5.5.2. Artisanal Mine Worker Co-operatives

It was not possible to arrange interviews with organisations representing mine worker co-operatives either at regional (FEDECOMIN) or national (FENCOMIN) level. Despite assurances from officials that information was available and would be provided upon request, no information was received in response to formal requests sent by my thesis supervisor.

A senior academic from Oruro Technical University indicated that his research into artisanal mine workers and *Palliris* revealed challenges for those who want to join mine worker co-operatives: *"It is hard for people to join co-operatives in Oruro as there are no spaces for new socios. New positions only become available if somebody leaves, retires or dies."* (interview #26). This was reinforced by an official from the *Viceministro de Cooperativas* who stated that: *"The original socios are now near retirement, but younger members cannot join due to restricted workstations in the mine or surface activities."* (interview #15).

5.5.3. Non-Governmental Organisations (NGOs)

Interviews with NGO representatives provided a good source of information about the work of artisanal mine worker co-operatives, the changing role of women mine workers, and the NGO projects that have taken place in recent years. Ingeniero Carlos Jungwirth provided information about the EMPLEOMIN project and confirmed that in his experience, women were becoming more influential in their mine worker co-operatives: *"Women are the leaders of some mining co-operatives in Oruro."* (interview #25).

Although it is clear that NGOs are providing a significant amount of support to the mining sector in general, and to women workers in particular, they are treated with suspicion by many in mining communities. Ironically, this was confirmed by the *Assesora* of the NGO *Red Mujeres y Mineria*: *"Many NGO's visit mine sites to photograph poor living and working conditions so they can get funding for their projects, but they don't return and conditions don't improve."* (interview #24).

5.5.4. Mine Worker Unions

It was not possible to arrange interviews with representatives of the FSTMB or COB during the fieldwork, principally due to heightened tensions between government and workers, and on-going protest action by state mine workers.

5.6. Women Mine Workers

Several interviewees commented on the pragmatism behind women's involvement in the mining sector, with comments including: *"…the main reason women enter the mines is the growing demand for mineral and their need for a greater and more secure income."* (interview #23)*, and "Palliri numbers are growing in some areas and declining in others, according to mineral availability in the waste rock and tailings piles."* (interview #22). This pragmatism is also reflected in the response of male mine workers, as: *"Men acknowledge that women need to earn a living wage and accept that they can work just as hard as the men, and accept them as colleagues."* (interview #22). This clearly indicates a substantive shift in attitude amongst male mine workers over the past 25 years.

Despite the evidence of growing female influence in artisanal mining, those working in mine worker co-operatives operate in a doubly competitive environment. A university academic identified: *"a healthy competitiveness between male and female mine workers and they can produce similar output"* (interview #27)*,* while the *Assessora* of the *Red Mujeres y Mineria* stated that: *"There is competition between individual Palliris, and confrontation can occur if one Palliri works at the site allocated to another."* (interview #24). There were, however, differing opinions about the type of underground work roles performed by women involved mine workers. A representative from the NGO CEPA suggested that they perform all roles: *"Initially, women underground workers did support tasks, but now do anything that men do, including drilling."* (interview #21). Although it does appear that women do seem to have access to most mining sector roles, the Director of CEPROMIN commented that: *"....there are virtually no women engineers in the mines, and few women study engineering at university"* (interview #20)*.*

Several interviewees considered that there was a growing involvement of women in underground mine work, and this was supported by media articles. However, it was not supported by field observations, and comments made by a senior environmental consultant who had visited most *Altiplano* mine sites since 1997 and 2002 commented that: *"We did not see any Palliris during our work at mine sites across the Altiplano"* (interview #10)*.* Unfortunately, official statistics were found to be ambiguous, with one government official confirming the lack of accurate statistics about artisanal mine worker participation:

"…no government department has access to reliable statistics for the number of cooperativas, socios or socias." (interview #15). A prominent NGO also concurred, adding that: *"The lack of statistics about women in the mining sector meant that they are excluded from government policy and programmes."* (interview #24). However, despite the lack of reliable statistics, the *Assessora* of the *Red Mujeres y Mineria* was optimistic for the future of women in the mining sector, as: *"The situation for women mine workers is improving in small steps, and their voice is now being heard.", and "There is a growing feminist movement in Bolivia, which is helping women mine workers to gain recognition."* (interview #24). The absence of reliable data to quantify actual participation by artisanal mine workers (and women artisanal mine workers) means that any statements about the participation of women in the artisanal mining sector will inevitably be qualitative, and subject to personal experience, opinion and political agendas.

5.7. Department of Potosi

Although the in-country data collection was focused upon the Department of Oruro, an opportunity arose to visit the significant mine sites of Siglo XX and Uncia in the adjacent Department of Potosi. This visit was done to gain an understanding into how conditions and operations encountered in Oruro compare to those in another Department, and revealed that they were broadly comparable. Mine worker co-operatives conducted all extraction and reprocessing activity viewed in the Department of Potosi.

Mina Siglo XX is currently mined by several mine worker co-operatives, although the scale of their operation is significantly less than that of previous COMIBOL activities, as evidenced by miners bringing out concentrated mineral in backpacks, as opposed to COMIBOL's use of ore trains for run of mine. Male miners stated that eight women worked underground in the upper levels of the mine, and it was reported that several *Palliris* worked on the waste piles below the mine entrance. According to one NGO, this is significantly fewer than in the past, when *"...over 600 women worked the same piles in the 1970's"* (interview #24). This suggests that female mine worker participation is now only 1.3% of that over 30 years ago, and raises serious questions about whether women workers will be present at any *Altiplano* mine sites in the near future.

A female *Palliri* was seen working on the waste piles below the upper access to Mina Siglo XX, and a local NGO representative confirmed that she was one of several female *Palliris* who worked for one of the mine worker co-operatives. When interviewed, the *Palliri* stated that: *"I work on the waste rock pile*

during the week and sell food in the market on weekends. Sometimes I also get 20 Bolivianos (US$3) from miners who ask me to concentrate their mineral." (interview #1). When asked what had happened to other *Palliris* who used to work in the area, she commented that: *"Many women who used to work as Palliris now work as Rescatiris, or in the foundries."* (interview #1). She also confirmed that she had previously tried working underground: *"I have worked inside the mine, but it is too dangerous for me."* (interview #1). However, it was also clear that working on the waste rock piles was not without its own risks: *"…a Palliri died yesterday in a rock fall, and a few weeks ago, several miners rescued another Palliri from a collapsed hole using their bare hands"* (interview #1). It is clear from statements made by this *Palliri* that although personal safety was a significant consideration, the lack of alternative work options means that she feels compelled to work in what she knows to be a very dangerous environment.

During the visit to Potosi, only two women mine workers were encountered who worked in underground activity. Both worked in the upper levels of Mina Siglo XX, and one of them gave an indication of how although her underground mining work paid more than her previous catering job, she still needed supplementary income: *"I used to sell food in the plaza at Huanuni, but needed to earn more money for my family. I have six children and no husband. I still sell gelatina in the (Llallagua) plaza on weekends"* (interview #6). She also commented on how restrictions imposed by her mine worker co-operative effectively forced her into underground work*: "I want to work as a Palliri, but there are no more spaces on the waste rock piles, so I have no option but to work in the mine."* (interview #6). Again, this *Palliri* expressed a clear preference for surface work rather than working underground, and also indicated that although underground work provides greater income, she still needed supplementary income to meet her family's needs.

It was not possible to view the mine at Uncia due to lack of time and transport. However, a visit was made to the COMIBOL *ingenio* below the mine, which was being operated by a mine worker co-operative. The *ingenio* recovered zinc from run of mine and waste rock from Mina Siglo XX, and run of mine from Mina Catavi. Two female *Relaveras* from this co-operative were seen working in the adjacent river, but would not comment.

5.8. Summary

The in-country data collection was conducted over 25 days in March and April 2011, and involved a combination of 18 site visits, 27 interviews and literature collection. It provided an opportunity to view a

wide range of mining activities and organisations across the Department of Oruro, as well as those at mining sites in the adjacent Department of Potosi.

The site visits and interviews provided valuable information with which to updates and supplement the information collected by the literature review. Although some individuals were more subjective than others in their interview, there were many opportunities to validate information received via a combination of cross-referencing, observation of actual conditions and reference to documented research. Consequently it is considered that comments received and observations made provided a reliable and valuable source of information. The following section will compare the findings of the literature review and the in-country data collection, to identify and evaluate issues significant to the research objectives.

Fieldwork confirmed that mining activity was still widespread across the Department of Oruro, and that historic mine sites are in an advanced state of deterioration. Mina Huanuni remained the biggest mining operation in terms of scale of operations, employment and production. Mine worker co-operatives were evident at many sites, although the level of activity encountered was substantially less than anticipated. Furthermore, only a handful of women were found to be actively involved with mine worker co-operatives, despite indications to the contrary in the literature and official statistics, and anecdotal evidence that women were actively involved in underground work at mine sites. Trans-national corporations were also actively involved in the sector, and their operations differ from those of State mines and artisanal mine worker co-operatives in that they make extensive use of modern technology, and have lower labour requirements.

Government departments and NGOs remained engaged in the sector, with both focusing in particular on the involvement of women workers. However, the mine workers union is in decline due to the falling numbers of state sector employees, and has effectively been replaced by national and regional entities representing mine worker co-operatives.

Both State mines and artisanal mine workers use shaft and tunnel methods to extract ore, differing only in their scale of operations, and the habit of artisanal miners to concentrate mineral inside the mine, rather than removing run of mine for processing. The bulk of mineral reprocessing activity is conducted by *Relaveras* using buddles to concentrate tailings waste, with little variation in design and operation between the sites visited. Waste rock reprocessing activity is negligible, with only three *Palliris* seen reprocessing waste rock piles during the fieldwork.

The next section (Analysis of Results) takes into consideration both the literature review and fieldwork findings, to identify the key issues, trends, consistencies and contradictions. It focuses on sector organisations and activity, the occupational opportunities available to women and their participation in the mining sector. Key issues identified in the analysis then contribute toward the conclusions presented in Chapter 7.

6. Analysis of Results

6.1. Introduction

This section presents a qualitative analysis of the information collected via the literature review (chapters 3 and 4) and in-country data collection (chapter 5). The aim of the analysis was to characterise contemporary *Altiplano* mining activity, with a specific focus on the roles of women involved in artisanal mine work, their opportunities and factors influencing their participation. The structure of this section is designed to reflect the key themes underpinning each of the research questions posed in Chapter 2, which focused on the institutional arrangements, the nature of mining activity, artisanal mine worker roles. This establishes the basis from which to draw conclusions about the work opportunities available to women and their participation in the sector. Significant issues raised by this analysis are used to frame and substantiate the conclusions presented in Chapter 7.

6.2. Organisation of the Mining Sector

There are many key players in the Bolivian mining sector, which fall into five stakeholder groups, namely the government, individual mining companies, mining sector groups, organised labour representation and non-governmental organisations (NGOs). The component parts of these categories and their interrelationships are illustrated in Figure 6.1. However, this figure cannot portray changes over time in the influence of, and relationship between the different component parts that make up the mining sector.

When evaluating the key stakeholders in the mining sector and their relationships, it was apparent that there was good agreement between information gleaned from the literature review and in-country observations. The only difference was that documented research does not currently make much reference to the recent dramatic growth in private mining operations managed by trans-national mining corporations.

Significant changes in stakeholder relationships since 1985 have been the declining involvement of the State in mining activity, the declining power of the mine workers union, and a corresponding growth in the importance of mine worker co-operatives. These trends were identified in the literature review and confirmed by information collected during the in-country data collection.

The government still dominates the national mining scene, with the Ministry of Mining and Metallurgy setting sector policy and COMIBOL playing a pivotal role in the interface between the government and

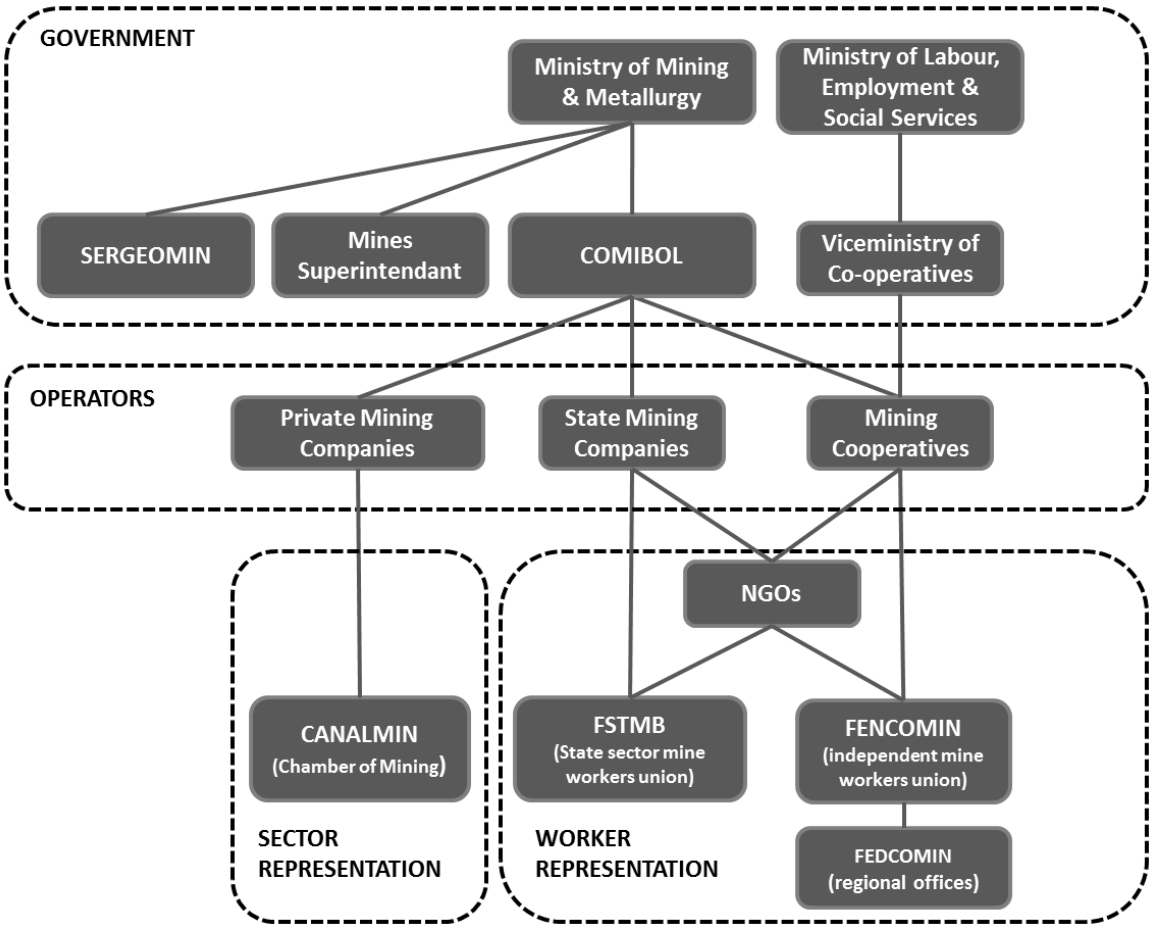


Figure 6.1 Stakeholder Relationships in the Bolivian Mining Sector

Source: Author

mine operators. COMIBOL administers all aspects of mine access, extraction and mineral export, and its current focus upon attracting foreign investment for large scale mining operations has led to a reduced interest on the mine worker co-operatives. However, another dynamic within government is that the Vice-ministry of Co-operatives is starting to become more involved in the issues that challenge mine worker co-operatives, and the *Direccion General de Cooperativas* is currently considering future policy initiatives. Mine worker co-operatives have experienced rapid growth in their number and membership since 1985, and remain a significant contributor toward production and employment in the *Altiplano* mining sector.Although the government does not have data available to describe long term trends in the number and membership of mine worker co-operatives, FENCOMIN data for 2008 to 2010 (see Figures 6.2 and 6.3) show recent strong growth in both the number of mine worker co-operatives (by 42%) and their total membership (by 31%). However, the number of artisanal mine workers witnessed during the

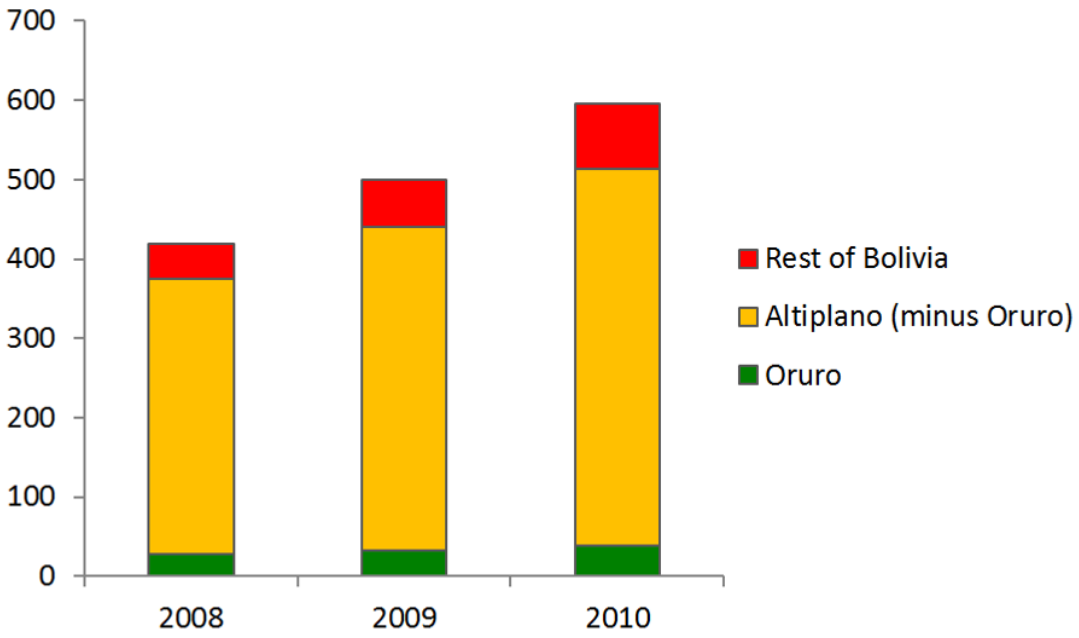


Figure 6.2 Mine Worker Co-operatives Affiliated to FENCOMIN

Source: Penaloza 2011 (see Table 3.6)

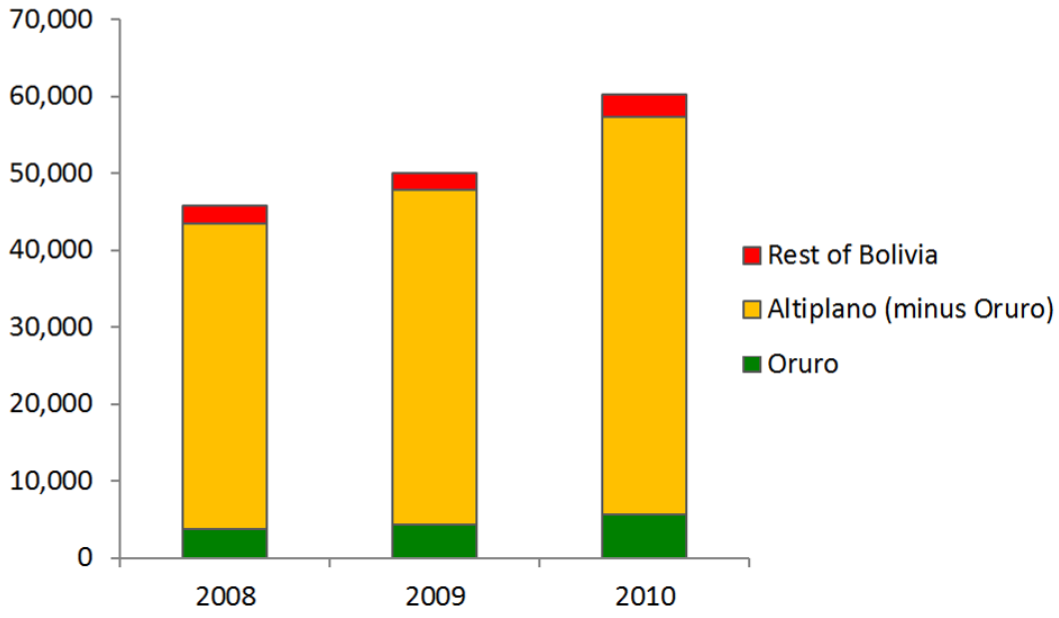


Figure 6.3 Membership of Mine Worker Co-operatives

Source: Penaloza 2011 (see Table 3.6)

fieldwork was significantly lower than the number of mine workers, at all sites visited. This observation challenges the validity of FENCOMIN statistics.

Several researchers identified the tension between state mine workers and *cooperativistas,* which has been attributed to State mine workers enjoying better employment conditions, income and security than *cooperativistas* (Bebbington et al. 2008a, Gill 1997, Andean Information Network 2007, The Internationalist 2007). This was confirmed during the fieldwork, as *Relaveras* at Mina Huanuni currently earn approximately double the national average wage, while mine workers at Mina Huanuni earn even more. However, *Relaveras* and managers working with Empresa Mina Huanuni revealed that *"Some cooperativistas working on piece rates are currently earning higher incomes than their State sector counterparts, due to record high tin prices"* (interview #8). Consequently, tensions between the two groups appear to have reversed, with State miners currently involved in protests to demand salary increases.

The national mine worker union (FSTMB) has lost members due to the declining number of mine labourers, and has lost influence due to the recent rise of the petrochemical sector as Bolivia's main export earner. The decline in the FSTMB's political influence was evidenced by mine workers aligning themselves with the general workers union (COB) during recent anti-government protests, whereas in the past, they had sufficient critical mass to protest in their own right. While the mine workers union is in decline, the national body for mine worker co-operatives (FENCOMIN) appears to be becoming a more prominent vehicle for liaison between mine workers and the government as its membership grows strongly.

The recent re-emergence of international mining companies has come in response to a strong and sustained increase in world demand for industrial metals, and a period of relative stability in Bolivian politics, and government policies that encourage overseas investment in the sector. This has led to growing relationships between the government and overseas mining corporations, but appears to be alienating communities and artisanal mine workers. Furthermore, such mining operations tend not to employ labourers, preferring instead to use qualified engineers and technicians to monitor and maintain the mining and processing plant. Although modern, large scale mining operations look set to dominate future production in the *Altiplano*, very few women in Bolivia train as engineers, and so are unable to participate.

Women mine workers do not currently have a national representative body, so their intersts are currently served by a combination of small stakeholder orgainsations, including the *Viceministerio de la Mujer* (Vice-ministry of Women), the National Housewives Committee *(Comite Nacional de Amas de Casa)*, the annual national encounters of women mine workers *(encuentras nacionales),* the national mine workers union (FSTMB) and NGO activities which focus on women's needs. However, themes such as gender equality, women's rights and feminism are currently gaining greater recognition across Bolivia.

NGOs such as CEPROMIN and EMPLEOMIN are becoming increasingly involved in projects that benefit mine workers and communities, such as environmental improvement and institutional strengthening. They are particularly focused upon assisting women mine workers, with projects including re-training *Palliris*, providing them with mechanical crushing plant, and providing education in women's rights. However, mine workers still treat many NGOs with suspicion as there have been many promised projects that secured funding but never eventuated, while some NGO projects have been misguided (interview #24). It is interesting to note that the major recent NGO projects focus upon assisting women mine workers (e.g. EMPLEOMIN, Cumbre Sajama, Project Sajama), despite them representing less than 3% of sector employees, and exhibiting a rapid decline in their numbers.

6.3. Mining Sector Activity

Most major tin producing nations use large scale and highly mechanised open-cast mining and processing methods, which depend on abundant energy and access to finance. By contrast, the unavailability of both finance and energy in the *Altiplano* has (until very recently) meant that deep shaft mining methods have predominated. Although some State and private mines use large scale industrial extraction and processing methods, the most commonly encountered means of production involves poorly financed mine worker co-operatives that rely on manual extraction methods to recover ore from mine shafts, and using rudimentary buddle technology to reprocess historic waste piles. This is consistent with mining methodologies characterised in the research literature (Priester, Hentschel & Benthin 1993). Figure 6.4 illustrates a generic process schematic for tin mining and mineral processing at *Altiplano* mine sites (note that Figure 6.6 presented later in this chapter superimposes occupational roles onto the same process schematic).

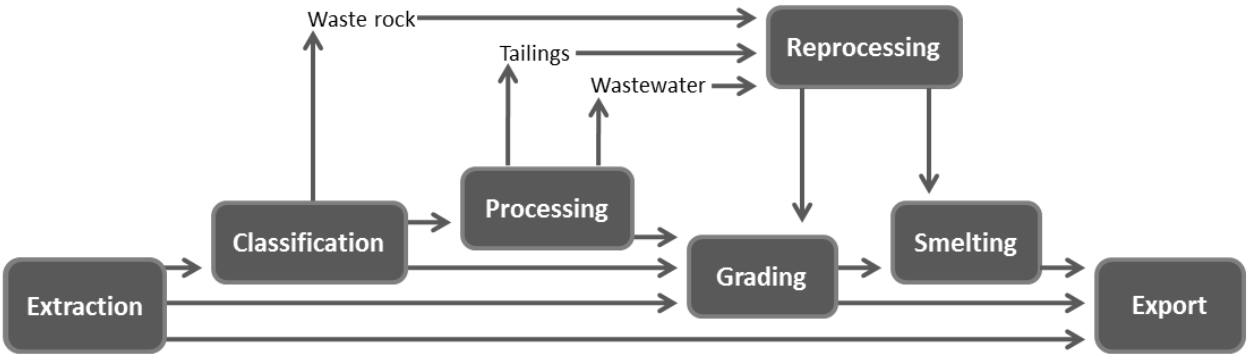


Figure 6.4 Tin Mining & Processing Overview (Generic)
Source: Author

There are two main mining methods employed by mining operations in the Department of Oruro. The most common method is to extract ore from underground via shafts and tunnels, with larger scale operations using mechanical drills and dynamite, while smaller scale operations use manual perforation methods and dynamite. A recent alternative has been the introduction of open cast mining methods. Although open cast tin mines exist elsewhere in the *Altiplano*, this method is currently used only for gold mining in the Department of Oruro.

Three distinct methods are used to recover mineral from surficial mine waste deposits, namely tailings and waste rock piles. Waste rock piles are re-worked by manually picking rock and using a lump hammer to concentrate mineral. This work has traditionally been dominated by women labourers *(Palliris)*, and appears to have virtually ceased in Oruro. The second method is to use manual methods to recover mineral from historic mine tailings piles, and in some cases, along river banks below mine sites. Recovery is typically done using a batch sedimentary process involving shallow pits called buddles. This work is performed by both males and females *(Relaveras),* and is a prominent means of production for artisanal mine worker co-operatives. The third reprocessing method is a recent arrival used by a private sector operator, in which historic tailings are passed through physico-chemical processes to recover a range of valuable metals. This is only done at one site in Oruro.

Differences between the mining and mineral processing methods employed by large mines and mine worker co-operatives were identified in the literature review (Bebbington et al 2008b, Godoy 1985, Michard 2008, Gall 1974) and confirmed by field observations. These differences are illustrated in Figure 6.5, which shows that State sector operations tend to be large scale, mechanised, extraction focused and export oriented, with extensive mineral processing methods. By contrast, artisanal mine worker co-

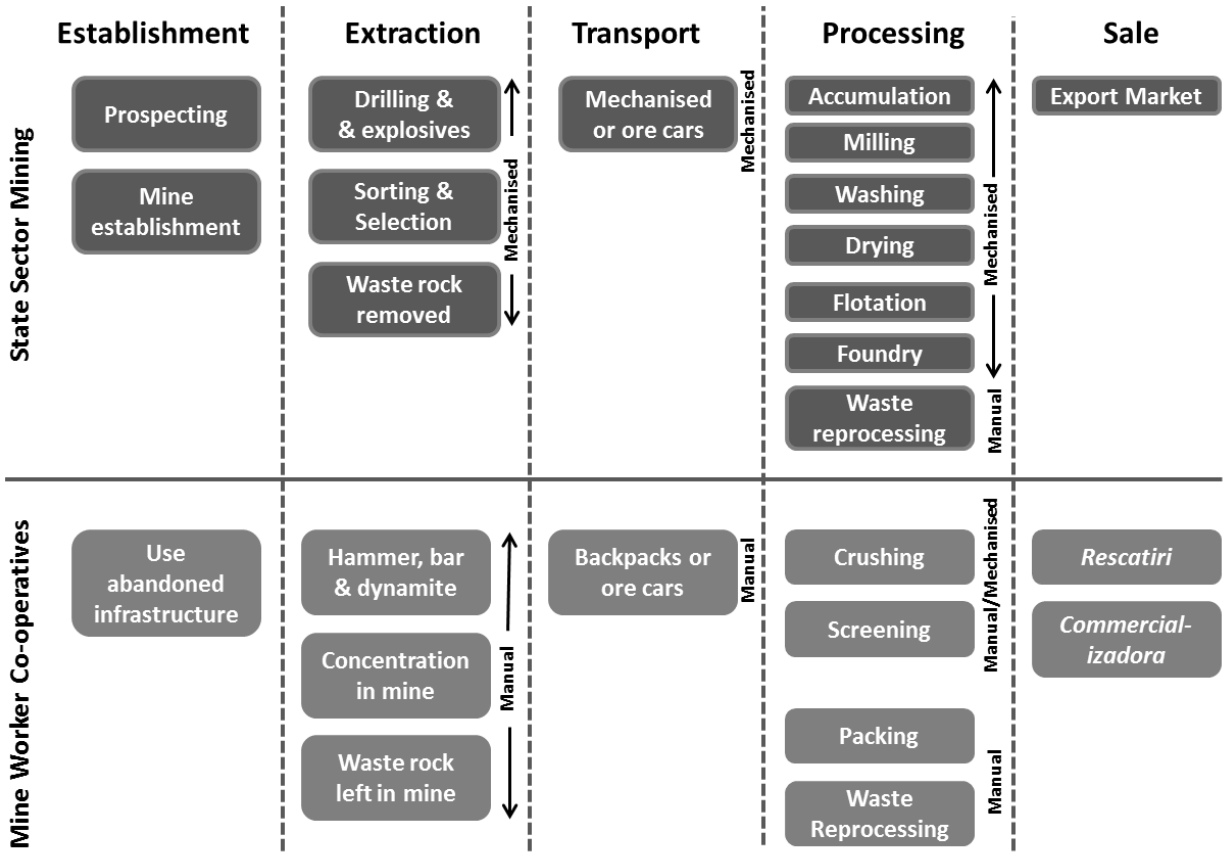


Figure 6.5 Comparison of State and Co-operative Sector Mining Operations in Oruro

Source: Author

operatives have an equal emphasis on extraction and reprocessing, both of which are dominated by manual methods. Co-operatives are also restricted from exporting their mineral, which they can only legally trade by selling it to local intermediaries.

Although field observations confirmed that the research literature accurately represents mining operations conducted by the state and mine worker co-operatives, little formal research has been conducted into the dramatic growth of large scale private mining operations that has occurred over the last decade. Several international companies have begun to establish large scale, high technology mining operations in the *Altiplano*, in response to record demand for industrial metals and the availability of cheap gas to power mining processes. However, despite several successful new mine developments in the *Altiplano* in recent years, international investors are still wary of Bolivia's political stability, particularly given the government's nationalistic policies and penchant for nationalising profitable industries (The Economist 2006).

Site visits revealed that the levels of activity, organisation and industrialisation at COMIBOL mine sites were notably higher than at mines operated by mine worker co-operatives. Mina Huanuni was by far the busiest site visited during the in-country data collection, with a constant stream of workers and vehicles rushing to and from the site. By contrast, at many sites operated by mine worker co-operatives, occasional workers drifted in and out of the mine entrance, either individually or in groups of up to five miners. This may be due to the significant cassiterite deposits that remain, while the other sites have smaller resources that are closer to depletion. Mine sites visited in the Department of Potosi indicated that mining infrastructure, methods and organisation of labour were comparable to those witnessed in the Department of Oruro.

One feature that characterised all sites visited (with the exception of Mina Huanuni and the gold mining operation at Kori Chaca) was the old age and poor condition of mine site infrastructure. All sites were in an advanced state of deterioration, with the only sign of infrastructure investment or maintenance involving essential plant such as air compressors and drainage pumps. Many buildings and mine openings showed evidence of structural failure or instability, while all windows were broken and most roofs were extensively rusted and holed. These observations suggest chronic under-investment, which is consistent with comments made 30 years ago by Godoy, which suggested that the Bolivian mining sector had been: *"undergoing 'involution' and reverting to pre-capitalist modes of production as a result of longer working hours, more piece rate work, lower ore grades, less mechanisation and reliance on peasant labour"* (Godoy, 1985). This is clearly a problem with a long history.

Much of the international literature about the Bolivian mining sector focuses upon underground mining activity, and to a lesser extent, mineral processing in *ingenios*. However, waste reprocessing activity has clearly been a significant operational focus for artisanal mine worker co-operatives, particularly since 1985, and has been well characterised by Bolivian researchers (Aranibar 2003, Trujillo 2005). Reprocessing of waste piles is only now declining due to depletion of mineral residues in accessible waste piles. Interestingly, some of the large mining operations currently being implemented or planned focus upon the recovery of mineral from historic waste piles. Major waste reprocessing operations underway at San Bartolome and Itos, and a new reprocessing facility is being planned for a site downstream of Mina Huanuni. It is notable that modern reprocessing operations are principally presented as contaminated site remediation projects. This is of course true, but they are also reprocessing operations subject to business economic principles (i.e. operations are only viable provided

the revenue from the sale of recovered metals exceeds operating expenditure and repayment of capital invested in the project).

With the exception of the reprocessing operation at Itos conducted by Baremsa SA, all other reprocessing of tailings waste in the Department of Oruro was done using buddles, irrespective of whether the operation was managed by the State or mine worker co-operatives, and regardless of whether the tailings waste came from current or historic sources. Although the buddles at *Ingenio* Machacamarca were constructed from concrete, they were disused. At all other sites, the buddles were simple shallow excavations lined by rocks. The design and operation of these buddles appears to be relatively primitive, which is consistent with observations (Priester, Hentschel & Benthin 1993) that buddles in Bolivia have not changed substantively for over a century.

6.4. Occupational Roles in the Mining Sector

Much current literature fails to acknowledge the diversity of occupational roles within the mining sector, or to differentiate between them. Most authors and Bolivian nationals refer to male mine workers as *Mineros* (Wicky, 2002), and female mine workers as *Palliris* (Nash 1979, Barrios de Chungara 1978, Hinton et al 2003), although more contemporary publications also identify *Barranquilleras* and *Relaveras* as distinct occupational groups (Trujillo 2005, Aranibar 2003). However, it is clear that there are at least distinct occupational roles typically performed by artisanal mine workers in the *Altiplano* mining sector, a summary of which is provided in Table 6.1. This provides a summary description for roles identified, and also estimates the proportional participation of male and female workers for each. Note that although approximately 100 female *Relaveras* were seen outside Huanuni, their presence at other sites was negligible. This is portrayed in Table 6.1 as women occupying 60% of *Relavera* positions, and males the remaining 40%. The occupational roles are also illustrated in Photographs 6.1 to 6.14.

Role	Description	Workforce[1]
Barranquillera	Person who pans alluvial deposits in rivers to recover gold residues.	N/A[2]
Commercializadora	Person who acts as an intermediary between the mine and the smelter/exporter, exchanging mineral for money.	
Ingeniero/a	Man/woman who provides technical or engineering input (e.g. mechanical, electrical, structural, process, hydraulic, geological).	
Lamero/a	Man/woman who pans river sediment or *ingenio* waste to recover tin residues, typically working in rivers, drains and channels.	N/A[2]
Lavadora	Woman who washes clothes for mine workers.	
Locatorio/a Minero/a	Male/female underground mine worker.	
Palliri	Person who selects and concentrates mineral manually, using a lump hammer.	
Perforista	Person who works underground, using a drill to remove ore.	
Recolectera	Person who carries tools and supplies for miners.	
Relavera	Person who concentrates mineral using a batch sedimentation process, typically in a buddle.	[3]
Rescatiri	Person who is an unregistered (illegal) ore trader, buying mineral from individual miners and co-operatives.	[4]
Sirena	Man/woman who monitors the mine opening or the status of important plant such as compressors, pumps and shaking tables.	
Transportadora	Person who carries' run of mine' from the working face to the surface.	
Vendedora	Woman who sells food and mine supplies (e.g. dynamite, detonators, coca leaf, alcohol or food) near the mine opening.	
Venerista	Person who recovers mineral by excavating alluvial deposits along river banks.	N/A[2]

KEY

1. Indicates the proportion of male & female workers
2. None present
3. 100 women at Huanuni, but few elsewhere
4. Unknown level of activity (illegal practice)

100% 50% 0%

Table 6.1 Occupational Roles & Participation Rates at Mine Sites (Department of Oruro)

Source: Author

Photograph 6.1 ***Barranquilleras*** **panning for gold residues in Bolivia's lowlands.**

Source: Aranibar 2003

Photograph 6.2 ***Commercializadora*** **(mineral trader) operation in Oruro**

Source: Author

Photograph 6.3 *Lamera* panning *ingenio* waste to recover tin residues, Huanuni, Oruro.

Source: CEPROMIN 2009

Photograph 6.4 *Lamera* using a filter box to concentrate tin residues, Uncia, Potosi.

Source: Author

Photograph 6.5 *Lavadoras* (laundry workers) at Mina San Jose, Oruro

Source: Author.

Photograph 6.6 *Locatorias* (female mine labourers), Mina Itos, Oruro

Source: Género con Clase (2010)

Photograph 6.7 *Palliri* concentrating mineral on waste rock piles, Santa Rita, Oruro.

Source: Author

Photograph 6.8 *Perforista* (male driller) at Mina Pulucayo.

Source: Mining Technology.com (2011)

Photograph 6.9 R*ecolecteras* (miner worker assistants), location unknown, circa 1980

Source: Trujillo 2011

Photograph 6.10 *Relaveras* using a buddle, Machacamarca, Oruro

Source: Author

Photograph 6.11 ***Sirena*** **monitoring a shaking table,** ***Ingenio*** **Machacamarca, Oruro.**

Source: Author

Photograph 6.12 ***Transportadoras*** **pushing an ore car, Mina Poopo, Oruro**

Source: Author

Photograph 6.13 *Vendedora* with food for mine workers, Mina San Jose, Oruro.
Source: Author

Photograph 6.14 *Veneristas* recovering mineral from alluvial deposits, Mina Unificada, 1997
Source: courtesy of URS Corporation.

The position each of these different roles occupy within the mining and reprocessing process is illustrated in Figure 6.6 (which uses the process schematic first presented in Figure 6.4). Some of the roles are effectively gender specific. For instance, the occupational roles of driller *(Perforista)* engineer (*Ingeniero*), mineral trader *(Commercializadora)* and driver *(Chauffer)* tend to be performed by males, while females are most likely to reprocess waste rock *(Palliri)* or enter black market ore trading *(Rescatiri)*, while those working in support roles such as laundry workers *(Lavadoras)* and food vendors *(Vendedoras)* are exclusively female. Other roles are gender neutral, including tailings reprocessor *(Relavera)*, sediment reprocessor *(Venerista* and *Lamera)*, guard *(Sirena)*, manual haulier *(Transportadora)*, underground labourer *(Locatoria)* and gold panner *(Barranquillera)*.

6.5. Opportunities for Women Mine Workers

The diversity of roles available to women mine workers has generally increased over time, as illustrated in Figure 6.7. This shows that women have been able to access a greater range of roles over time, and that generally speaking, women mine workers now have greater opportunity than at any time in the past. However, the exceptions are those roles which have been prohibited by mine owners (e.g. *Barranquilleras* at Kori Chaca and *Lameras* at Mina Huanuni), and those whose work is dependent upon tailings and waste rock piles (e.g. *Palliris* and *Veneristas*) where the declining mineral content of surficial deposits has made it impossible for them to collect sufficient mineral without mechanical equipment.

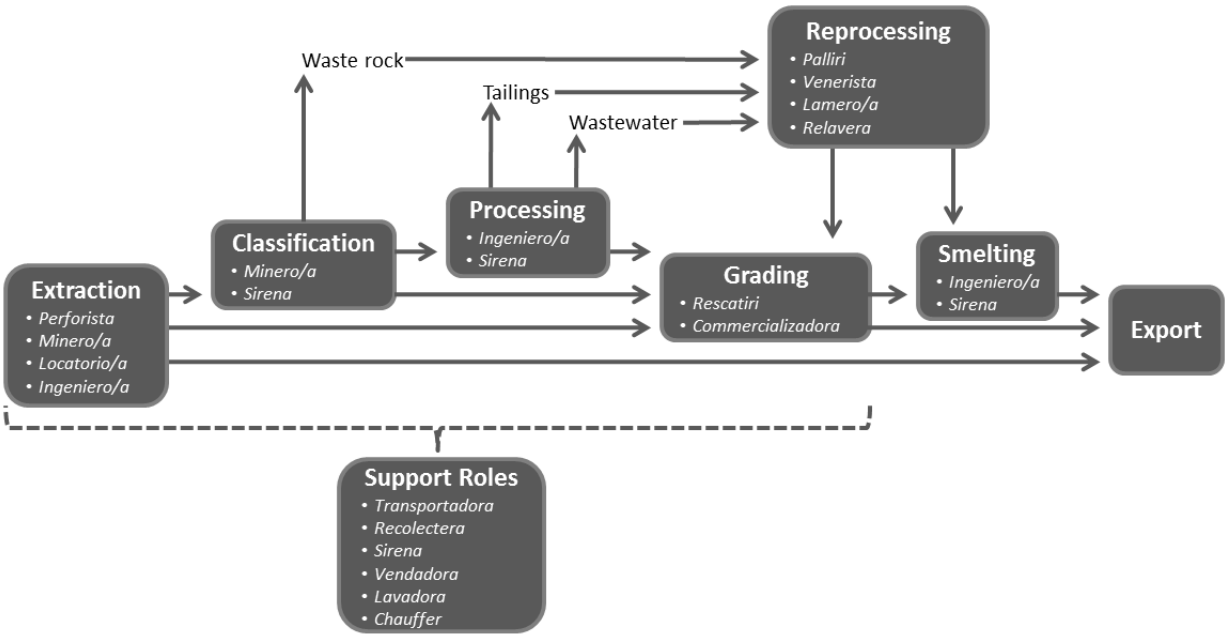


Figure 6.6 Distribution of Mining Sector Occupational Roles

Source: Author

The main factor that has increased role availability for women mine workers appears to be changing societal attitudes, particularly amongst male workers in the sector. Long-held superstitions, prejudice and discrimination are slowly disappearing across the sector, although discriminatory practices appear to be more prominent in mine worker co-operatives and private operations than in State mines. This transition is also supported by growing empowerment of women in the workplace, via national and sector education programmes, government policies and a growing feminist movement. It is also likely that women now have greater access to some roles as urban migration and *Relocalizacion* has led to there being fewer male workers available in mining communities, and so less competition for available work.

Despite the improving opportunities for women mine workers, there has been little improvement with respect to their working methods, equipment or conditions. This is illustrated using a series of paired photos, which compare historic and contemporary working conditions. Photo pair 6.15 shows that there is little difference between historic and current methods for *Palliris* working on the waste rock piles, as they still use the same manual equipment in the same way. Similarly, the technology used by *Relaveras* (Photo pair 6.16) shows no sign of substantive change in recent decades, which is consistent with observations made by other researchers (Godoy 1985 & 1990, Altamirano 1995). Although *Relaveras* working for Empresa Mina Huanuni now have standard issue protective clothing, comprising overalls, sun hat, gumboots and gloves. Very few employees of artisanal mine worker co-operatives were seen wearing any form of protective clothing (e.g. gumboots). There have, however, been some significant changes in the numbers of workers engaged in artisanal mining activities, particularly for *Palliris*, *Barranquilleras*, *Veneristas, Lameras* and *Transportadoras* working with depleted waste resources at *Altiplano* mine sites. These changes include a significant reduction in the number of *Palliris* working on waste rock piles (photo pair 6.17) and the disappearance of Lamera's workstations at Mina Huanuni, as they have been destroyed by a combination of channel re-profiling and installation of a vehicular access from one side of the river to the other (photo pair 6.18).

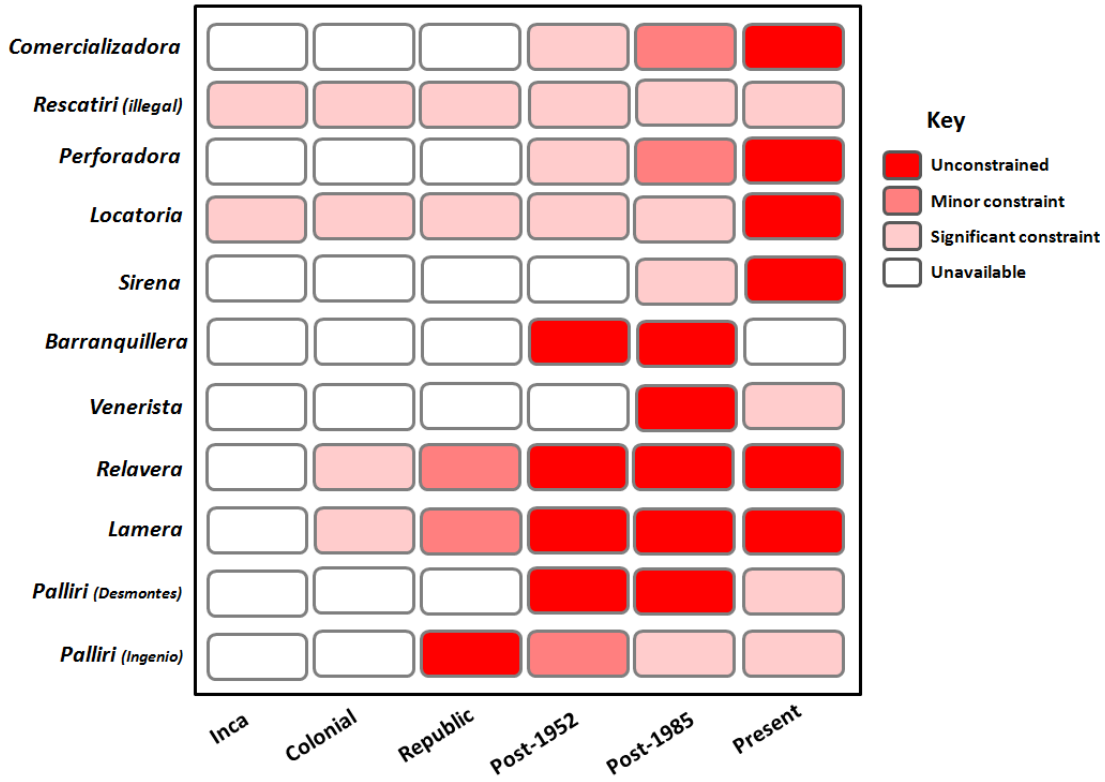
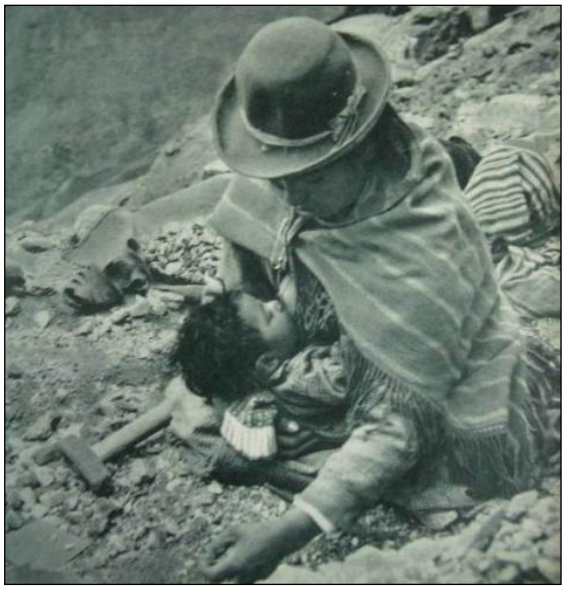


Figure 6.7 Role Availability Trends for Women Mine Workers

Source: Author



Circa 1950 -*Palliri* breastfeeding while working
Source: Unknown Author, 2008

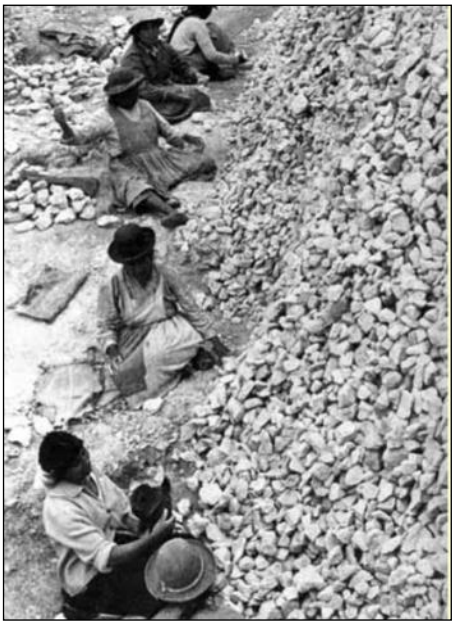
2011– *Palliri* at Mina Santa Rita, Oruro
Source: Author

Photo Pair 6.15 *Palliris* working on waste rock piles

1960 - *Relaveras* using buddles at Siglo XX
Source: Gall 1974b

2011 - Female *Relaveras* at Mina Huanuni
Source: Author

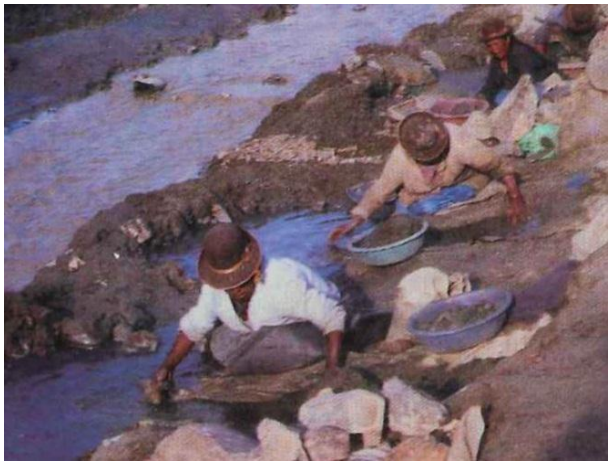
Photo Pair 6.16 *Relaveras* using buddles



1966 – Group of *Palliris* at Siglo XX
Source: Gall 1974b

2011 – Two *Palliris* (circled) at Santa Rita, Oruro
Source: Author

Photo Pair 6.17 *Palliris* numbers working on waste rock piles



2004 – Group of *Lameras*
Source: Aranibar 2005

2011 – *Lamera* workstations replaced by road
Source: Author

Photo Pair 6.18 *Lameras* at Mina Huanuni, Oruro

6.6. Professional Recognition for Women Mine Workers

In addition to the changing availability of labouring roles available to women workers in the mining sector, it is also important to consider changes in the professional recognition that women achieve, which is defined by the status they are able to achieve in their organisations. Figure 6.8 illustrates status trends, and shows that women have historically not been able to progress beyond labouring roles, although the 1952 revolution enabled some to achieve white collar positions. Despite significant status improvements since 1985, women in State sector and private mining organisations are still not well represented at senior management level or as professional engineers. In recent years, women have been able to achieve positions on the *Directiva* (management team) of some mine worker co-operatives, or represent co-operative collectives at a regional or national level.

Perhaps as a consequence of this status imbalance, male workers in the sector still appear to earn a greater income than their female counterparts, although the differential is reportedly falling. The declining number of *Peones* illustrated in Figure 6.8 is a result of women in mine worker co-operatives transitioning from *Peon* to *Socia*. However, there has not been a corresponding increase in the number of *Socias*, as the total number of women working with mine worker co-operatives appears to have declined significantly in recent years.

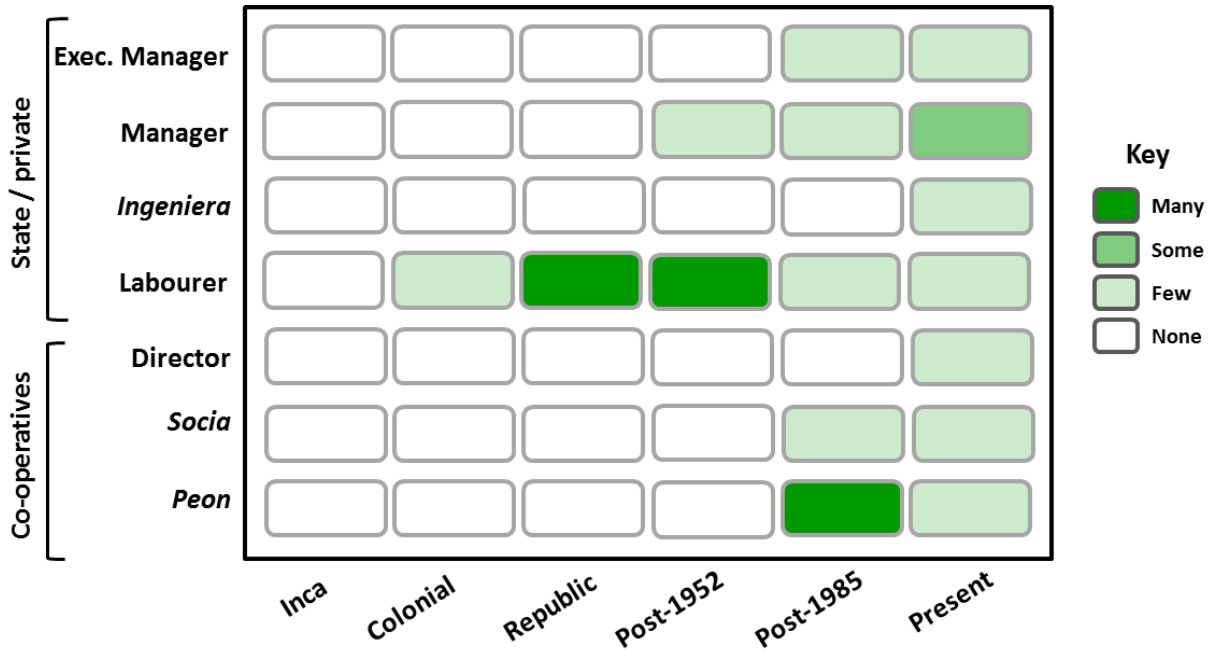


Figure 6.8 Occupational Status Trends for Women Mine Workers

Source: Author

6.7. Participation of Women Mine Workers

Despite the larger 'portfolio' of roles now available to women in the mining sector, there has not been a direct relationship between role availability and female participation in those roles. Figure 6.9 illustrates how participation rates have changed over time for women mine workers.

Many factors have contributed to reduced female participation in mine sector work roles in the *Altiplano*. The most significant historic impact was industrialisation of mining operations, where the mechanisation of mineral processing and transportation operations previously conducted by women labourers led to widespread job losses. The government's withdrawal from many mines after the 1985 Tin Crisis also reduced demand for services offered by women working in sector support roles, such as *Lavadoras*, *Cocineras*, *Referequeras* and *Vendedoras*. A further significant factor driving change over the last decade has been the declining mineral content of historic tailings and waste rock piles, which has reduced the viability of traditional mineral recovery methods, and so made work less available to many *Palliris*, *Lameras, Relaveras* and *Veneristas*. The relationship between work and mineral content is confirmed by the quotation *"Palliri numbers are growing in some areas and declining in others, according to mineral availability in the waste rock and tailings piles."* (interview #22).

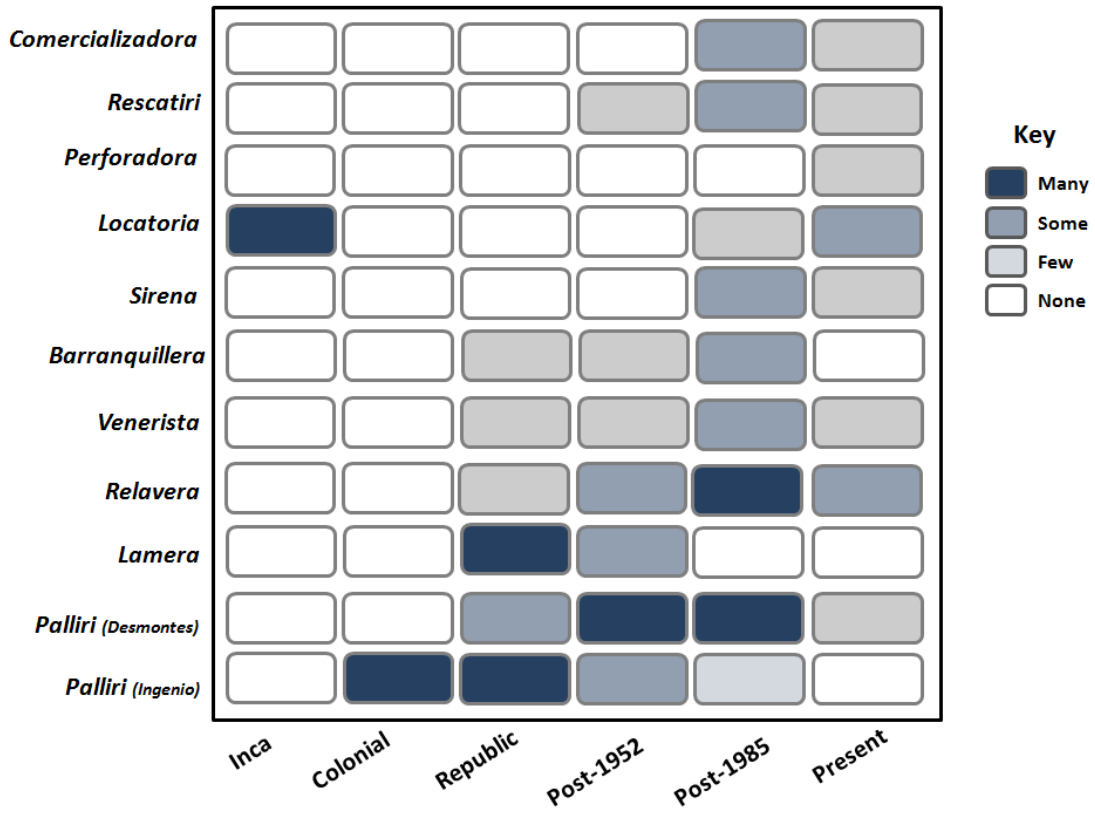


Figure 6.9 Participation Trends for Women Mine Workers
Source: Author

Bolivia's rapidly improving economy has significantly contributed to reduced participation of women in the mining sector. Finance has become more readily available to those wanting to start their own business, and government funding has been directed to development projects in a number of communities, creating new opportunities for women outside the mining sector (e.g. in civic improvement projects). Some NGOs have also offered re-training programmes for women mine workers, enabling them to generate an income outside the mining sector. This has been complemented by improved mobility, with better roads and access to vehicles making it easier for women to leave mining communities for opportunities in the urban centres of Cochabamba and La Paz. Not only do women appear to be leaving mine worker roles, but fewer young women are joining the sector, with current recruitment insufficient to replace those who retire or die. This has resulted in an increased average age (and reduced physical ability) for women mine workers in the sector. Some mine sites have also specifically prohibited some work activities, including *Barranquilleras* (at Kori Chaka) and *Lameras*

(at Mina Huanuni), resulting in the complete disappearance of these roles in the Department of Oruro.

A final factor that reduces participation for all workers in the mining sector is the introduction of high technology operations at some sites previously worked by artisanal mine workers. Mechanised operations offer few employment opportunities for the skilled artisanal mine workers they displace, and experience to date is that women mine workers are less likely than men to secure the roles that are available (particularly with private mining operations).

The main factor which has historically increased women's participation in the sector is the need for work to combat poverty. In particular, the neo-liberal reforms that followed the 1985 Tin Crisis led to significant increases in household poverty and drove many women in mining communities to seek supplementary income from mineral recovery work. Another key historic factor that resulted in short term increases in female participation was war. More precisely, the conscription of male mine workers led to significant loss of labour from mine sites, which was largely filled by women in those mining communities. Although the War of the Pacific (1879-1884) and Chaco War (1932-1935) directly led to women entering underground mine work, but this was only a temporary role relocation and women reverted to their traditional roles when male workers returned.

Although rising world prices for industrial metals have enabled mine operators and mine worker co-operatives to offer more attractive salaries or piece rates over the last decade, this does not appear to have attracted many women into the sector. This is presumably due to the availability of more attractive work elsewhere in the informal sector, as indicated by quotes such as: "*Some older Palliris work in the black market as Rescatiris.* (interview #24), and: *"Most Palliris who used to work on the waste rock piles became labourers for municipal authorities in Huanuni or Oruro, or got government loans to sell used clothes in the market. Some of them became Jukus or Rescatiris, or sell contraband such as electro-domestic items, cell phones and drugs." (interview #11).* Other women are securing work with local and central government departments which have begun opening up positions previously only available to male employees. It is particularly notable that the State company Mina Empresa Huanuni employs a significantly greater number of women labourers than do artisanal mine worker co-operatives.

Other factors have resulted in role transfer for women within the mining sector. For example, the introduction of mechanical ore processing methods into *ingenios* displaced many *Palliris* from the *ingenio* to the waste pile, while some women who previously worked as *Palliris* or *Relaveras* are now working as *Locatorias* in underground roles, where they are able to obtain a greater, steadier income.

Rising world prices for industrial metals have also made it more profitable for mines to re-assign *Palliris* and *Lameras* to extraction roles (as *Locatorias* and *Mineras*) or to reprocessing activities *(*as *Relaveras)*. Initiatives by some NGO's have also enabled women to shift into underground roles as *Perforistas*, by giving them access to small pneumatic drills which are easier for them to use. The growth of a black economy has also reportedly led some *Palliris* to become *Rescatiris* or to trade contraband goods and drugs. A further factor driving role transfer is the increasing average age of women mine workers, as ageing women are less able to participate in physically demanding work. Consequently, Mineras*, Locatorias, Palliris* and *Relaveras* may transition to less arduous roles such as *Sirenas* and *Vendedoras*.

Although women are now moving into occupational roles that were previously exclusive to men, the reciprocal is not true. No men were seen performing 'women's' support roles as *Lavadora*, *Cocinera*, *Refresquera* or *Vendedora*, although (very few) men are known to work as *Palliris*. However, this is unlikely to be a preference that is limited to the mining sector, as my observations of Bolivian men in general is that few cook or wash clothes, and food vendors in markets across the country are almost exclusively women.

A development that has been widely reported in the local newspaper La Patria and feminist websites in recent years (La Patria 2010b, Género con Clase 2010).) has been the apparent movement of women into underground mine worker roles, although the vast majority of underground workers are still male. Women were reported to be drilling at the work face in some mines in Oruro, but no women drillers (*Perforistas*) were encountered during the field investigation. Recent media and government publications suggest that substantial numbers of women mine workers are active underground. However, this was not evident at the mine sites visited in the Departments of Oruro and Potosi. Anecdotal evidence from mine workers was that the women entering underground work were not necessarily coming from a mining sector background, and that there was even a movement in the reverse direction, where women not willing or able to cope with the physical demands and dangers of underground work are moving into surface roles.

A comprehensive literature search and review of websites revealed no photographs of women *Perforistas* involved in underground drilling activity, and very few contemporary photographs of *Locatorias* at work. However, there is a variety of documented and anecdotal evidence which suggests that a growing number of women are involved in drilling work. The European Union funded EMPLEOMIN project (see page 48) is actually providing lightweight drills for *Perforistas* and mechanical crushing plant for *Palliris*, presumably on the understanding that female participation in the mining sector is significant,

and they have an interest in underground work. However, official statistics indicate that the number of women mine workers is declining, while fieldwork observations suggest that the actual participation of women in the mining sector is negligible (with the exception of *Relaveras* at Mina Huanuni), and that few are currently involved with, or interested in, underground work.

Several researchers have attempted to quantify the number of artisanal mine workers workers at Bolivia's mine sites (see Table 4.2 on page 51). However, there are no reliable statistics for female participation in the sector, other than mine-specific data. However, international studies around 2005 estimated that women represented 10-30% of the artisanal mine worker labour force (Lahiri-Dutt & Macintyre 2006, ILO 2008, IIED 2002). Statistics provided by FENCOMIN (see Tables 4.3 and 4.4 on pages 54 and 55 respectively) show that by 2007, only 3% of mine worker co-operative members in the Department of Oruro were female (CONCOBOL and SOCODEVI 2009). The same proportionality was also evident four years later (FEDECOMIN 2011). These statistics suggest that there has been a dramatic decline in female participation in artisanal mining between 2005 and 2007. However, field observations and anecdotal evidence indicate that current statistics may be concealing an even more marked decline, and that 1% may be a more realistic figure for present day female participation with mine worker co-operatives.

A final consideration with respect to female participation in the mining sector is that although women continue to participate in mine worker protest marches and strikes, they appear less militant than their male counterparts, and are not evident in any photographs of violent confrontation. This contrasts markedly the prominent role that miner's wives played in historic mine site protests against the government, some of which led to violent and led to massacres of mine workers. However, this may be explained by the fact that their numbers are greatly reduced and that few protests in recent years have actually occurred within mining communities. Consequently, it cannot be concluded from this observation that contemporary women mine workers are less likely to engage in violent confrontation than their historic counterparts.

6.8. Summary

This section involved a qualitative comparison between documentary evidence and the in-country data collection. Generally speaking, there was a reasonable degree of consistency between the two sources of information, with the site visits and interviews validating or updating most formal research work and information from secondary sources. However, there were some areas of divergence. Historic research

work indicated that women's participation in the sector was growing strongly, while in-country observations concluded that women were almost absent from the sector. Available statistics also indicated that the proportion of women working in the mining sector was growing and stood at around 10% of all employees, whereas in-country data collection indicated this figure was more likely to be around 1%. The only significant presence of women mine workers encountered during the fieldwork were the *Relaveras* at Mina Huanuni, where approximately 100 were working for the State mining company. There international research literature also provided little information to characterise strong growth in new mining investments by trans-national corporations operating in Bolivia, as a result of a sustained increase in the value of industrial metals over the last decade, and record prices for tin and silver. Much existing research work also focuses upon the poverty of artisanal mine workers. Although this was undoubtedly true in the past, record high tin prices mean that some of today's artisanal miners are relatively affluent members of the *Altiplano* society.

The fieldwork also enabled a much clearer characterisation of occupational roles available to women mine workers, although it was interesting to note that even in Bolivia, women mine workers tend to be referred to as *Palliris*, irrespective of the type of work that they do in the sector, and despite the fact that *Palliris* have virtually disappeared from the waste rock piles.

Analysis confirmed that women have access to virtually any labouring role available at mine sites, and have even broken historic taboos that prevented them from working underground. Women also appear to have overcome discriminatory practices that kept them from senior positions in both state mining companies and in mine worker co-operatives. However, they do not have a presence as either labourers or managers with private mining companies.

The next section goes on to draw conclusions from the findings presented in this Chapter. The conclusions chapter is also structured around the research questions for consistency.

7. Conclusions

7.1. Introduction

This chapter draws conclusions from the previous (Analysis of Results) chapter, and specifically returns to the research questions presented in Chapter 1 (Introduction), which were:

1. What institutions constitute the *Altiplano* mining sector?
2. What mining activity is currently taking place?
3. What occupational roles are available to women
4. What factors influence women's participation?
5. What is the likely future for women mine workers?

Each of the research questions are considered in turn, following which, several suggestion for possible future research topics are suggested.

7.2. What institutions constitute the *Altiplano* mining sector?

Key stakeholder groups that make up the mining sector in Bolivia are the government, the mining companies (State, co-operatives and private) and mine worker unions, while NGOs are playing a growing role. The government still retains overall control of mineral resource exploitation, with COMIBOL administering all extraction activity. The State also operates some of the larger, more profitable mines, with the majority of smaller mines operated by mine worker co-operatives.

The FSTMB remains the principal trades union for mine workers. Although it has historically been a powerful stakeholder in the mining sector, declining membership and influence since the 1985 Tin Crisis means that the union is no longer able to directly challenge the government. In recent protests, FSTMB members have joined with the general workers union (COB) in anti-government protests. In contrast to the declining influence of the mine worker union, mine worker co-operatives have become the pre-eminent force representing labourers, due to their growing membership and national organisation. However, this has led to growing tension between *co-operativistas* and the salaried mine workers represented by FSTMB.

Restrictions on foreign investment have meant that small and medium-size mining operations have dominated production for the past 25 years, but large international mining corporations are now

starting to emerge as major players in the sector. They are introducing large scale extraction and reprocessing methods based on modern technology and mechanisation, with little demand for labour. Consequently, these corporations do not interact directly with the unions or mine worker co-operatives, and typically find themselves in conflict with NGOs that typically focus upon indigenous rights, labour conditions and environmental protection.

7.3. What mining activity is currently taking place?

Many of the extractive operations across the Department of Oruro are focused upon cassiterite (tin ore), although there is also a significant gold extraction operation, and a few smaller mines extract zinc, silver or other minerals. Many of the tin mines are over 100 years old, and some date back to Spanish colonial times. They typically use shafts and tunnels to access mineral veins underground, and due to the lack of motive power at many sites, rely on manual labour for most extraction and transport activities. Chronic under-investment in infrastructure maintenance and improvements means that the majority of sites are in a very poor state of repair. The only exception to this is at Mina Huanuni, which uses a large scale, mechanised operation to extract cassiterite from tunnels inside Cerro Posokoni.

In addition to extractive activities, a large proportion of the mining sector is engaged in mine waste reprocessing activities, recovering mineral from historic tailings and waste rock piles, or from present day *ingenio* waste discharges. Reprocessing technology is primitive at most sites, with manually charged buddles (a basic gravity settlement process) used to recover cassiterite. This is an inefficient and labour intensive process, and requires little skill by operators. The exception to this is the Baremsa SA reprocessing operation at Itos, which uses modern technology to recover a range of precious metals from historic tailings waste.

Large scale mineral processing is typically done via *ingenios*, which use basic mechanical crushing and flotation methods and separating tables to recover cassiterite from run of mine. The *ingenios* themselves are typically over 100 years old and many still use the original equipment. Some artisanal mining operations continue to use manual methods for mineral concentration and processing. This includes the use of heavy rollers used to crush mineral and panning methods to concentrate cassiterite. Concentrated mineral may be packaged for export, or sent to the smelter at Vinto, where it is converted into ingots.

With the exception of Mina Huanuni (which has significantly increased its production over recent years), mining and reprocessing activity at mine sites visited in the Department of Oruro appeared to be

significantly less than in the past, with small numbers of workers recovering small quantities of mineral.

7.4. What occupational roles are available to women?

Over the last decade, a dramatic rise in demand for industrial metals has re-invigorated production at many tin mine sites around Bolivia and an increasing range of opportunities are available to women working in the sector. The historic barriers of superstition and discrimination are gradually disappearing, and for the first time in almost 500 years, Bolivian women are working alongside their male counterparts in the mines as equals in virtually all aspects of extraction and mineral reprocessing. Discriminatory practices that barred women from management roles are also diminishing and some women now occupy senior roles in the government and mine worker co-operatives, but are having less success in private mining operations.

There are a number of distinct occupational roles that have historically been associated with women mine workers in the *Altiplano*, the most recognisable of which are the surface-based waste reprocessing roles of *Palliri, Relavera, Lamera, Venerista* and *Barranquillera.* Others are the support roles of *Transportadora, Recolectera, Cocinera, Refresquera, Vendedora, Lavadora* and *Sirena,* and the black market role of *Rescatiri.*

In more recent times, women mine workers have also been able to access the underground mine worker roles of *Perforista, Locatoria* and *Minera*. Women were previously restricted from these roles due to a combination of superstition and discrimination, both of which appear to have declined markedly in recent decades.

7.5. What factors influence women's participation?

Despite women mine workers having many roles available to them, it is not common to find women working at mine sites in Oruro, either underground or at the surface. It is estimated that they represent around 1-3% of the mine labour force, rather than the 10% -15% reported by some researchers using official or historic statistics. The participation of women in the mining sector is influenced by a range of factors, including resource availability, male attitudes, risk perceptions, government policy, technological development and engagement in formal education.

Although women mine workers can now access underground labouring roles, those working in the roles of *Palliri, Relavera* and *Lamera* have all but disappeared, principally due to the declining mineral content of waste piles. In addition, some mines have restricted mine worker co-operatives from accessing their

traditional work sites, which has led to the disappearance of *Lameras* from Huanuni, and *Barranquilleras* from Kori Chaca. The increasing average age of women mine workers is also creating an effective barrier to women accessing physically demanding roles such as *Perforista*, *Locatoria* and *Transportadora*, and causing them to transition to less labour intensive support roles, such as *Sirena, Vendedora* and *Rescatiri*.

Risk perceptions also significantly affect the participation of women mine workers, particularly with respect to income and personal safety. State mining operations have historically offered generous salaries, which are attractive not only because they offer more income than that available from mine worker co-operatives, but also because they offer greater income stability (as opposed to working on more variable piece rates). Although underground workers in a mine worker co-operative can secure a greater income, they also face a greater personal risk than surface workers. Interviews conducted during the field data collection indicated that some women mine workers prefer surface roles to underground work, although if surface work provides insufficient income and they do not have access to supplementary income, they may consider working underground.

Women mine workers have yet to challenge male domination in technical professional areas, as very few women train or work as engineers. As a consequence, they are unable to join the modern mining and reprocessing operations established by overseas mining companies, which rely upon technical experts for their operation, maintenance and management.

Although women first gained access to positions of influence in State mining organisations after the 1952 Socialist revolution, they have struggled to gain similar influence in the *Directivas* of mine worker co-operatives and have always been a small minority of members, never exceeding 10% of total membership. Although in recent times, women have managed to secure some senior positions at local, regional and national level, there are much fewer women working with the co-operatives.

Two other factors which have specifically affected the ability of women to participate in underground work are recent developments in tourism and advances in mining equipment technology. There has been a growing number of female tourists visiting underground artisanal mine workings at Cerro Rico, which demonstrated to male miners that far from bringing bad luck, the presence of women underground has significantly improved their income. The second has been the introduction of smaller, lighter pneumatic rock drills, to replace the larger hydraulic drills previously used. These drills demand less upper body strength to operate them, enabling many more women to work as *Perforistas*.

The government and NGOs have also begun to implement initiatives that specifically recognise the needs of women in the mining sector. Although some initiatives actually reduce female participation (e.g. training *Palliris* to sew or make jewellery), others encourage workplace equality (e.g. improving awareness of women's rights) or give specific consideration to women's needs (e.g. providing smaller drills). The improving economy has also enabled the government to provide women mine workers with finance to establish their own businesses. Not only does this empower women, but enables them to move into a less hazardous role, often outside their existing community.

Although the research literature indicates that substantial numbers of women mine workers are active underground in Bolivia's tin mines, this was contradicted by observations and information from mine sites visited in the Departments of Oruro and Potosi. In the Department of Oruro, it is now possible to visit many mine sites and not see any women mine workers, with the only exception being the COMIBOL operated mine at Huanuni.

7.6. What is the likely future for women mine workers?

The future for women mine workers is of course inextricably linked to the future of the mining sector itself, which has already been discussed in section 4.9 (page 65). The marked decline in female participation in the *Altiplano* tin mining sector suggests there is a real risk that despite current world record prices for tin in world markets, many of the occupational roles occupied by women mine workers for over 500 years could disappear within the next decade. This is particularly so for women involved in waste reprocessing roles. *Barranquilleras, Veneristas* and *Lameras* have already disappeared from many *Altiplano* sites, and there is already evidence of a steep decline in the number of *Palliris* and *Relaveras*. Women will continue to have access to underground roles at mine sites, such as *Perforistas, Mineras* and *Locatorias*. However, their number is unlikely to grow, and will more probably decline due to the low level of female recruitment to the sector, and the growing availability of less hazardous work elsewhere.

It is considered likely that women mine workers will continue to secure positions of influence in the government, State mining operations and with artisanal mine worker co-operatives. Current government policies and NGO programmes are likely to support this trend, which could conceivably result in a situation of imbalance, where women hold positions of influence but are almost absent from the labour force. However, it is considered unlikely that women will play a significant part in large scale, private mining operations, either on their labour force or on their management teams.

Many tin mines and mine worker co-operatives are able to operate profitably as tin is at a record high price, but a significant fall in price would devastate the *Altiplano* mining sector, causing the widespread closure of mines and mine worker co-operatives. Such a scenario would significantly impact the ability of women to participate in the sector.

7.7. Summary

Although mine worker co-operatives have dominated the sector since the Tin Crisis, the recent arrival of major mining operations run by trans-national corporations is changing the status quo, as the scale of new mining operations and the technology they employ enables significantly greater production with little demand for manual labour. This is likely to bring the *Altiplano* mining sector into line with production methods applied across much of the rest of the world. It is ironic to note that CEPROMIN considered mine worker co-operatives as a vehicle to transition from capitalism to socialism (Moeller 2002a), but ironically the combination of record tin prices and individualistic working methods has conspired to produce the reverse, with some artisanal mine workers becoming the new capitalists in the *Altiplano*.

The *Altiplano* mining sector still has a dual focus on both extraction and reprocessing, although low technology operations are becoming less and less viable as they are unable to extract mineral from depleted waste piles. By contrast, larger scale, high technology operations can continue to do so. This has obvious consequences for those involved in artisanal reprocessing operations, which even with record tin prices, continue to follow the trajectory of 'involution' identified by Godoy 30 years ago (Godoy 1985), and seem destined to disappear if the price of tin falls significantly.

Women are able to work in many specific roles within the mining sector, although in recent years, the opportunities have declined dramatically for *Palliris*, *Lameras*, *Barranquilleras* and *Veneristas*. Although new opportunities are arising for *Locatorias*, *Perforistas* and *Mineras*, there appear to be few women available to work in these roles, and some of those available prefer not to work underground.

Key factors that encourage women's participation in the mining sector are reduced discrimination and superstition, high wages (currently), declining competition from male mine workers, new technology (such as smaller rock drills). Factors that discourage women's participation are perceptions of work hazards, the availability of less hazardous alternatives in the informal sector, the introduction of new technologies that reduce the demand for labourers (principally in the private sector at present) and government policies and NGO initiatives designed to provide alternate work for women. Women mine

workers appear acutely aware of the hazards associated with their work, but it appears that their need for income and a lack of viable alternative work overwhelm their considerations of personal safety.

It is ironic that although women mine workers have now overcome almost all barriers to their participation in the mining sector, their numbers have declined to the extent that they have disappeared completely from some *Altiplano* mine sites. Some may express concern about the disappearance of women workers from sites where they have operated for almost 500 years. However, their participation was largely driven by dependency and exploitation, which confined women to miserable labouring roles for insufficient reward. As such, the decline in women's participation in such work is to be celebrated, particularly as many women workers currently have access to better work options elsewhere.

7.8. Suggested Further Research

The following are suggestions for possible further research into different aspects of the *Altiplano* mining sector:

- Why do official statistics show strong growth in the number of mine worker co-operatives and their membership, while observations clearly indicate a dramatic decline in the participation of artisanal mine workers in general, and women mine workers in particular?
- To what extent do the governance systems and operating methods of Bolivian mine worker co-operatives differ from the Rochdale Principles for co-operative societies?
- When women mine workers exit the sector, what occupations are they moving to, and in what locations?
- What has been the relative significance of growing gas revenues and debt relief upon the Bolivian economy?
- To what extent do large mining and reprocessing operations managed by trans-national corporations affect productivity and employment?

References

Absi, P. (2009). *Los ministros del diablo, el trabajo y sus representaciones en las minas de Potosi,* Fundacion PIEB, La Paz, Bolivia.

Absi, P. (2010). La parte ideal de la crisis: Los mineros cooperativistas de Bolivia frente a la recession, *Cuadernos de Antropología Social* No. 31, pp 33–54.

Acebey, D. (1985). *!Aquí también, Domitila! Testimonios recopilados*, Siglo XXI editors, Mexico.

Alexander, R. J. & Parker, E. M. (2005). *A history of organized labour in Bolivia*, Greenwood Publishing Group.

Alliance for Responsible Mining (2010). *Our initiative:- Artisanal and small-scale mining (ASM).* Retrieved from http://www.communitymining.org/index.php/en/our-initiative

Altamirano, N. (1995). Environment versus investment: The Bolivian mining industry, Regional Report: Bolivia. *Journal of Environment & Development*, 4 (1), 185-210.

Andean Information Network (2007, May). *Mines & Communities,* website: http://www.minesandcommunities.org/article.php?a=2596

Anderson, S. T. (2004). The mineral industry of Bolivia, in *US Geological Survey minerals yearbook - 2004*, pp 3.1 - 3.16.

Anderson, S. T. & Velasco, P. (2003). The mineral Industry of Bolivia, *US Geological Survey minerals yearbook – 2003* pp 1-8.

Aranibar Jiménez, A. M. (2003a). *La mineria con rostro mujere*, Apoyo Grafico, La Paz, Bolivia.

Aranibar Jiménez, A. M. (2007). *Mujeres de oro, quienes son?*, Cumbre del Sajama S. A., Apoyo Grafico, La Paz, Bolivia. Retrieved from http://cumbredelsajama.com/es/cv/mujeresdeoro.pdf

Auty, R. M. (1994). Industrial policy reform in six large newly industrializing countries: The resource curse thesis, *World Development* (22) 1, 11–26

Azzopardi, T. (2005). Bolivian miners end protest; Huanuni restarts tin production, *Platt's Metals Week*, 76 (21) 2-3.

Baldwin, W. L. (1983). *The world tin market, political pricing and economic competition*, Duke University Press, USA.

Ballard, C. & Banks, G. (2003). Resource wars, the anthropology of mining, in *Annual Review of Anthropology*, 32, pp287-313, Annual Reviews.

Barreto, M. L. (2011, March). L*egalization guide for artisanal and small scale mining (ASM) draft for discussion*, ARM Series on Responsible ASM, No.5, Alliance for Responsible Mining, March 17.

Barrios de Chungara, D. (1978). *Let me speak! Testimony of Domatila, a woman of the Bolivian mines,* Monthly Review Press.

BBC (2008). Bolivia holds key to electric car future, BBC News Online, Sunday, 9 November 2008. Retrieved from http://news.bbc.co.uk/2/hi/7707847.stm)

BBC (2010). How Rochdale pioneers changed commerce forever, BBC online 20 July 2010. Retrieved from:
http://news.bbc.co.uk/local/manchester/hi/people_and_places/history/newsid_8838000/8838778.stm

Bebbington, A., Bebbington, D. H., Bury, J., Lingan, J., Munoz, J. P. & Scurrah, M. (2008a). Mining & social movements: struggles over livelihood, *World Development Report* 36 (12), pp. 2888–2905, Elsevier Limited. Retrieved from
http://people.ucsc.edu/~jbury/Publications/Bebbington,%20Bury%20et%20al,%202008,%20Mining%20and%20social%20movements,%20World%20Development.pdf

Bebbington, A, Hinojosa L, Bebbington, D. H., Burneo, M. L., Warnaars, X. (2008b). *Contention and ambiguity: mining and the possibilities of development*, BWPI Working Paper 57, Brooks World Poverty Institute, University of Manchester.

Berdeja Hurtado, S. G. (2008). *La minería de hoy con rostro de mujer: una aproximación al análisis temático,* articulo.

Bethell, L. (ed.). (1994). *The Cambridge history of Latin America: Volume VI, part 1, 1930 to the present,* Cambridge University Press.

Beveridge, M. (1983). *Un estudio de los niveles de metales pesados en el Lago Poopó, Bolivia (a study into levels of heavy metal levels in Lake Poopó, Bolivia),* University of Stirling, Institute of Aquaculture.

BG Group (1998). *Successful gas discovery in Bolivia.* Retrieved from http://www.bg-group.com/MediaCentre/PressArchive/1998/Pages/pr-064.aspx

Bilaterals.org (2008, September). *Bolivia: two years of 'post-neoliberal' indigenous nationalism — a balance sheet.* Retrieved from http://www.bilaterals.org/spip.php?article13084

Bocangel, D. (2002). Small scale mining in Bolivia; national study. *Mining Minerals & Sustainable Development,* International Institute for Environment & Development (IIED) & World Business Council for Sustainable Development.

Bolivia Information Forum (2011). *About Bolivia: People.* Retrieved from http://www.boliviainfoforum.org.uk/inside-page.asp?page=43&section=2

Bonilla, H. (2006). Religious practices in the Andes and their relevance to political struggle and development: The case of El Tío and miners in Bolivia, *Mountain Research and Development* 26(4):336-342. 2006.

Bose, C. E. & Acosta-Belén, E. (eds.). (1995). *Women in the Latin American development process,* Sociologists for Women in Society.

Botin, J. A. (2009). *Sustainable management of mining operations,* Society for Mining, Metallurgy & Exploration Inc. Retrieved from http://books.google.co.nz/books?id=EOq691P4oq8C&pg=PA150&dq=mining+ngo+developing+countries&hl=en&ei=OxTLTr_fNOqpiAL2_vDcCw&sa=X&oi=book_result&ct=result&resnum=6&ved=0CE8Q6AEwBQ#v=onepage&q=mining%20ngo%20developing%20countries&f=false

British Mineworkers Union (1977). *Report on Bolivian miners*, Mimeo. Burke, Melvin.

Bridges, G. (2004, November). Contested terrain: Mining and the environment, in *Annual Review of Environment and Resources,* (29), 205-259.

Brough Smyth, R. (1869). *The gold fields and mineral districts of Victoria: with notes on the modes of occurrence of gold and other metals and minerals*, John, Ferres Government Printer, Melbourne.

Bury, J. (2008). Transnational corporations and livelihood transformations in the Peruvian Andes: an actor-oriented political ecology, *Human Organisation* (67) 3, 307-321.

Bystrowicz, M. & Unamuno, L. (2010). *Sinopsis Palliris*, CISEP internal report, Oruro.

Cajias de la Vega, M. (2008). *Huanuni: de pie a pesar de todo* (DVD), La Paz.

Campillo, F. & Fauné, M. A. (1993). *Gender Women and development a framework for IICA's action in Latin America and the Caribbean,* Inter-American institute for Cooperation in Agriculture, Costa Rica.

Canelas, O. (1966). *Mito y realidad de la COMIBOL*, Editorial Los Amigos del Libro, Cochabamba, 1966.

Cardoso, F. H. & Faletto, E. (1969). *Dependencia y desarrollo en Latinoamerica*, Siglo Veinteuno Editores, Mexico.

Cardoso, F. H. & Faletto, E. (1971). Dependency and development in Latin América, University of California Press.

CELDA (2011). *2.175 ONGs operan en Bolivia*, CELDA website. Retrieved from: http://cedla.org/content/2439

CEPROMIN - Centro de Promocion Minera (1996). E*l trabajo invisible de la mujer minera Boliviana*, CEPROMIN, La Paz, October.

CEPROMIN - Centro de Promocion Minera (2009). *Desde 1979.... 30 ano,* Anniversary publication, CEPROMIN, La Paz, February 2009.

CEPROMIN -Centro de Promocion Minera (1995, May). *The participation of women in small-scale mining in Bolivia*, paper prepared for the World Bank International Round Table on Artisanal Mining at Washington, DC, CEPROMIN, La Paz.

CEPROMIN -Centro de Promocion Minera (1989a). *El cooperativismo minero: paliativo, engaño o solucion?* Cuaderno de informacion (segunda edicion).

Chavez, F. (2011). *Bolivia: women fight superstition, machismo to join mining co-operatives*, Bolivia Rising website, 24 June 2011. Retrieved from http://boliviarising.blogspot.com/2011/06/bolivia-women-fight-superstition.html

Choque, F. (2000). Bolivia: the invisible work of women miners*,* in: *Construction, participation, solidarity in the women and mining movement*, Conference Report, II international conference 'International Network of Women and Mining", pp 47-50, September 16-25 2000, Oruro, Bolivia.

CIA – US Central Intelligence Agency (1989). *World factbook - Bolivia*. Retrieved from: http://www.theodora.com/wfbcurrent/bolivia/

CIPMA& IDRC (eds.). - Centro de Investigación y Planificación del Medio Ambiente & Centro Internacional de Investigaciones para el Desarrollo (2002). *Minería, minerales y desarrollo sustentable en América del Sur*, Mining, Minerals and Sustainable Development (MMSD), International Institute for Environment and Development (IIED) & World Business Council for Sustainable Development (WBCSD). Retrieved from http://www.wbcsd.org/web/publications/mmsd_south_america.pdf

CISEP (2007). *Oruro y las cooperativas mineras*, joint publication by the Centro de Investigacion y Servicio Popular (CISEP) and the Federacion Departmental de Cooperativas Mineras de Oruro (FEDECOMIN), Oruro, Bolivia 2007.

Coeur d'Alene Mines Corporation (2011). *San Bartolom (Bolivia) - one of the world's largest pure silver mines*. Retrieved from http://www.coeur.com/operations-san-bartolome-bolivia.html

Collier, P. (1988, December). *Women in development: defining the issues*, Policy Planning & Research Working Papers: Women in Development, WPS129, Population and Human Resources Department, World Bank, Washington DC.

Collier, P. & Hoeffler, A. (2004). *Greed and grievance in civil war,* Oxford Economic Papers, (56), 563–95.

Collier, P. & Hoeffler, A. (2005). Resource rents, governance and conflict, *Journal of Conflict Resolution* (49) 4, 625-633.

COMIBOL- Corporación Minera de Bolivia (2011). *Objetivos institucionales,* La Paz, Bolivia. Retrieved from http://www.comibol.gob.bo/nuestra_identidad/objetivos_institucionales

CONCOBOL & SOCODEVI (2009). *Diagnostico Nacional Cooperativo; Mineras,* Confederación Nacional de Cooperativas de Bolivia and the Canadian Cooperation Society for International Development, Québec, Canada.

CONCOBOL & SOCODEVI (2011). *Aims and objectives,* Confederación Nacional de Cooperativas de Bolivia. Retrieved from http://www.concobol.coop/site/

Contreras, C. (1985). *Mineros y campesinos en los Andes. Mercado laboral y economica campesina en la Sierra Central.* Siglo XIX. Instituto de Estudios Peruanos, Lima, Peru.

Coutinho de Arruda, M. C. (2009). Ethics and corporate social responsibility in Latin American small and medium sized enterprises: Challenging development, in Spence, L. J. & Painter-Morland, M. (eds.), *Ethics in small and medium sized enterprises: a global commentary,* Ch. 5, pp 65-84, The International Society of Business, Economics and Ethics book series, Springer.

Dames & Moore (1997). *Environmental audits of operations and installations of COMIBOL to be transferred to the private sector or permanently closed* (final report), prepared for the Corporacion Minera de Bolivia, November 1997, Cochabamba.

Dames & Moore (2000a). *Hydrogeological study of the San José mine and adjacent aquifers supplying water to the city of Oruro: Risk Source Characterization* (final report), prepared for the Corporación Minera de Bolivia, May 2000, Cochabamba.

Dames & Moore (2000b). *Generation of environmental baseline information: Salar de Uyuni & Salar de Coipasa (final report),* prepared for the Viceministerio de Minería y Metalurgia, November 2000, Cochabamba.

Dangl, B. (2007). *The price of fire: resource wars and social movements in Bolivia*, AK Press.

De Echave, J. (2007). *La Minería en el Perú: Entre la transformación de los conflictos y el desafío programático,* Presentation to the seminar on Territory, Conflicts and Development, Manchester, October, 2007.

Dimel, D. A. (2009). Demands from the East: a destabilised Bolivia, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, Centre for Latin American Research & Documentation, pp 98 - 111, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

Direccion General de Cooperativas (2009). *Lineamientos de politica publica del sector cooperativo,* Ministerio de Trabajo, Empleo y Prevision Social, La Paz, Bolivia.

Dollar, D. & Gatti, R (1999). *Gender inequality, income, and growth: Are good tmes good for women?*, Policy Research Report on Gender and Development, Working Paper Series, No. 1, World Bank Development Research Group.

Downie, J. (1933). *Peter Cornelius Plockboy, pioneer of the first co-operative commonwealth, 1659,* Manchester: the Co-operative Union Limited Publications Department.

Downing, T. E., Moles, J., McIntosh, I. & Garcia-Downing, C. (2002). Indigenous peoples and mining encounters: strategies and tactics, in *Mining, Minerals and Sustainable Development*, IIED & WBCSD, April 2002. Retrieved from http://pubs.iied.org/pdfs/G00548.pdf

Dreyer, J. T. (2006). From China with love: PRC overtures in Latin America*, Journal of World Affairs*, (12) 2, 85-98.

Eaton, K. (2007). Backlash in Bolivia: regional autonomy as a reaction against indigenous mobilization, *Politics & Society*, (35) 1, 71-102.

Echavaria C., Factor G., Mosquera C., & Laura Barreto, M. (eds. 2008). *La rama dorada, quia para mineria artesanal y de pequeña escala* responsable, Red Por la Mineria Responsable (RESPOMIN), Peru.

Eckstein, S. (ed.). (2001). *Power & popular protest: Latin America social movements,* University of California Press.

Eich, L. (1872). *Informe relative a la Empresa Huanchaca, Valpariso*, Imprenta de Mercurio.

Empresa Minera Huanuni (2009). *Empresa Minera Huanuni: Huanuni eje de la revolucion productiva en Bolivia* (public information booklet).

Encyclopaedia Britannica Online (2011). *Tin*. Retrieved from http://www.britannica.com/bps/search?query=tin

Enriquez, A. C. (2009). *El rostro minero de Bolivia: los mineros.... martires y heroes.* Sygnus, La Paz, Bolivia.

Escobari, J. (2003, April). *Problematica ambiental en Bolivia*, Unidad de analysis de politicas sociales y economicas (UDAPE), La Paz, Bolivia.

Espinoza Morales, J. (2011). *Mineria Boliviana: su realidad,* Plural, La Paz, Bolivia.

Evia, J. L & Molina, R (1997). *Estudio medio ambiental de la mineria mediana, pequeña y artesanal en bolivia*, documento de trabajo. Retrieved from http://pubs.iied.org/pdfs/G00714.pdf

Farcau B. W. (1996). *The Chaco War: Bolivia and Paraguay, 1932-1935*. Greenwood Publishing Group.

FEDECOMIN - Federación Departamental de Cooperativas Mineras (2011). *Statistical summary:* a*ffiliated mine worker co-operatives,* data obtained in September 2011 from FEDECOMIN offices, Oruro.

FENCOMIN - Federación Nacional de Cooperativas Mineras (2008). *FENCOMIN gestion 2006-2008*, information leaflet, La Paz, Bolivia.

Fokkelman, E. (2009). Natural wealth in Bolivia: fortune or misfortune?, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, pp. 83-93, Centre for Latin American Research & Documentation, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

Friedman-Rudovsky, J. (2011). *Mined to death: why Bolivia's Cerro Rico mountain is collapsing*, Time World. Retrieved from http://www.time.com/time/world/article/0,8599,2077641,00.html#ixzz1g7XVWZeH

Galeano, E. (1973). *Open veins of Latin America*, Monthly Review Press, New York.

Gall, N. (1974a). *The price of tin, Part 1: Patiño mines and enterprises,* Norman Gall Publications. Retrieved from http://www.normangall.com/bolivia_art2.htm

Gall, N. (1974b). *The price of tin, Part 2: the crisis of nationalisation*, Norman Gall Publications. Retrieved from http://www.normangall.com/bolivia_art3.htm

Garcia-Guinea, J. & Harffy, M. (1998). Bolivian mining pollution: past, present and future, *Ambio*, (27) 3 251-253, Published by Allen Press on behalf of Royal Swedish Academy of Sciences.

George, A. S., Kalluri, B. & Jonko, L .Q. (2000). India: mining in India - effects on women, their land rights and cultures, in: *Construction, participation, solidarity in the women and mining movement*, Conference Report, II international conference 'International Network of Women and Mining", September 16-25 2000, Oruro, Bolivia pp 95-97.

Género con Clase (2010). *Bolivia: la minería, un oficio de mujer*, 15 December. Retrieved from: http://generoconclase.blogspot.co.nz/2010/12/bolivia-la-mineria-un-oficio-de-mujer.html

Gill, L. (1997). Relocating class: ex miners and neoliberalism in Bolivia, in *Critique of Anthropology*, (17) 2 293-312, Sage Publications.

Global Entrepreneurship Monitor (2008). *Reporte Nacional Bolivia 2008*, Imprenta Soipa, La Paz, Bolivia. Retrieved from http://www.gemconsortium.org/download/1324457372894/GEMBolivia08.pdf

Godoy, R. A. (1985). Technical and economic efficiency of peasant miners in Bolivia, in Economic *Development and Cultural Change*, (34), No. 1 (Oct., 1985), pp. 103-120, The University of Chicago Press.

Godoy, R.A. (1990). *Mining and agriculture in highland Bolivia: ecology, history, and commerce among the Jukumanis*, University of Arizona Press.

Government of Bolivia (2001). *National census 2001*, La Paz, Bolivia.

Government of Bolivia (2009) .*Constitution of the plurinational state of Bolivia,* 7 February 2009. Retrieved from http://www.amazon.com/Constitution-Plurinational-Bolivia-Bolivian-ebook/dp/B002DYJRBO/ref=sr_1_1?ie=UTF8&s=digital-text&qid=1245850127&sr=1-1#reader_B002DYJRBO

Grewal I (2011) *Introduction to Mineral processing*, website of Met-Solve Laboratories Inc. Retrieved from http://www.met-solvelabs.com/index.php?option=com_content&view=article&id=4:mineral-processing-intro&catid=5:papers&Itemid=11

Guire, J. (2000). *Burkina Faso: the invisible work of women miners, in: Construction, participation, solidarity in the women and mining movement,* Conference Report, II international conference 'International Network of Women and Mining'', pp 33-34, September 16-25 2000, Oruro, Bolivia, published June 2002.

Harris, O. (1983). *Los muertos y los diablos entre los laymi de Bolivia.* evista Chungara no. 11, pp 135-152, Universidad de Tarapaca, Arica.

Hausmann, R., Tyson, L. D. & Zahidi, S. (2008) *Global gender gap report* 2008, World Economic Forum, Geneva, Switzerland.

Heemskerk, M. (2002). Livelihood decision-making and environmental degradation: Small-scale gold mining in the Suriname Amazon, in *Society and Natural Resources*. 15 (4): 327-344. Retrieved from

http://www.ddiglobal.org/login/Upload/Livelihood%20Decision%20Making%20And%20Enviro%20Deg.pdf

Heemskerk, M. (2003). Self-employment and poverty alleviation. Women's work in artisanal gold mines. *Human Organization.* 26 (1): 26-73

Hemphill, T. (2008). The political economy of globalism in South America: strategic implications for foreign direct investment. *Competition and Change.* (12) 3, 287-303.

Hentschel T., Hruschka F. & Priester M. (2002). Global report on artisanal & small-scale mining. *Mining, Minerals & Sustainable Development.* No. 70.

Hentschel, T., Hruschka, F., M Priester (2003). *Artisanal and small-scale mining: challenges and opportunities,* IIED and WBCSD, Russell Press, Nottingham. Retrieved from http://www.bvsde.paho.org/bvsacd/cd27/artisanal.pdf

Hetherington, L. E., Brown, T. J., Benham, A. J, Bide, T. Lusty, P. A. J, Hards, V. L., Hannis, S. D., Idoine, N. E. (2008). *World Mineral Production 2002 - 2006*, British Geological Survey, Nottingham.

Hilson, G. (2002). *On overview of land use conflicts in mining communities*, Land Use Policy (19) 65-73.

Hinton, J. J., Veiga, M. M. & Beinhoff, C. (2003). Women and Artisanal Mining: Gender Roles and the Road Ahead, in Hilson, G. (ed.) *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries*. A.A. Balkema, Swets Publishers, Netherlands.

Hollender, R. & Schultz, J. (2010, May). *Bolivia and its lithium: can the gold of the 21st century help lift a nation out of poverty?,* the Democracy Centre special report. Retrieved from http://www.ifg.org/pdf/DClithiumfullreportenglish.pdf

Honorable Gobierno Municipal de Huanuni (2005). *LXIII Aniversario de Creacion Provincia 1943-2005* (public information pamphlet).

Hudson, R. A. & Hanratty, D. M. (1989). *Bolivia, a country study* (3rd edition), Area Handbook Series, US Department of the Army.

ICE - International Co-operative Alliance (2011). *Co-operative movement in the world: statistical information on the co-operative movement.* Retrieved from http://www.aciamericas.coop/Co-operative-Movement-in-the-World

ICMM (2011). *About ICMM*, website of the International Council on Mining and Metals. Retrieved from http://www.icmm.com/

IIED - International Institute for Environment and Development (2002). *Breaking New Ground, Mining, Minerals and Sustainable Development* (MMSD) Project. Retrieved from: http://www.iied.org/pubs/pdfs/9287IIED.pdf

ILO - International Labour Organisation (1999a). *Social and labour issues in small-scale mines*, Report for discussion at the Tripartite Meeting on Social and Labour issues in Small-scale Mines, Geneva.

ILO - International Labour Organisation (2004). *Child labour in small-scale mining & quarrying - a thematic evaluation,* Geneva, May 2004. Retrieved from http://www.ilo.org/ipecinfo/product/download.do?type=document&id=10150

ILO - International Labour Organisation (2008). *Promotion of rural employment for poverty reduction*, Paper IV, International Labour Conference, 97th Session, Geneva.

IMF - International Monetary Fund (2009, September). *Factsheet: debt relief under the heavily indebted poor countries (HIPC) initiative*. Retrieved from http://www.imf.org/external/np/exr/facts/hipc.htm

Inara, W. (2012). COB abandona reunión con García Linera, *La Prensa*, 10 October 2011. Retrieved from: http://www.laprensa.com.bo/diario/actualidad/bolivia/20111010/cob-abandona-reunion-con-garcia-linera_8797_14780.html

INE - Instituto Nacional de Estadisticas (2009). *Censo nacional de poblacion y vivienda 2010 - Oruro Resultados*, La Paz, Bolivia.

INE - Instituto Nacional de Estadisticas (2010). *Estadisticas departmentales de Bolivia 2009*, La Paz, Bolivia.

INE - Instituto Nacional de Estadisticas (2011). *Producto interno bruto departmental 2010, La Paz, Bolivia.* Retrieved from http://www.ine.gob.bo/indice/general.aspx?codigo=40203

InterCarto (2012). *Map of Bolivia: Physical version. Retrieve*d from: http://www.intercarto.com/EN/map-of-bolivia-physical-version-1460-524.html

ITRI Limited (2009). *Huanuni Mine Boosts Output*. Retrieved from http://www.itri.co.uk/pooled/articles/BF_NEWSART/view.asp?Q=BF_NEWSART_31

IWMN - International Women and Mining Network (2000). *Construction, participation, solidarity in the women and mining movement,* Conference Report, II international conference, pp 40-41, September 16-25 2000, Oruro, Bolivia, published June 2002. Retrieved from http://www.rimmrights.org/Reports/secondconference.htm

IWMN - International Women and Mining Network (2004). *Defending our lives, demanding our rights*, Conferencia Internacional Mujeres y Mineria, 1-9 October 2004, Visakhapatnam, India. Retrieved from http://www.mmpindia.org/womenandminigreport.PDF

Jindal Steel & Power (2011). *Jindal Bolivia Limited*. Retrieved from http://www.jindalsteelpower.com/business/jindal-steel-bolivia.aspx.

Jones, A. (2011). *Genocide, a comprehensive introduction* (second edition), Routledge. Retrieved from http://books.google.co.nz/books?id=BqdVudSuTRIC&pg=PA110&dq=slaves+died+cerro+rico+potosi&hl=en&ei=USLjToCiH_GNiAfSy9W2BQ&sa=X&oi=book_result&ct=result&resnum=4&ved=0CD8Q6AEwAzgK#v=onepage&q=slaves%20died%20cerro%20rico%20potosi&f=false

Kelly, T. D. & Matos, G. R. (2011). *Historical statistics for mineral and material commodities in the United States*, US Geological Survey. Retrieved from http://minerals.usgs.gov/ds/2005/140/

Kohl, B. (2004). Privatization Bolivian style: a cautionary tale, *International Journal of Urban and Regional Research*, (28) 4, 893-908.

Kohl, B. H. & Farthing, L. C. (2006). *Impasse in Bolivia: neoliberal hegemony and popular resistance*, Zed Books.

Kohn, J. V. (1982). The Cliza and Ucureña war: syndical violence and national revolution in Bolivia, *The Hispanic American Historical Review,* (62) 4, 607-628.

Kolata, A. L. (1983). *The Tiwankau: portrait of an Andean civilization*. Blackwell Publishers, Cambridge.

Kyne, M. J. (1943). *Labor conditions in Bolivia*, Report to the Congress of Industrial Organizations, New York.

Labonne, B. (1996). Artisanal mining: an economic stepping stone for women, in *Natural Resources Forum*, a United Nations Sustainable Development Journal, (20) 2, 117-122.

La Patria (2010a). *Gobierno boliviano triplicara inversion minera en 2011,* Supplemento Especializado: Perspectiva Minera no. 636, November 19.

La Patria (2010b). *Mujeres trabajan a la par de hombres en muchas minas de Bolivia,* supplemento especializado: perspectiva minera no.639, December 10.

La Patria (2010c). *San Cristobal pago US$100m al estado y solo 48 milliones a Potosi,* supplemento especializado: perspectiva minera, no. 642, December 31.

La Patria (2011a). *Ventas record de minerales en Bolivia* supplemento especializado: perspectiva minera, no. 644, January 14.

La Patria (2011b). *Mineria chica en Bolivia*, supplemento especializado: perspectiva minera, no. 650, February 25.

La Patria (2011c). *Megaproyectos tendrán prioridad el 2011*, supplemento especializado: perspectiva minera, 28 January 2011.

Lahiri-Dutt, K. & Macintyre, M. (eds.). (2006). *Voices in development management: Women miners in developing countries: pit women and others,* Ashgate Publishing Limited, UK.

LAMMP - Latin American Mining Monitoring Programme (2010). *Women, mining and human rights: beyond the challenge*, International Conference, Guatemala, 14-17 March.

Laslett, J. H. M (1996). *The united mine workers of America: a model of industrial solidarity?* Pennsylvania State University Press.

Latin Freight (2011). *South America*, website: http://latinfreight.com/samerica_map.php

Lind, A. (2003). Feminist post-development thought: "Women in Development" and the gendered paradoxes of survival in Bolivia, *Women's Studies Quarterly*, (31) 3/4, 227-246.

Lindgren, W & Abbott, A. C. (1931). *The silver-tin deposits of Oruro, Bolivia,* Economic Geology, (26) 5, 453-479.

Lujan, A. I. (2000). Peru: the invisible work of women in artisanal mining, in *Construction, participation, solidarity in the women and mining movement,* Conference Report, II international conference 'International Network of Women and Mining", pp 83-86, September 16 2000, Oruro, Bolivia, published June 2002.

Lupu, N. (2004). *Towards a new articulation of alternative development: Lessons from coca supply reduction in Bolivia*, Development Policy Review 22 (4) 405-421.

Maalderink, .J. M. (2009). Bolivia's resource policy 1880-1964, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, pp. 21-31, Centre for Latin American Research & Documentation, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

Mabenge, J. (2000). Zimbabwe: how to make the invisible work of women miners visible, in *Construction, participation, solidarity in the women and mining movement*, Conference Report, II international conference 'International Network of Women and Mining", pp 40-41, September 16 2000, Oruro, Bolivia, published June 2002.

Madrid, R. L. (2005). Indigenous parties and democracy in Latin America*, Latin American Politics & Society* (47) 4 161-179.

Mayers, L. (2008). *A dangerous place to work! Women and children of the Devon and Cornwall mining industries 1300 - 1970,* Blaize Bailey Books.

McCall, J. (2009). Pachamama's belly: an analysis of indigenous discourse in modern Bolivia, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, pp 115-124, Centre for Latin American Research & Documentation, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

McCracken, S. (2011). Women in the Bolivian Mines, 1961 – 1985, in *Prospect: Journal of International Affairs at UCSD*. Retrieved from: http://prospectjournal.ucsd.edu/index.php/2011/10/women-in-the-bolivian-mines-1961-1985-2/

McMahon, G. (ed.). (1999, May). *An environmental study of artisanal, small, and medium mining in Bolivia, Chile & Peru,* World Bank Technical Paper 429, Washington DC.

Meoweather (2011). *Annual average temperature for Oruro, Bolivia*, website: http://www.meoweather.com/

Michard, J. (2008). *Cooperativas mineras en Bolivia; formas de produccion y comercializacion*, Centro de Documentacion e Informacion Bolivia (CEDIB), Cochabamba, Bolivia. Retrieved from http://www.cedib.org/bp/CooperativasMineras.pdf

Minera de Bolivia (2011). *Jindal explotará solo el 2.5% de las reservas del Mutún*, February 27 2011. Retrieved from http://boliviaminera.blogspot.com/2011/02/jindal-explotara-solo-el-25-de-las.html

Minera San Cristobal SA (2011). *Fact sheet*. Retrieved from http://www.minerasancristobal.com/en/news-room/press-releases/fact-sheet

Mineria de Bolivia (2007). *Bolivia registra solo 50% del mineral que exporta*, 31 December. Retrieved from http://boliviaminera.blogspot.com/2007/12/bolivia-registra-slo-50-del-mineral-que.html

Mining Technology.com (2011). *Pulacayo project, Bolivia*. Retrieved from: http://www.mining-technology.com/projects/pulacayo-project/pulacayo-project2.html

Mitre, A. (1981). *Los patriarcas de la plata: estructure socioeconomica de la mineria boliviana en el siglo XIX,* Instituto de Estudios Peruanos, IEP Ediciones, Lima, Peru.

Moeller, H. S., Trujillo Lunario, J. E., Claros, S. C., Jacinto, F. E., Claure, G,Vargas J. A. & Alanez, E. G. (2002b). *Situacion socio-economica del trabajo infantil en la mineria artisanal,* CISEP publicaciones, Oruro, Bolivia.

Moeller, H. S., Trujillo Lunario, J. E., Soria, N. P., Soria, Y., Choque, E. & Jacinto, F. E. (2002a). *Cooperativas mineras: dinamitas y contaminantes*, Programa de investigacion estrategica en Bolivia (PIEB), Oruro, Bolivia.

Montoya, V. (2009). The San Juan Massacre*,* in *Revista Almiar* 46, May/June, website http://www.margencero.com/articulos/new03/masacre_minera_english.html

Moody, R. (2007). *Rocks and hard places, the globalisation of mining*, Zed Books Limited, London.

Morales, J. A. & Sachs, J. (1988, June). *Bolivia's economic crisis,* in National Bureau of Economic Research Working Paper No. 2620. Retrieved from: http://www.nber.org/papers/w2620.pdf?new_window=1

Nash, J. (1979). *We eat the mines and the mines eat us*, Columbia University Press.

Nash, J. (1988a). Cultural resistance and class consciousness in Bolivian tin-mining communities, in Eckstein, S. (ed.), *Power and popular protest - Latin American social movements*, pp 182-202, University of California Press.

Nash, J. (1988b). Mobilization of women in the Bolivian debt crisis, in Larwood, L., Gutek, B. A. & Stromberg, A. H. (eds.). *Women and work* (pp. 67 – 86), Sage Press.

Nash, J. (1995). Latin American women in the world capitalist crisis, in *Gender and Society*, (4) 3, 338-353, Sociologists for Women in Society.

Neff, W. (1929). *Victorian working women: an historical and literary study of women in British industries and professions, 1832-1850*, Frank Cass & Co. by arrangement with George Allen & Unwin Ltd.

New Internationalist (2007). *Andean capitalism vs. permanent revolution - Bolivia: Evo Morales against the workers and oppressed,* in New Internationalist, Issue 399, September 2007.

Noetstaller, R., Heemerskirk, M., Hruschka, F. & Drechsler, B. (2004). *Program for improvements to the profiling of artisanal and small scale mining in Africa and the implementation of baseline surveys* (final report), World Bank (Communities and Small-Scale Mining Secretariat). Retrieved from http://www.heemskerk.sr.org/CASM/toolkit.pdf

Noetstaller, R., Heemskerk, M. Hruschka, F. & Drechsler, B. (2005). *Toolkit for implementing artisanal and small-scale mining baseline surveys in Africa.* Communities & Small-Scale Mining (CASM) Secretariat, at the World Bank: Washington D.C., April 2005.

Ordóñez, L. O. (2007). *Uncia y Llallagua: empresa minera capitalista y estrategias de apropiacion real del espacio (1900-1935)*, Instituto frances de estudios andinos, Lima, Peru.

Østergaard, L. (1992). *Gender and development: a practical guide*, Commission of the European Communities. Directorate-General Development, Routledge.

Pan American Silver Corp. (2011). *San Vicente*. Retrieved from http://www.panamericansilver.com/operations/bolivia/san-vicente/

Pellegrini, L. (2011). *Participation, planning and natural resources in Bolivia: from fiction to practice?* NEBE (Nationalisation of Extraction in Bolivia and Ecuador), working paper 1, Creative Commons, San Fransisco, USA.

Peñaloza, M. B. (2011). *Estimated growth of the co-operative system in Bolivia* (unpublished), FENCOMIN & DIGECO, La Paz, Bolivia.

Perry, G., Maloney, W., Arias, O, Fajnzylber, P., Mason, A. & Saavedra-Chanduvi, J. (2007). I*nformality: exit and exclusion*, World Bank, Washington D.C.

Pinto, J. (2000). Bolivia: women miners and the environment*,* in: *Construction, participation, solidarity in the women and mining movement,* Conference Report, II international conference 'International Network of Women and Mining", pp 51-55, September 16-25 2000, Oruro, Bolivia, published June 2002.

Polar Star Films (2005). *The devil's miner* (DVD), edited by Kief Davidson, Urban Landscapes Productions Inc.

Postero, N. & Zamosc, L. (2004). *The struggle for indigenous rights in Latin America*, Sussex Academic Press.

Priester, M. & Hentschel, T. (1991). *The Bolivian round buddle and the circular buddle - two traditional types of processing equipment for small-scale mining in the Andes*, Aufbereitungs-Technik, (32) 11, 634-639.

Priester, M., Hentschel, T. & Benthin, B. (1993). *Tools for mining: techniques and processes for small scale mining*, Berlin: Gate/GTZ.

Promocion Mutual La Paz (2011). *Un cole de altura*, Centro Educativo Mutual, La Paz. Retrieved from http://iondelcemlapaz.wordpress.com/de-los-himnos-de-bolivia/escudo_bolivia/

Pryce, W. (1778). *Mineralogia cornubiensis: a treatise on minerals, mines, and mining*, Goldsmiths' Library, University of London. Retrieved from http://www.archive.org/stream/mineralogiacorn00prycgoog#page/n8/mode/2up

PSAC Social Justice Fund (2010). *Searching through the scraps: Women and mining in Bolivia*. Retrieved from http://www.psac-sjf.org/pages/index_e.aspx?ArticleID=216

Quiroga, E. R. (2002). The case for artisanal mining in Bolivia: Local participatory development and mining investment opportunities, *Natural Resources Forum*, 26 (2) 127–139. Retrieved from http://onlinelibrary.wiley.com.ezproxy.massey.ac.nz/doi/10.1111/1477-8947.00013/abstract

RDMM - Red Departmental Mujeres y Mineria (2009a). *Responsibilidad social y ambiental con enfoque de genero en los cooperativas mineras,* Comision de Mineria Responsable, La Paz, Bolivia.

RDMM - Red de Mujeres y Mineria (2009b). *Comunidades mineras contra violencia intrafamiliar: Modulos 1 (Violencia Intrafamiliar) 2 (Salud sexual y reproductiva) y 3 (Lideres mujeres en la minera)*, Cumbre de Sajama SA, La Paz, Bolivia.

Render, J, M. (2010). *Good practice guide: mining and indigenous peoples*, International Council on Mining and Metals (ICMM). Retrieved from http://www.icmm.com/library/indigenouspeoplesguide

Ribera, A. (2008). *Problemas socio-ambientales de la mineria en Boliviana*, Liga de Defensa del Medioambiente (LIDEMA), La Paz, Bolivia.

Rivera, Y. (2006). *Debt forgiveness*, UICIFD Briefing No. 1, University of Iowa for International Finance and Development January 20, 2006.

Rojas J. C. & Vandecasteele, C. (2007). Influence of mining activities in the North of Potosi, Bolivia on the water quality of the Chayanta River and its consequences, in *Environmental Monitoring and Assessment* 132, pp 321-330, Springer.

Rojas, J. (1997). I Spent My Life in the Mines: The Story of Juan Rojas, Bolivian Tin Miner, in *The Australian Journal of Anthropology*, January 1, 1997.

Scoones, I. (1998). *Sustainable rural livelihoods, a framework for analysis,* Working Paper 72, Institute of Development Studies, University of Sussex, UK.

Scott, J. C. (1976). *The moral economy of the peasant, rebellion and subsistence in Southeast Asia*, New Haven: Yale University Press.

Silverprice.org (2011). *34 year silver price*. Retrieved from http://silverprice.org/silver-price-history.html

Simatauw, M. (2000). Indonesia: the position of women in the mining world, in: *Construction, Participation, Solidarity in the Women and mining movement*, Conference Report, II international conference 'International Network of Women and Mining", pp 98-101, September 16-25 2000, Oruro, Bolivia, published June 2002.

Social License in Action (2009*). Case history - Mineria San Cristobal*. Retrieved from http://socialicense.com/action.html

Spiegel, S. J. (2009a, September). Occupational health, mercury exposure and occupational justice: learning from experiences in Tanzania, *American Journal of Public Health (*99) 3, 550-558.

Spiegel, S. J. (2009b). Socioeconomic dimensions of mercury pollution abatement: engaging artisanal mining communities in Sub-Saharan Africa, in *Ecological Economics,* (68) 12, 3072-3083. Retrieved from http://www.sciencedirect.com.ezproxy.massey.ac.nz/science/article/pii/S092180090900305X

Stalker, P. (1984). A second look, in *New Internationalist* issue 131, January 1984.

Stern, S. (ed.). (1987). *Resistance, rebellion, and consciousness in the Andean peasant world: 18th to 20th Centuries*, University of Wisconsin Press.

Strijdonck, J. (2009). The legacy of the water war in Cochabamba, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, pp. 69-78, Centre for Latin American Research & Documentation, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

Strobele-Gregor, J., Hoffman, B. & Holmes, A. (1994). From Indio to Mestizo... to Indio. *Latin American Perspectives* (21) 2, 106-123.

Sumitomo Corporation (2010). *Effect of protests in Bolivia on the San Cristobal mine*, April 23. Retrieved from http://www.sumitomocorp.co.jp/english/news/2010/20100423_042721.html

Summit Mining International SA (2011). *Mina San Cristobal*. Retrieved from http://summitmininginternational.com/node/5

Susapu, B. & Crispin, G. (2001). *Country study: Report on small-scale mining in Papua New Guinea,* Mining, Minerals and Sustainable Development, International Institute for Environment and rail

Swain, E. B., Jakus, P.M., Rice, G., Lupi, F., Maxson, P. A., Pacyna, J.M., Penn, A., Spiegel, S. J. & Veiga, M. M. (2007). Socioeconomic consequences of mercury use and pollution, *Ambio* 36, pp 45-61.

Taussig, M., T. (1980). *The Devil & Commodity Fetishism,* The University of North Carolina Press Chapel Hill.

The Economist (2006, May). Now it's the people's gas, *The Economist*, volume 380, Issues 8489-8492. Retrieved from: http://www.economist.com/node/6888567

The Economist (2008, August). The Amazon: tread softly. *The Economist.* volume 388. Retrieved from http://www.economist.com/node/12010425

The Economist (2009, December). The Latinobarometro poll, a slow maturing of democracy, *The Economist* December 12th, 2009, pp 41-42.

The Economist (2010). Democracy Index 2010: Democracy in retreat, The Economist Intelligence Unit Limited, *The Economist. Retrieve*d from http://graphics.eiu.com/PDF/Democracy_Index_2010_web.pdf

Thoburn, J. (1977). Commodity prices and appropriate technology-some lessons from tin mining, *Journal of Development Studies,* 14 (1) 35-52.

Transparency International (2009). *Corruption perception index.* Retrieved from www.transparency.org/policy_research_indices/cpi/2009/

Traore, A. P. (1997). Socio-economic aspects and gender issues related to artisanal gold mining, in *UNIDO Expert Group Meeting on Introducing New Technologies for Abatement of Global Mercury Pollution Derived from Artisanal Gold Mining*, UNIDO Headquarters, Vienna, July 1-3, 1997.

Trujillo Lunario, J. E. (2004). *La mineria cooperativizada apoyado con manos femeninas: Las Palliris (trabajo final)*, postgraduate thesis in social sciences, Universidad para la investicacion strategica en Bolivia (U-PIEB), Oruro, September 2004.

Trujillo Lunario, J. E. (2005). *La mineria cooperativizada apoyado con manos femeninas: Las Palliris,* CISEP, La Paz, Bolivia.

Trujillo Lunario, J. E. (2011). Photographs from an undated, untitled book owned by Eloys Trujillo of the Universidad Tecnica de Oruro. Photos estimated to be taken in 1980.

UDAPE - Unidad de Análisis de Politicas Sociales y Económicas (2006). *Dossier de Estadísticas - Sector Minero (1990-2004*), Unidad de Analisis de Politicas Sociales y Economicas, La Paz-Bolivia. Retrieved from http://www.constituyentesoberana.org/estudiosymaterialdeanalisis/mineria/Documento%20Sector%20Minero.pdf

UNDP - United Nations Development Programme (2009). *Human development index 2009,* United Nations Development Program. Retrieved from http://hdrstats.undp.org/en/indicators/160.html

UNDP - United Nations Development Programme (2010). *Human development report 2010, The real wealth of nations: pathways to human development*. Retrieved from http://hdr.undp.org/en/media/HDR_2010_EN_Complete_reprint.pdf

UNDP United Nations Development Programme (2011). *Democratic dialogue website*. Retrieved from http://www.democraticdialoguenetwork.org/network/cases/view.pl?cases_id=2;var_name=abstract

UNEP - United Nations Environment Programme (2006). *Guide for reducing major uses and releases of mercury*, Inter Organization Panel for the Sound Management of Chemicals (a co-operative agreement among UNEP, ILO, FAO, WHO, UNIDO, UNITAR and OECD), UNEP, Washington. Retrieved from http://www.chem.unep.ch/mercury/Sector%20Guide%202006.pdf

UNESCO - United Nations Educational, Scientific and Cultural Organization (2000). *Potosi's silver tears*, UNESCO. Retrieved from www.unesco.org/courier/2000_03/uk/dici/txt1.htm

UNICEF - United Nations Children's Fund (2004). *Buscando la luz al final del tunel: niños, niñas y adolescentes en la mineria artesanal de Bolivia.* Retrieved from http://www.unicef.org/bolivia/bo_resources_buscandolaluz.pdf

UNICEF - United Nations Children's Fund (2011). *Bolivia: population and geography*. Retrieved from http://www.unicef.org/bolivia/resources_2334.htm

United Nations (1976). *Report of the world conference of the international women's year,* Mexico City, 19 June – 2 July 1975, New York.

UN Women (2010). Website for the United Nations entity for gender equality and the empowerment of women. Retrieved from http://www.un.org/womenwatch/daw/daw/

University of Texas (1971a). *Bolivia: Vegetation,* Library Map Collection, Map No. 78499 1971. Retrieved from http://www.lib.utexas.edu/maps/americas/bolivia_veg_1971.jpg

University of Texas (1971b). *Bolivia: Economic Activity,* Library Map Collection, Map No. 78499 1971. Retrieved from http://www.lib.utexas.edu/maps/americas/bolivia_econ_1971.jpg

Unknown Author (2008). *Precio del estañ*o, unknown publisher, Bolivia.

US Government (1995). *Joint Operations Graphic (Air),* series 1501, sheet SE 19-12 edition 1 (Uncia). Retrieved from: http://www.lib.utexas.edu/maps/jog/latin_america/txu-oclc-224571173-se19-12.jpg

US State Department (2009). *Background note: Bolivia (September 2009).* US State Department. Retrieved from http://www.state.gov/r/pa/ei/bgn/35751.htm

Van Damme, P. A., Hamel, C., Ayala, A. & Bervoets, L. (2008). Macroinvertebrate community response to acid mine drainage in rivers of the high Andes (Bolivia), *Environmental Pollution*, (156) 3, 1061-1068.

Van Hoecke, E. (2006). The invisible work of women in the small mines of Bolivia, in Lahiri-Dutt, K. & Macintyre, M. (eds.), *Women miners in developing countries: pit women and others*, pp. 265-285, University of Melbourne, Australia. Retrieved from http://onlinelibrary.wiley.com.ezproxy.massey.ac.nz/doi/10.1111/1477-8947.00013/abstract

Van Ryckeghem, M. (1997). *Contaminación Minero Metalúrgica y Salud Pública en la cuenca del lago Poopó* - Presentación del "Plan de Gestión Ambiental", documento final del Proyecto Piloto Oruro (PPO). Eco Andino Año 2 No. 4, 27-60.

Vargas Suárez, R. (2009). La nacionalizacion de los hidrucarburos bolivianos en la presidencia de Evo Morales Ayma, *Revista de Estudios Latinoamericanos*, 49, pp. 11-34, Universidad Nacional Autónoma de México.

Velasco, P. (2000). *The mineral industry of Bolivia. Retriev*ed from http://minerals.usgs.gov/minerals/pubs/country/2000/9503000.pdf

Verbeek, B. J. (2009). Changing international relations: Bolivia's call for self-determination, in Hogenboom, B., *Revolutionary politics: Bolivia's new natural resource policy*, pp. 33-46, Centre for Latin American Research & Documentation, Amsterdam. Retrieved from http://www.cedla.uva.nl/50_publications/pdf/other_publications/cmp/bolivia_gas.pdf

Viceministerio de Cooperativas Mineras (2011). *Ckojta, boletin informativo*, Ministerio de Minera y Metalurgia, Ano 2, no 2, January 2011.

Viceministerio de la Mujer (2005). *Warmi: mineral y copajira, memoria de mujeres mineras en diez cooperativas*, La Paz, Bolivia.

Vizcarra, J. L. E. & Barrios, R. M. (1997, March). *Estudio medio ambiental de la mineria mediana, pequena y artesanal en Bolivia*, Documento de trabajo No 02/97.

Von Gleich, A. (2000). Poverty reduction strategies, the experience of Bolivia, in Halvorson-Quevedo, R. & Schneider, H. (eds.), *Waging the global war on poverty: strategies and case studies*, Organisation for Economic Co-operation and Development: Development Centre, pp115-129. Retrieved from http://books.google.co.nz/books?hl=en&lr=&id=xMThSqEic38C&oi=fnd&pg=PA7&dq=waging+the+global+war+on+poverty+strategies+and+case+studies&ots=-S8YZxuptd&sig=L107kk7-_3M_HyI-BKAHOhv-iEg#v=onepage&q&f=false

Voyi, M. (2000). South Africa: how to make the invisible work of mining women visible - SAWIMA (South African Women in Mining Association), in: *Construction, Participation, Solidarity in the Women and mining movement,* Conference Report, II international conference 'International Network of Women and Mining', pp 40-41, September 16-25 2000, Oruro, Bolivia, published June 2002.

Wasserman, E. (1999), Environment, health and gender in Latin America: Trends and research issues, in *Latin American Research Issues*, Environmental Research Section A, 80, 253-273.

Watkins, T. (2012). *The economic history and economy of Bolivia*, San José State University Department of Economics. Retrieved from http://www.sjsu.edu/faculty/watkins/bolivia.htm

Webber, J. (2008). Dynamite in the mines and bloody urban clashes: Contradiction, conflict and the limits of reform in Bolivia's movement towards socialism, *Journal of the Society for Socialist Studies,* (4) 1 pp 102-153.

Webber, J. (2011). *From rebellion to reform in Bolivia: class struggle, indigenous liberation and the politics of Evo Morales*, Haymarket Books.

Webster (2011). Webster's Online Dictionary. Retrieved from http://www.websters-online-dictionary.org/definitions/buddle

Weisbrot, M. & Sandoval, L. (2006). *Bolivia's challenges*, Centre for Economic Policy & Research, Washington DC..

Weston C. H. (1968). An ideology of modernization, the case of the Bolivian MNR, *Journal of Inter-American Studies*, (10) 1, 85-101.

Whitehead, L. (1972). El impacto de la gran depresión en Bolivia, *Desarrollo económico* (45) pp 68-72, (April-Jun), Buenos Aires: IDES.

Wicky, J-C. (2002). *Mineros: Bolivia*, Lunwerg Editores, Spain.

Widerkehr, D. E. (1980). Autonomy overshadowed: A Bolivian co-operative within the nationalized mining industry, in *Human Organization*, (39) 2, 153 – 160.

Wills, B. A. & Napier-Munn, T. J (2006). *Wills' mineral processing technology: an introduction to the practical aspects of ore treatment and mineral recovery*, Elsevier Limited (7th edition).

Winterton, J. & Winterton, R. (1989). *Coal, Crisis and conflict: the 1984-85 miners' strike in Yorkshire*, Manchester University Press.

Weisbrot, M. (2007, January). *Bolivia's economy: The first year*, CEPR Centre for Economic & Policy Research Issue Brief, Washington DC.

WMMF (2000), Mining Communities Workshop: Artisanal Mining, In: *Procs. of the 1st World Mines Ministries Forum*, Toronto, Canada, March 8-11.

World Bank & International Finance Corporation (2002). *Global mining: treasure or trouble,* Mining and development series, Washington DC. Retrieved from http://siteresources.worldbank.org/INTOGMC/Resources/treasureortrouble.pdf

World Bank & International Finance Corporation (2002). *It's not over when it's over: mine closure around the world*, mining and development series: global mining, Washington DC. Retrieved from http://siteresources.worldbank.org/INTOGMC/Resources/notoverwhenover.pdf

World Bank (1999, May). *An environmental study of artisanal, small, and medium mining in Bolivia, Chile & Peru*, World Bank Technical Paper 429, Washington DC.

World Bank (2010a). *Country data: Bolivia.* Retrieved from http://data.worldbank.org/country/bolivia

World Bank (2010b). *Gross national income per capita 2010*, World Bank. Retrieved from http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf

World Bank (2011a). *World development indicators database, July 2011.* Retrieved from http://siteresources.worldbank.org/DATASTATISTICS/Resources/GNIPC.pdf

World Bank (2011b).*Country data; Bolivia*. Retrieved from http://data.worldbank.org/indicator/SI.POV.2DAY

Wren (2010). Cerro Rico, Bolivia: mining, capitalism & mythology, website: *the seams & the story*, photograph by Jason Rothe. Retrieved from http://www.seamsandstory.net/?p=41

Zamora G. E., Hinojosa O. C. & Salas A. C. (2010). *Remediar ganado, tratamiento de sedimentos de Rio Huanuni, como alternativa de remediacion ambiental y desarrollo local de communidades afectadas*, Supplemento especializado: perspectiva minera, La Patria no. 638, 3 December 2010.

Appendices

Appendix A **Mining Terminology and Acronyms**

Appendix B **Bolivia: Chronology of Key Events**

Appendix C **Massey University Human Ethics Committee Approval**

Appendix D **Project Information Sheets**

Appendix E **Stakeholder Organisations**

Appendix F **Fieldwork Programme**

Appendix G **Record of Site Visits**

Appendix A - Mining Terminology and Acronyms

The following provides a summary of the acronyms and terms used in this thesis, which include a translation of Spanish and Quechua words, and mining terminology.

Ama de Casa	Housewife.
Apiri	Ore carrier.
Barranquillera	Person who pans river sediments to recover gold (those using the same method to recover metals such as tin and silver are called *Lameras*).
Buddle	A shallow round pit which is used to separate tin from *ingenio*. The buddle is then left to drain, and the tin rich core is dug-out for further processing).
CAEP	Centro de Apoyo de Educacion Popular (Centre for Educational Assistance).
Campesino/a	Male/female rural peasant.
CEDLA	Centro de Estudios para el Desarrollo Laboral y Agrario (Centre for Studies to Develop Employment and Agriculture).
CENDA	Centro de Comunicacion y Desarrollo Andino (Andean Centre for Communication & Development).
Cocinera	Woman at mine sites who cooks food for mine workers.
Cola	Tailings pile (solid waste from concentration & amalgamation processes).
Copajira	Acidic leachate from tailings piles, with elevated metal concentrations.
COMIBOL	Corporación Minera de Bolivia.
Commercializadora	Licensed ore trader who buys, concentrates, packs and sells mineral to the foundry. Most Commercializadoras are ex-*Palliris*.
Cuadrilla	Group of 10-12 mine labourers working under a single foreman (typically 10-12 for miners, or 3-4 for *Relaveras*).
Cuenta Casas	Independent operator paid by mine worker co-operatives to manage mine infrastructure.
Desmonte	Waste rock pile, discarded below the mine opening.

Dirigente	Chief/senior manager of an organisation.
Directiva	Group of *Socios* that manage a co-operative.
IndoVara	Indigenous manager of early mines.
Ingenio	Plant comprising mechanical and chemical processes to crush, clean, classify and concentrate run of mine to produce mineral for smelting or sale.
Ingeniero/a	Male/female engineer.
Juku	Ore thief.
Kacha	Independent (free) mine worker (originally a reference to those who stole mineral from Spanish mines, but now refers to miners who work for co-operatives or are not affiliated to either the State or private mining companies).
Lamas	Mineral rich waste sludge found in drains and channels around mine processing plant (also see *Relaves*).
Lamero/a	Male/female who pans sediment and *ingenio* waste to recover tin. They typically work in or near rivers, drains and channels, or in another location with a water supply (typically from a small impoundment). Where the mineral recovered is gold, they are referred to as *Barranquilleras.*
Lavandera	Female worker at a mine site who washes the clothes of mine workers.
Locatorio/a	Male/female who works at their workstation inside a mine.
Maquipura	Associate member of miner co-operatives (temporary worker involved in support activities such as shoring, cleaning, hauling supplies etc.)
Minero/a	Male/female underground mine worker (women typically on selection, concentration, transport and cleaning operations).
La Mita	Quechua word for 'period of service', which refers to the forced conscription of indigenous men workers (*Mitayos*) in mines of the Spanish colonial period, which was institutionalised in 1570).
Pachamama	Earth goddess who provides fertile soil, crops and livestock.

Palliri	Spallier. *Palliri* is a Quechua word meaning to 'select by picking'. Prior to industrialisation, they were the main means of mineral classification in *ingenios*, but have been replaced by machines and now mainly work on tailings and waste rock piles.
Peaje	Work station allocated inside the mine or on the waste piles.
Perforista	Driller, who uses a hydraulic, pneumatic or mechanical drill to remove ore from the working face of a mine.
Pirquinero	A labour system involving a group of manual mine labourers under a single foreman. Participants share their revenue equally.
Pulperia	Mine store (with equipment for miners, and foodstuffs and other essentials for mining communities).
Quimbate	Hand operated crusher to reduce the size of rock fragments.
R*ecolectera*	Woman who carries tools and supplies for miners.
Refresquera	Women at mine sites who prepare drinks for mine workers.
Relave	Waste slurry discharged from an *Ingenio*, typically into a nearby river (also see *Lamas*).
Relavera	Person who recovers mineral (tin) from *ingenio* waste, typically using a uses a batch sedimentation process in a *buddle*.
Relocalizado	Displaced worker following the nationalisation of COMIBOL mines in 1992.
Relocalizacion	Migration of redundant workers from COMIBOL mine sites which were nationalised in 1992.
Rescatiri	Illegal (un-licensed) ore trader intermediary, who buys mineral direct from miners, *Palliris* or *Jukus*, and sells it to *Commercializadoras* or others. Many *Rescatiris* are ex-*Palliris*.
Sirena	Person who guards a mine opening to prevent unauthorised access or theft of mineral.

Socio/Socia	Male/female member of a mining co-operative, with rights to vote on motions addressed by the *Directiva*.
SMACA	Acronym for 'Small- scale, Co-operative and Artisanal' miners
Supay or *El Tio*	A representation of the devil inside underground mines. Miners make offerings to the statue to bring them good luck.
Transportadora	Person who moves run of mine from the workface to the *ingenio*.
Veneros	Alluvial deposits that contain mineral
Venerista	Person who excavates alluvial deposits near mine sites to recover mineral.

Appendix B - Bolivia: Chronology of Key Events

1200 BC	Agricultural community of Tiwanaku established, and later grew to 6.5 square kilometres with up to 30,000 inhabitants (Kolata 1983).
1000	Tiwanaku disappeared following prolonged drought (Kolata 1983).
1532	The Spaniard Pizarro landed in South America, eventually leading to demographic collapse between early colonization and the eighteenth century, due to smallpox, measles, flu and typhus (Godoy 1990).
1540	*La Mita* (forced draft of indigenous mine workers) was introduced to overcome a labour shortage (Absi 2009)
1545	Silver discovered in Potosi, in the hill now called Cerro Rico (Quiroga 2002).
1570	Indigenous waged workers appeared (Godoy 1990).
1570	*La Mita* was institutionalised (Absi 2009)
1575	Mercury amalgamation process introduced (Godoy 1990).
1742	Start of the 40 year 'age of Andean insurrection', which lasted until 1782 (Stern 1987)
1809	Rebellion begins against Spanish colonial rule (Watkins 2012)
1824	August 6: Bolivia became an independent republic following defeat of Spanish forces by Simon Bolivar's forces (Nash 1979).
1836-1839	Confederation of Bolivia and Peru (Watkins 2012)
1866	President Malgarejo abolished Indian (indigenous) communities in Bolivia (Godoy 1990).
1879-84	War of the Pacific. Bolivia lost its coastal territory the following year (Aranibar 2003, Watkins 2012).
1890	Silver prices collapsed in this decade, causing a shift in emphasis to tin mining to meet soaring industrial demand (Quiroga 2002).
1890	Tin becomes Bolivia's primary export revenue earner and enabled export led growth for the next 40 years (Quiroga 2002).

1899 Revolution led the capital to be relocated from Sucre to La Paz (Kohl & Farthing, 2006)

1904 Military service became mandatory for Bolivian males (Gill 1997).

1919 Several mining contractors killed at Catavi mine following a pay dispute (Barrios 1966)

1929 The great depression in the USA between 1929 and 1933 caused the loss of 10,000 mining jobs in Bolivia, who went on to establish themselves as the first mining co-operatives in Bolivia (Moeller 2002a).

1930 *Movimiento Nacionalista Revolucionario* (MNR) political party formed (Weston 1968; Strobele-Gregor et al. 2005)

1932 Bolivia declared war on Paraguay (Chaco War) which lasted until 1935 and killed 65,000 Bolivians. It also resulted in Bolivia losing large area of its Eastern territory and precipitated a recession (Farcau 1996)

1940 Simon Patiño died (Quiroga 2002)

1941 Nationalist Revolutionary Movement (MNR) established (Weston 1968)

1942 15-22 December: Siglo XX and Catavi worker pay demands led to the arrest of union leaders and a strike by 7,000 workers. The army moved in to Catavi, killing at least 19 protestors on 21 December (Kyne 1943, Enriquez 2009)

1943 Military coup (Watkins 2012)

1944 Federated Union of Mine Workers of Bolivia (FSTMB) established (Enriquez 2009).

1947 General strike at 49 mines, which was broken by the government imprisoning union representatives (Enriquez 2009).

1949 Strike at Catavi. The government sent in the army who used guns and mortars against miners, killing 42 people. This event is referred to as 'the second massacre at Siglo XX' (Enriquez 2009).

1949 MNR initiates civil war but is defeated (Enriquez 2009).

1950 All major mines in Bolivia controlled by three families (Patiño, Hoschild and Aramayo) (Quiroga 2002).

1950	April 19: Hunger strike at Villa Victoria led to armed response, and the death of hundreds of workers, women and children (Enriquez 2009).
1950	First mine worker co-operatives appear (Absi 2009).
1951	MNR wins national elections but is prevented from taking power. (Weston 1968)
1952	COMIBOL formed, and employment at state owned mines increased 50% from 1951 to 1956 levels (yet production dropped to half 1951 levels) (Gall 1974b)
1952	April 9th: Bolivian Revolution initiated by MNR under Dr. Victor Paz Estenssoro, where peasants rose up against the landlord class (Morales & Sachs 1988).
1952	Major tin mines were nationalized and administered by COMIBOL. Mine owners transferred liquid assets overseas and demanded compensation for nationalized mine sites (Widerkehr 1980, Quiroga 2002).
1953	Agrarian reform destroyed the hacienda system and fixed wages for agricultural workers. This led to widespread migration of *campesinos* to the mines and urban centres (Absi 2009).
1956	Inflation reached 178.6% (Morales & Sachs 1988).
1956	Bolivia approached US for aid (Elder Monetary Stabilization Plan) (Widerkehr 1980).
1957	General strike (Alexander & Parker 2005)
1956-1960	Presidency of Siles Luazo (MNR).US and IMF activity to stabilize the economy (Morales & Sachs 1988).
1958	September 13: General Law of Co-operative Societies was promulgated to standardise the operations of co-operatives and formalise their relationship with the state (CEPROMIN 1989).
1960-1964	Presidency of Estenssoro (Morales & Sachs 1988).
1961	Mine production hits a new low, resulting in the 'Triangulation plan' to restructure COMIBOL supported by US, Inter-American Development Bank and West Germany (Widerkehr 1980).

1964 Military coup led by Barrientos Ortuno deposed President Paz Estenssoro, and started a period of military rule that lasted until 1982. The army occupied mine sites and imprisoned, tortured and murdered mine workers (Widerkehr 1980).

1965 Peasants sign Military Pact with Banzer (Nash 1979).

1965 Mass lay-offs at mine sites and endemic unemployment encouraged the growth of pre-industrial mining techniques (Widerkehr 1980).

1966-1969 Civilian presidency of Barrientos, who died in a plane crash in April 1969 (Morales & Sachs 1988)

1967 24th June: San Juan massacre at Siglo XX, Llallagua (CEPROMIN 1989, Montoya 2009)

1968 22st December: FENCOMIN was established to represent the interests of mining co-operatives across Bolivia (FENCOMIN 2008).

1969 Vice President Sue Salinas becomes president; deposed in coup by Ovando Candia (Morales & Sachs 1988).

1970 Ovando Candia deposed by Gen. Miranda. Miranda deposed by General Juan Jose Torres (Morales & Sachs 1988).

1970 Bolivia's Average calorie intake 1834/day - well below recommended required. Child mortality rate reached 27.6%, up from 16.8% in 1960-66 (Nash 1979).

1971 Military coup by right wing deposed Torres and installed a left-wing government supported by the military, PBS, and MNR (Morales & Sachs 1988).

1971 Coup brought the dictator Hugo Banzer Suarez to power with MNR support - hundreds were killed over 3 days, with many imprisoned and tortured, & 5,000 went into exile. US gave loan of $10.6m and $4.5m for special programmes almost immediately (Nash 1979).

1971 August: political leaders forced into exile following death under interrogation of Colonel Selich (Nash 1979).

1971 The Vinto tin foundry started operations on January 9th, with a capacity to process 42,000 tonnes of concentrate per year, creating 20,000 tonnes of refined metal per year (Pinto 2000).

1971-1972 Universities closed for a year (1971-2) & concentration camps set up (Nash 1979).

1972 Bolivian peso devalued by 60%, resulting in large profits for COMIBOL as the price of tin rose on commodity markets (Widerkehr 1980).

1974 Universities closed for several months (Nash 1979).

1974 November: Decree 11947 made the Bolivian Workers Centre illegal & strikes, prohibited unions & made obligatory civil service for Bolivians over 21. Supreme Decree 11952 replaced union leaders, & led to imprisonment of Bolivian Mine Workers Union leaders (Nash 1979).

1974 Non-violent peasant uprising in Cochabamba against food costs. Miners called for strike, leading to confrontation with Banzer's troops –killing over 100 demonstrators in what is referred to as the Massacre of the valley (Nash 1979).

1974 Journalists and Red Cross officials prohibited from visiting mining centres (Nash 1979).

1976 May: militant miner congress in Corocoro to demand increased wages. Oruro and Potosi mining centres were declared military zones, occupied by the army.50 mineworkers were exiled to Chile & others imprisoned (Nash 1979).

1976 July: Ex-president Torres assassinated in Argentina (Nash 1979).

1977 Government imprisoned 58 journalists. Church radios destroyed, only state radio permitted (Nash 1979).

1977 British mineworkers union report on harsh living conditions in Bolivian mines led to withdrawal of UK aid to improve mines (Nash 1979).

1977 Bolivian ministry of health stats (Presencia 1977):

- average peasant life expectancy was <35 years
- only 9% had access to regular source of water

1977 Daily arrests in mining centres & peasants arrested for not joining official trades unions (Nash 1979).

1977 Banzer declared amnesty for political prisoners & exiles (Miners Day 21 Dec 1977) - but on paper only. Hunger strike by miner's wives & children grew to a protest (Nash 1979).

1978 Inconclusive election.

1978 July 9: election rigged by Banzer according to international observers (Latin American Political Report July 21 1978). Banzer puppet Juan Pereda Asbun declared himself president before counting concluded (Nash 1979).

1978 International group on International Affairs reported on abuse of indigenous groups, with Indians relocated to forced agricultural labour (Nash 1979).

1978 January 16: 2 day strike by thousands of miners. Police raided hunger strike centre, leading to other strikes. Banzer eventually promised elections in July 1978 (Nash 1979).

1978 November: General Padilla seized control from Pereda (Nash 1979).

1979 Inconclusive election. Pereda becomes president in allegedly fraudulent election, but was deposed by Padilla, who calls for 1979 election (Morales & Sachs 1988).

1979 Inconclusive election. Senate President Walter Guevara Arze served as interim president but was deposed by Col. Natusch Busch (who resigned 15 days later). Lidia Gueller becomes interim president (Morales & Sachs 1988).

1979 CEPROMIN was established as an NGO to educate, advise and support the mining sector (CEPROMIN 2009)

1980 Inconclusive election. Gueiler deposed in a coup by Major General Luis Garcia Meza (Morales & Sachs 1988).

1982 Start of 8 years of declining world commodity prices for tin, which caused production to fall 56% by 1987. This caused widespread unemployment in the mining sector and resulted in the growth of new mining co-operatives (Moeller 2002a).

1981 Garcia Meza forced to resign in favour of Gen. Bernal.

1981 General Bernal resigned in favour of General Torrelio (Morales & Sachs 1988).

1982 70% of Bolivia's export earnings were used to repay foreign debt (Stalker 1984).

1982 Gen. Torrelio deposed in coup by Gen. Vildoso Calderon. Congress reconvenes; names Sues Suazo as president, ushering in democracy (Morales & Sachs 1988).

1985 Siles Suazo announces early elections. Paz Estenssoro became president. New economic policy declared on August 29, 1985 (Morales & Sachs 1988).

1985 International Monetary Fund Stabilization Plan drove austerity measures, leading to loss of subsidies on food in mining communities and reduced wages for miners (Gill 1997).

1985 August 29: Restructuring of COMIBOL via Supreme Decree 21377 closed hundreds of mines, leaving 30,000 miners with no work (CEPROMIN 1989, Andean Information Network 2007, Aranibar 2003).

1985 Mass protest by miners and their wives in La Paz in March (CEPROMIN 1987).

1986 National committee of miner's wives was formed (CEPROMIN 1989b).

1985 GDP fell by 20% compared to 1980, hyper-inflation reached 24,000% and public deficit was 25% of GDP (von Gleich 2000).

1986 Supreme Decree 21060 restructured the mining industry and introduced COMIBOL (over 30,000 miners lost their jobs between 1986 and 1992) and migration of unemployed workers to urban centres (Gill 1997).

1986 'March for Life and Peace', from Oruro to La Paz was stopped by the army and 200 miners arrested. The government declared a state of siege (Nash 1986).

1987 Cerro Rico became a UNESCO world heritage site (UNESCO 2000).

1987 Co-operative miners began re-working the Cerro Rico mine (UNESCO 2000).

1988 Argentine economic crisis results in reduced remittances to Bolivia (Kohl 2004).

1992 The government transferred ownership of COMIBOL mines to private companies. Although key personnel were retained by the new owners, many miners lost their jobs and had to move to other sites where they typically joined mine worker co-operatives. This process of displacement is referred to as *Relocalizacion* (Enriquez 2009) or the 'white massacre' (Absi 2009).

1992 Ministry of Sustainable Development and the Environment introduced new environmental legislation, imposing a regulatory framework for controlling environmental planning, permitting and performance at industrial facilities (McMahon 1999).

1994 Neo-liberal reforms by President Sanchez de Lozada (Goni) restructured the public sector and privatized 50% of major state owned enterprises: oil & gas, telecoms, airlines, power generation, railways (Kohl 2004).

1994 First annual *'Encuentra Nacional'* of women mine workers, at Radio Pio XII in Llallagua (Aranibar 2003)

1996 29 August: tailings dam failure at Porco lead/zinc mine released 235,000 tonnes of toxic material into the Rio Agua Castillo, resulting in toxic effects evident 800Km downstream (Garcia-Guinea &Harffy 1998).

1996 Local miners seize foreign owned mines at Capasirca and Amayapampa. Armed police intervened, resulting in the death of 9 miners and one policeman (Quiroga 2002).

1997 President Goni introduced a new Mining Code focused on neoliberal reform and mine sector investment. At the time, Goni owned COMSUR and the majority of 5 mining concessions and a foundry (Andean Information Network 2007).

1997 February: overflow from COMSUR Bolivar dam holding lead, zinc and arsenate waste overflowed in the Rio Antequera-Pazna (Garcia-Guinea &Harffy 1998).

1999 Mining sector nationalization. Vinto smelter and Huanuni mine sold to Allied Deals for US$27 million (The Economist 2007).

1999 Vinto smelter seized by the government, and sold for $6 million to COMSUR (owned by President Sanchez de Lozada). It was sold in 2005 for an estimated US$90 million (The Economist 2007).

2002 COMIBOL established to hold the title to land and mineral resources at Bolivian mine sites, and to receive royalties on production (Anderson & Velasco 2004).

2002 COMIBOL took over the administration of Huanuni tin mine from Empresa Minera Huanuni SB (Anderson & Velasco 2004).

2002 Election shock as Evo Morales' Movemiento al Socialism polled only 1% behind the election winner, giving rise to national protests (Postero & Zamosc2004).

2003 International Monetary Fund demanded a further reduction in budget deficit which led to public protest in February. Military fired on protesters, killing 23 and wounding hundreds (Kohl 2004).

2003 October: Goni resigned in response to the killing of protesters and growing unrest (Kohl 2004).

2003 COMIBOL re-acquired Huanuni tin mine from RBG following an ownership dispute (Anderson & Velasco 2004).

2003 Official estimate of 22,880 people employed in mining and mineral work in Bolivia. Unofficial figures estimated the real number exceeded 72,000 (Anderson & Velasco 2004).

2004 'Mining Re-activation Plan' aimed to increase exploration activity and restart projects 'frozen' between 1995 and 2003, and also emphasized the use of Bolivian labour and technology transfer (Anderson & Velasco 2004).

2004 April 9: Protest activity by SMACA miners at Huanuni tin mine resulted in Sejsani and Sora Sora areas being awarded to the Cooperativa Multiactiva, effectively preventing access for Compania Mineria Colquiri (Anderson & Velasco 2004).

2004 World tin prices rebound, but Bolivian mines were not competitive with those in Indonesia, Brasil, China and Peru (Anderson & Velasco 2004).

2004 Fraser Institute survey of mining investment appeal ranked Bolivia 61st out of 64 countries, due to legislative changes, poor enforceability of concession claims, tax uncertainties, labour regulation and political instability (Anderson & Velasco 2004).

2005 May 15th: thousands of co-operative miners blockade the Huanuni mine for 4-days, in protest at government investment proposals that did not favour co-operatives (Azzopardi 2005).

2006 January 22nd – Evo Morales is sworn in as President, the first time Bolivia has had a President representing Bolivia's indigenous majority. Development emphasis shifted from mining to hydrocarbons (Dimel 2009).

2006 October 5th& 6th: two day battle at Huanuni mine following a dispute over piece rates and restricted access for co-operatives. This resulted in a battle between 5,000

cooperativistas and 1,000 COMIBOL workers, with 16 killed, 115 injured and $2million damage to mine property (The Economist 2006, Andean Information Network 2007).

2007 January: Government started to raise mining taxes (Andean Information Network 2007).

2007 February 6th: 2,000 miners protested tax increases in La Paz, which resulted in taxes linked to revenues (Andean Information Network 2007).

2007 February 9th: Evo Morales nationalized the Vinto tin smelter (The Economist 2007).

2007 May 1st: Evo Morales nationalized mines in Bolivia (excluding previously granted concessions), with mineral reserves controlled by COMIBOL (Andean Information Network 2007).

2007 April: Protests at Huanuni resulted in 16 dead and 115 injured (Andean Information Network 2007, The Internationalist 2007).

2008 August 28th: Evo Morales declares referendum on a new constitution. At least 30 killed in ensuing clashes between pro and anti-government groups in Eastern Bolivia (The Economist 2008).

2009 December: Evo Morales elected with 63% of the vote, with a 90% turn out for the election (The Economist 2009).

2011 16 March - 10 April: In-country research conducted for this thesis.

2011 April 6-8: The workers union COB (Central Obrera Boliviana) protested against government policies in La Paz. Miners marched with COB.

Appendix C - Massey University Human Ethics Committee Approval

MASSEY UNIVERSITY

18 March 2011

Mr Howard Markland
43 Pembroke Road
Northland
WELLINGTON 6012

Dear Howard

Re: HEC: Southern B Application – 11/16
Disappearing Barranquilleras – the changing livelihood of female mine workers in the Bolivian Altiplano

Thank you for your letter dated 16 March 2011.

On behalf of the Massey University Human Ethics Committee: Southern B I am pleased to advise you that the ethics of your application are now approved. Approval is for three years. If this project has not been completed within three years from the date of this letter, reapproval must be requested.

Please note that travel undertaken by students must be approved by the supervisor and the relevant Pro Vice-Chancellor and be in accordance with the Policy and Procedures for Course-Related Student Travel Overseas. In addition, the supervisor must advise the University's Insurance Officer.

If the nature, content, location, procedures or personnel of your approved application change, please advise the Secretary of the Committee.

Yours sincerely

Dr Nathan Matthews, Acting Chair
Massey University Human Ethics Committee: Southern B

cc Glenn Banks
School of People, Environment
and Planning
PN331

Mrs Mary Roberts, Secretary to HoS
School of People, Environment
and Planning
PN331

Appendix D – Project Information Sheets

The Project Information Sheet was used prior to interviews and site visits, to inform people of the objective and scope of my investigative work. The Spanish language version was presented to individuals, although an English translation has also been presented in this Appendix, for the benefit of non-Spanish speakers.

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

School of People, Environment and Planning
Palmerston North, New Zealand
Supervisor: Glen Banks: tel 64 6356 9099 (x2983)
G.A.Banks@massey.ac.nz

Disappearing Palliris – the changing livelihood of female mine workers in the Bolivian Altiplano

PROJECT INFORMATION SHEET

Researcher

Howard Markland is a student researching the work and livelihood of *Palliris* at Bolivian *Altiplano* mine sites for his thesis. This will contribute toward his Master of Philosophy degree in Development Studies, at Massey University in New Zealand.

Howard's research is completely independent. The information collected will only be used in preparation of his thesis, and possible publication of a research paper. However, participants will be provided with a synopsis of findings if they request it.

Project Description

Despite the range of academic research into Bolivian mines, miners and mining communities over the last 30 years, much has focused on male miners working underground. There is very little information available to describe the livelihoods of *Palliris*, or the recent decline in their numbers. Howard is therefore trying to characterize the livelihoods of *Palliris* at Bolivian mine sites in the Bolivian *Altiplano*, and better understand the reasons for the decline in their numbers.

Howard will be spending 3 weeks at mine sites around Oruro, during which time he will meet with *Palliris* and representatives from mining companies; mining co-operatives; community groups; the Technical University of Oruro, and the Municipalidad de Oruro. He will also visit La Paz to meet with representatives from government departments and non-governmental organizations.

Howard will be collecting several types of information, including notes, photographs and voice recordings, none of which will be collected without prior consent (photographs will require prior written consent). On completion of his investigation, he will present the interim findings at a local venue with the cooperation of the mine and mine worker co-operative.

Invitation for *Palliris*

You and other *Palliris* at this mine site are invited to participate in this research, to share information about your background work experiences and home life. During the next few days, Howard will invite you to spend up to 1 hour discussing different aspects of your background (including their name, ethnicity and affiliations), work and home life. You can continue working during this discussion if you wish. You will receive a small food package in return for your assistance.

Invitation for Officials and Representatives

You are invited to participate in this research, as your organization is one of several that may be able to provide useful information about the work and livelihoods of *Palliris* in the Bolivian *Altiplano*. You will be asked to spend up to 30 minutes with Howard, during which time he will complete a questionnaire regarding information you may be able to share regarding the work of *Palliris* at *Altiplano* mine sites. You will receive a small token of appreciation in return for your assistance.

Data Management

The information collected by the researcher will be used for writing his thesis and preparing summary documents for the benefit of participants. Information collected may also be used in an academic publication summarizing the thesis.

All information collected and the identity of individual participants is confidential. Any notes and questionnaires will refer to participants by a code number, and only the researcher will have access to a cross-reference document which links code numbers to individual's names. All field notes, questionnaires and photographs will be digitized and held in a password-protected computer, accessible only by the researcher. Original documents will be destroyed once digitized.

Data collected during this study will be held by the researcher until submission of the final thesis, and offered to Massey University after this time. It is Massey University policy to hold such information for a period of 10 years before it is destroyed. All participants will be offered a Spanish language summary of preliminary fieldwork findings before the researcher returns to New Zealand.

Participant's Rights

You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study at any time during the discussion;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used unless you give permission to the researcher;
- be given access to a summary of the project findings when it is concluded.

Your conversation will be recorded to ensure the accuracy of translation and notes taken. You can ask for the recorder to be turned off at any time during the interview. Photographs may also be taken to characterize working conditions, but individuals will not be identifiable in any published photographs unless they have signed a consent form.

Contacts

You may contact Howard (the researcher), his translator or his supervisor if you have any questions about the project.

- The translator can be contacted at: <DETAILS TO FOLLOW>
- Howard can be contacted by email at: Howard.Markland@med.govt.nz
- His supervisor at Massey University is Glen Banks (contact details are listed at the top of this page).

Alternatively, you can contact the mine worker co-operative or a community representative if you want them to present questions on your behalf.

Ethics Committee Approval Statement

This project has been reviewed and approved by the Massey University Human Ethics Committee: Southern B, Application 11/16. If you have any concerns about the conduct of this research, please contact Dr Nathan Matthews, Acting Chair, Massey University Human Ethics Committee: Southern B, telephone 06 350 5799 x 8729, email humanethicsouthb@massey.ac.nz

MASSEY UNIVERSITY
TE KUNENGA KI PŪREHUROA

Escuela de Gente, Medioambiente y Planificacion
Palmerston North, Nueva Zelandia
Supervisor: Glen Banks: tel 64 6356 9099 (x2983)
G.A.Banks@massey.ac.nz

Palliris desapareciendo – el cambio de sustento de las mujeres mineras trabajadoras en el Altiplano Boliviano

HOJA DE INFORMACION DEL PROYECTO

Investigador

Howard Markland es un estudiante que esta investigando para su tesis el trabajo y el sustento de las *Palliris* en los sitios mineros del *Altiplano* Boliviano. Esta investigación contribuirá a obtener su Grado de Maestría en Filosofía en Estudios de Desarrollo en la Universidad de Massey en Nueva Zelandia.

La investigación de Howard es completamente independiente. La información recolectada solo sera usada para la preparación de su tesis, y la posible publicación de esta investigación. Sin embargo, los participantes recibirán un resumen de los hallazgos si ellos estan interesados.

Descripción del proyecto

A pesar del rango de investigaciones académicas desde hace 30 años sobre las minas en Bolivia, mineros y comunidades mineras, la mayoría se han enfocado en los trabajadores varones de la mina subterránea. Hay muy poca información disponible que describe sobre como se sostienen las *Palliris* y que el número de ellas actualmente esta disminuyendo. Howard esta entonces tratando de caracterizar el sustento y entender mejor las razones del decrecimiento en el número de *Palliris* en los sitios mineros del *Altiplano* Boliviano.

Howard estará 3 semanas en los sitios mineros en Oruro, durante el cual el se reunirá con las *Palliris* y los representantes de las companias mineras; cooperativas mineras, grupos comunitarios, Universidad Técnica de Oruro y la Municipalidad de Oruro. El también visitará la ciudad de La Paz para reunirse con representantes del gobierno y organizaciones no gubernamentales.

Howard recolectará varios tipos de información, incluyendo apuntes, fotografías y grabaciones, ninguno de los cuales serán recolectados sin previo consentimiento (fotografías requerirán previo consentimiento escrito). Al final de esta investigación, el presentará los hallazgos en un local con la cooperación de la mina y los mineros cooperativistas.

Invitación para las *Palliris*

Tu o otras *Palliris* en este sitio minero estan invitadas a participar en esta investigación, para compartir información acerca de tus experiencias de trabajo, experiencia y vida familial. En las proximas dias, Howard va a invitar usted a discutir aspectos diferentes de tu base (incluyendo tu nombre, etnicidad y afiliaciones, trabajo y vida familial. Puedes seguir trabajando durante del discusion si to quieres. Vas a recibir una paquette pequino de comida por to asistencia

Invitación para los oficiales y representantes

Tu estas invitado(a) para participar en esta investigación, porque tu organización es una de muchas que puede proporcionar importante información acerca del trabajo y el sustento de las *Palliris* en los sitios mineros del *Altiplano* Boliviano. Quisiéramos que ofrezcas 30 minutos de tu tiempo a Howard, durante este tiempo el completará una cuestionario y te hará preguntas acerca del trabajo de las *Palliris* en el *Altiplano* Boliviano. En retorno a tu ayuda, recibirás un pequeño regalito.

Manejo de datos

La información recolectada por al investigador sera usada para escribir su tesis y preparar un resumen para los participantes de este cuestionario. La información recolectada tambien puede ser usada para una publicacion académica, resumiendo el contenido de su tesis.

Toda la informacion recolectada y la identidad de los participantes será mantenida en confidencia. En los cuestionarios y los apuntes tomados, los participantes tendrán un código numérico y solo el investigador tendrá acceso para verificar referencias. Estas referencias concectarán los nombres de los participantes con los códigos. Todas las notas de campo, cuestionarios y fotografías estarán en forma digital y tendrán una contraseña. Toda esta información sólo sera accessible al investigador. Los originales de todos los documentos serán destruídos despues de ponerlos en for ma digital.

La información recolectada durante este estudio sera retenida por el investigador hasta la entrega de su tesis (una vez finalizada) a la Universidad de Massey. Es la política de la Universidad de Massey retener esta informaciónes por 10 años antes de su destrucción. Se ofrecerá a los participantes un resumen de los hallazgos preliminaries del trabajo de campo traducido al español. Esto será antes de que el investigador retorne a Nueva Zelandia.

Derechos de las participantes

No estas obligado(a) a aceptar esta invitación. Si decides a participar, tienes derecho a:

- No responder a cualquier pregunta
- Retirarte de este estudio en cualquier momento
- Durante tu participación, hacer cualquier pregunta en cualquier momento acerca de este estudio
- Dar información con el conocimiento de que sólo se usará tu nombre siempre y cuando le das tu permiso al investigador
- Tener acceso al resumen del proyecto cuando este completo

La conversación que tengas con el investigador sera grabada para asegurar la exactitud de los apuntes tomados y la tradución. Puedes pedir que no se te grabe en cualquier momento de la entrevista. También se podrían tomar fotografías para caracterizar las condiciones de trabajo, pero no se mostrará la identidad de personas individuals a menos que ellos hayan firmado una formulario de consentimiento.

Contactos

Puedes contactar a Howard (el investigador), su traductor o su supervisor si tienes algunas preguntas acerca de este proyecto.

- El traductor puede ser contactado en : <luego se proveerán los detalles >
- Howard (email): Howard.Markland@med.govt.nz
- Su supervisor de la Universidad de Massey en Nueva Zelandia es Glen Banks (ver sus detalles arriba).

Alternativamente, puedes contactar al minero cooperativista o al representante de la comunidad si tu quieres preguntar las preguntas por ti mismo.

Declaración de la aprobación del Comité de Eticas

Esta proyecto ha sido revisado y aprobado por el Comité de Eticas Humanos (Sur) en la Universidad de Massey (referencia 11/16). Si estas preocupado(a) de como se esta conduciendo esta investigación, por favor contacta a Doctor Nathan Matthews, Jefe Suplantando del Comité de Eticas

Humanos (tel. +64 6 350 5799 x 8729) o manda un correo elelctrónico a humanethicssouth@massey.ac.nz

Appendix E - Stakeholder Organisations

Organisation	Type	Location	Priority
ADSIB–Agencia para el Desarrollo de la Sociedad de la Información en Bolivia Social Development Information Agency	Central government	La Paz	1
ANMM– Asociacion Nacional de Mineros Medianos National Association of Medium Size Mining Companies	NGO	La Paz	1
APEMIN - Apoyo al Desarrollo Economico Sostenible en Areas Mineras Empobrecidas del Occidente de Bolivia Sustainable Economic Development Assistance for Poor Mining Areas in Western Bolivia	NGO	Oruro	1
CANALMIN– Cámara Nacional de Mineria National Chamber of Mining	Mining Organisation	La Paz	1
CEPROMIN - Centro de Promocion Minera Centre for the Promotion of Mining	NGO	La Paz	1
COMIBOL– Corporación Minera de Bolivia Bolivian Mining Corporation	Central government	La Paz	1
COMSUR - Cooperativa de Mineria del Sur Southern Mining Co-operative	Mining Company	Huanuni	1
CONCOBOL– Confederación Nacional de Cooperativas National Confederation of Co-operatives	NGO	Santa Cruz	1
Confederación de Cooperativas de Palliris Confederation of *Palliri* Co-operatives	Business Group	Oruro	1
Cooperativa Mineria Multiactiva Multiactivity Mining Co-operative	Mine Worker Co-operative	Huanuni	1
Domitila Barrios de Chungara	Academic	Cochabamba	1
FEDECOMIN - Federación Departamental de Cooperativas Mineras National Federation of Mining Co-operatives	Mine Worker Union	Oruro	1
FENCOMIN – Federación Nacional de Cooperativas Mineras National federation of mine worker co-operatives	Mine Worker Union	La Paz	1
FSTMB – Federación Sindical de Trabajadores Mineros de Bolivia Syndicated Federation of Bolivian Mineworkers	Political Party	Oruro	1
Gobernación de Oruro (Departamento Minero) Oruro district government (mining department)	Local Government	Oruro	1
INE – Instituto Nacional de Estadística National Statistics Institute	Central government	La Paz& Oruro	1
MMM - Ministerio de Mineria y Metalurgia Ministry of Mining and Metallurgy	Central government	La Paz	1
Ministerio de Trabajo, Empleo y Previsión Social Ministry of Labour, Employment and Social Services	Central government	La Paz	1

Organisation	Type	Location	Priority
UTO - Universidad Tecnica de Oruro Oruro Technical University	Academic Institution	Oruro	1
VMCM - Viceministerio de Cooperativas Mineras Vice ministry of Mining Co-operatives	Central government	La Paz	1
CEDIB - Centro de Documentacion y Informacion Boliviana Centre for Documentation & Information	Charity	La Paz	2
CENDA - Centro de Comunicacion y Desarrollo Andino Andean Centre for Communication & Development	NGO	Cochabamba	2
CEPA - Centro de Ecología y Pueblos Andinos Centre for Andean Ecology & Villages	NGO	USA	2
COB - Central Obrera Boliviana Bolivian Labour Union	Mine Worker Union	La Paz	2
FNDR– Fondo Nacional de Desarrollo Regional National Fund for Regional Development	Central government	La Paz	2
MEDMIN– Fundacion Medioambiente, Mineria y Industria Foundation for Environment, Mining & Industry	NGO	La Paz	2
REDESMA - La Red de Desarrollo Sostenible y Medioambiente Network for Sustainable Development &the Environment	NGO	La Paz	2
RENASEH - Red Nacional de Asentamientos Humanos National Network for Human Rights	NGO	Cochabamba	2
Secretariat Departmental de Desarrollo Sostenible y el Medioambiente Departmental Secretary for Sustainable Development & the Environment	Local Government	Oruro	2
UMSA - Universidad Mayor de San Andrés San Andres University	Academic Institute	La Paz	2
VMCM - Viceministerio de Desarrollo Productivo Vice-ministry of Productive Development	Central government	La Paz	2
Banco Mundial World Bank	Funding Agency	La Paz	3
CANALCOM– Cámara Nacional de Comercio National Chamber of Commerce	Business Organisation	La Paz	3
Casa de la Mujer The Women's House	NGO	Santa Cruz	3
CEDLA - Centro de Estudios para el Desarrollo Laboral y Agrario Centre for Labour & Agrarian Labour Development	NGO	La Paz	3
CIDOB - Confederación de Pueblos Indígenas de Bolivia Confederation of Indigenous Peoples of Bolivia	NGO	Santa Cruz	3

Organisation	Type	Location	Priority
CISEP - Centro de Investigaciones y Servicio Popular Centre for Investigation & Public Service	Mining Co-operative	Oruro	3
CONALCAM– Coordinadora Nacional por el Cambio National Coordinator for Change	NGO	La Paz	3
CPIB - Confederación de Pueblos Indígenas de Bolivia Confederation of Bolivian Indigenous Villages	NGO	La Paz	3
FBDM – Fundación Boliviana para la Democracia Multipartidaria Bolivian Foundation for Multi-Party Democracy	NGO	La Paz	3
MAS - Movemiento al Socialismo Movement Toward Socialism	Political Party	La Paz	3
Ministerio de Desarrollo Sostenible y el Medioambiente Ministry for Sustainable Development & the Environment	Central government	La Paz	3
MNR – Movemiento Nacionalista Revolucionario National Revolutionary Movement	Political Party	La Paz	3
Oficina de Catastro Minero (in COMIBOL) Mining Concession Registration Department	Central government	La Paz	3
UDAPE - Unidad de Análisis de Politicas Sociales y Económicas Economic Policy Analysis Unit	Central government	La Paz	3
UMSS - Universidad Mayor de San Simon University of San Simon	Academic Institution	Cochabamba	3

Appendix F - Fieldwork Programme

In-country research was conducted over a 25 day period between 16 March 2011 and 10 April 2011. Specific research activities conducted during this period are listed below.

16 March	Arrived in La Paz from New Zealand
17 March	Travelled to Oruro
18 March	Interviews with mining sector academics (UTO) and mining sector NGO (CEPA)
19 March	Interview with Radio Pio XII
20 March	Interview with ex COMIBOL Chief Mechanical Engineer
21 March	Document review & planning
22 March	Travelled to Huanuni to meet min officials and a mining sector NGO (CEPA)
23 March	Visited mine sites around Oruro (San José, Santa Rita, and Itos)
	Revisited UTO to collect loaned documents
24 March	Travelled to Llallagua, Uncia & Siglo XX in Department of Potosi, to visit mine sites and meet a representative from the Women's Network
25 March	Discussed preliminary findings with academics at UTO
26 March	Document review & planning, revisited to Mina San José & Santa Rita
27 March	Document review & planning
28 March	Visited organisations in Oruro (INE, local government and FEDECOMIN)
29 March	Visited EMPLEOMIN project office and UTO
	Visited Inti Raymi gold mine at Playa Iroco
30 March	Rest day
31 March	Visited sites at Huanuni, Machacamarca and Poopó

1 April	Revisited Mina San José
	Revisited *Palliris* on waste piles at Santa Rita
	Visited Commercializadoras to South of Oruro
	Made a presentation to students at Universidad Tecnica de Oruro (UTP) about environmental management and regulation in New Zealand
2 April	Rest day in Oruro
3 April	Travelled to Cochabamba
4 April	Cochabamba
5 April	Interviewed personnel from URS Corporation
6 April	Document review & planning
7 April	Flew to La Paz
8 April	Visited several government departments, unions and NGOs
9 April	Revisited CEPROMIN offices
10 April	Departed La Paz for New Zealand

Appendix G – Record of Site Visits

1. Mina San José, Oruro (23 March 2011).
2. Mina Santa Rita, Oruro (2 3 March 2011).
3. Mina Itos, Oruro (23 March 2011).
4. *Ingenio* Itos, Oruro (23 March 2011).
5. Baremsa SA, Itos, Oruro (23 March 2011).
6. Mina Siglo XX (lower entrance), Llallagua (24 March 2011).
7. Mina Siglo XX (upper entrance), Llallagua (24 March 2011).
8. Mina Siglo XX waste rock piles, Llallagua (24 March 2011).
9. *Ingenio* Uncia (24 March 2011).
10. Mina Kori Chaca, Oruro (29 March 2011).
11. *Relaveras* downstream of Mina Huanuni (31 March 2011).
12. *Ingenio* Machacamarca (31 March 2011).
13. *Ingenio* Machacamarca tailings piles (31 March 2011).
14. Empresa Sinchi Wayra, Poopó (31 March 2011).
15. Mina Poopó (31 March 2011).
16. *Ingenio* Tiwanaku, Poopó (31 March 2011).
17. Commercializadora SRV, Oruro (1 April 2011).
18. Commercializadora Kori Sonco, Oruro (1 April 2011).

SITE VISIT 1

Site: Mina San José, Oruro

Date: 23rd& 26thMarch 2011

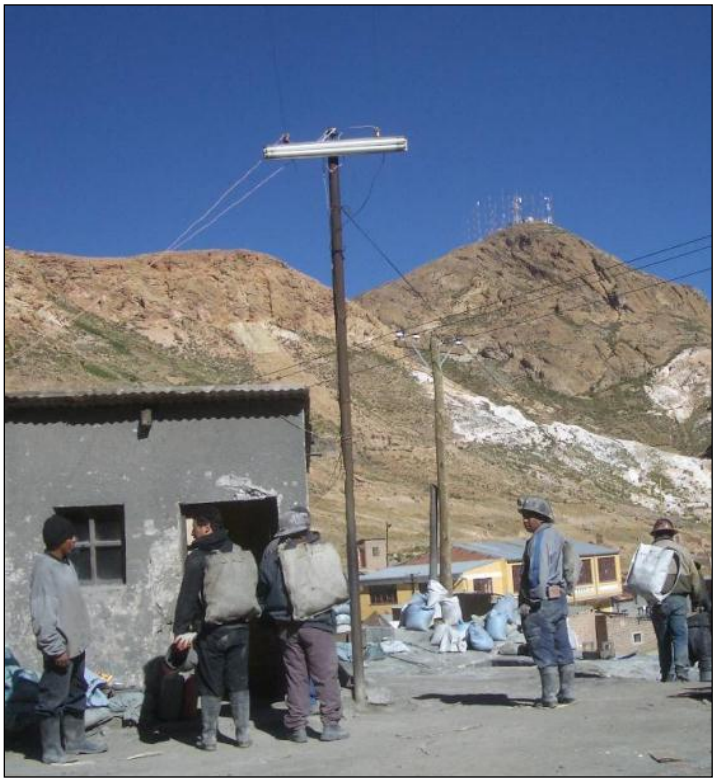
The San José mine was first opened in 1837 and operated by COMIBOL until 1985, after which it was worked by mining co-operatives. Co-operatives began re-working this mine in 1992. Although the old COMIBOL buildings and equipment were in an advanced state of decay, five mining co-operatives were currently active at the site.

It was apparent that current mining activity was at a much smaller scale than that of COMIBOL operations. However, no miners were seen entering or leaving the mine at the time of visit, and no *Palliris* were seen working the waste rock or tailings piles.

The site security guard *(Sirena)* for the co-operative was an ex-COMIBOL miner and head of mechanical maintenance at San José mine, stated that due to the extensive deterioration, damage and theft at the site since COMIBOL abandoned the site, co-operatives have had to install their own generators, compressors, pumps and mineral crushing plant. They access the mine using the COMIBOL shafts, although they also installed a new mine opening following a collapse in the main shaft. Co-operative mining operations are 24 hours per day (using 3 shifts), seven days per week. Unlike COMIBOL operations, the waste rock from current mining activity is left inside the mine, with only the mineral removed. *Socios* pay 2,500 Bolivianos (US$364) to join the co-operative.

Highly acidic and contaminated water continually drains from the mine and runs all the way to Challapampa, where it infiltrates into the ground. The potable water supply for Oruro is drawn from groundwater near Challapampa, and the aquifer is now so contaminated with heavy metals from mine drainage that it has to be diluted with water from another source for it to meet minimum health standards for potable supply.

Photograph G1 Mina San José, Oruro



Photograph G2 Miner workers with mineral in their backpacks (Cooperativa Mineria Nueva San José)

Male and female miners work for the co-operatives, with female miners are aged from 18 to 40 (older women are not able to manage the heavy work required). Other women are employed by the co-operatives to provide shower and laundry facilities at the mine. *Palliris* have not been active at San José since 1992 because the waste rock piles have been covered as part of the APEMIN II remediation project funded by the European Union. The remediated piles will be vegetated in the future. A revisit to Mina San José on 26th March again failed to encounter any miners or *Palliris* at the site, although some male and female workers were seen working on a remediation project to install drainage and a cap on the main waste rock pile, prior to planned re-vegetation work.

Photograph G3 Deteriorating infrastructure (Mina San José)

Photograph G4 Female laundry workers (Mina San José)

Photograph G5 Female labourers moving soil to re-vegetate the waste rock pile (Mina San José)

SITE VISIT 2

Site: Mina Santa Rita, Oruro

Date: 23rd& 26thMarch 2011

Although the mine is not used for production, the winding gear is used by Cooperativa Salvadora to give its miners access to deeper levels of Mina San José which is situated on the other side of the same hill. Miners and the mineral they produce leave the mined via a mine opening at the San José site. No miners were seen entering or leaving the mine at the time of visit, and the winding gear was not manned or operating.

Three *Palliris* were seen working the waste rock piles below Mina Santa Rita. The third *Palliri* seen was an elderly male (estimated to be in his 50's), working surficial beside the access track to the Santa Rita mine. Unfortunately, he was only viewed from a distance, and left his workstation while the other *Palliris* were being spoken to. He did not return that day and was not present the following week when the site was revisited. As with the others, he worked with a lump hammer with no protection from the sun, and had only collected a small quantity of concentrate before he left.

Photograph G6 *Palliri* working the upper waste rock pile (Mina Santa Rita)

Photograph G7 *Palliri* working the waste rock pile (Mina Santa Rita)

SITE VISIT 3

Site: Mina Itos

Date: 23rd March 2011

Two mine worker co-operatives were active around the mine openings at Mina Itos, on the opposite side of the hill from the *ingenio*. These were Cooperativa Salvadora Ltda. and Cooperativa Nueva San José. Each co-operative at Itos used a different mine opening, and several miners were seen leaving the mine openings individually or in pairs. Of the 18 miners viewed at the time of visit, all were male and all wore safety helmets, helmet-mounted electric lights and gumboots. However, none wore gloves or had other safety equipment such as gas detectors or escape respirators. Each was carrying a sack of recovered mineral on their back, estimated to weigh between 15-30 kg.

Photograph G8 Miners leaving the mine opening (Cooperativa Mina Nueva San José)

SITE VISIT 4

Site: *Ingenio* at Mina Itos

Date: 23rd March 2011

The abandoned COMIBOL *ingenio* at Itos was in an advanced state of deterioration and no longer operating. It was viewed from a distance as it was not considered safe to visit the site. There were expansive tailings waste piles and lagoons below the *ingenio*. A remediation project is underway to reduce the environmental contamination associated with the tailings waste at this site (see Baremsa SA remediation below).

Photograph G9 Cooperativa Salvadora at Itos

Photograph G10 Abandoned *Ingenio* and Tailings Pile (Mina Itos)

SITE VISIT 5

Site: Mina Itos, Oruro (Baremsa SA Remediation Project)

Date: 23rd March 2011

This site has modern industrial plant beside the old tailings pile, which was operated by the Bolivian private company Baremsa SA Ltda. An interview on site with Juan Carlos Chumacero (Chief of Operations for Baremsa) revealed that the company had been working alongside the COMIBOL tailings dam, reprocessing *colas* and *relaves* to produce silver, copper and lead, which were contaminating adjacent water supplies. Approximately 150 people were employed at this site.

In this highly industrialized process, waste was mixed with sodium chloride and acid before heating, and then the resulting liquid was filtered. Solids were disposed of in lined pits, while the liquid passed through iron to precipitate out the metal and recover lead (by sedimentation), copper (by sulphuric acid extraction) and silver (by electrolysis). Silver is converted into ingots via an on-site foundry. The process recovered 140g of silver from each tonne of waste, producing ingots of 99.5% purity for export to Canada. Solid waste from the reprocessing operation was deposited into lined pits, and so the operation was effectively both metal recovery and remediation of contaminated tailings at this site. This operation had been underway since 2003, and was forecast to continue until 2015.

Photograph G11 Baremsa SA remediation plant at Itos

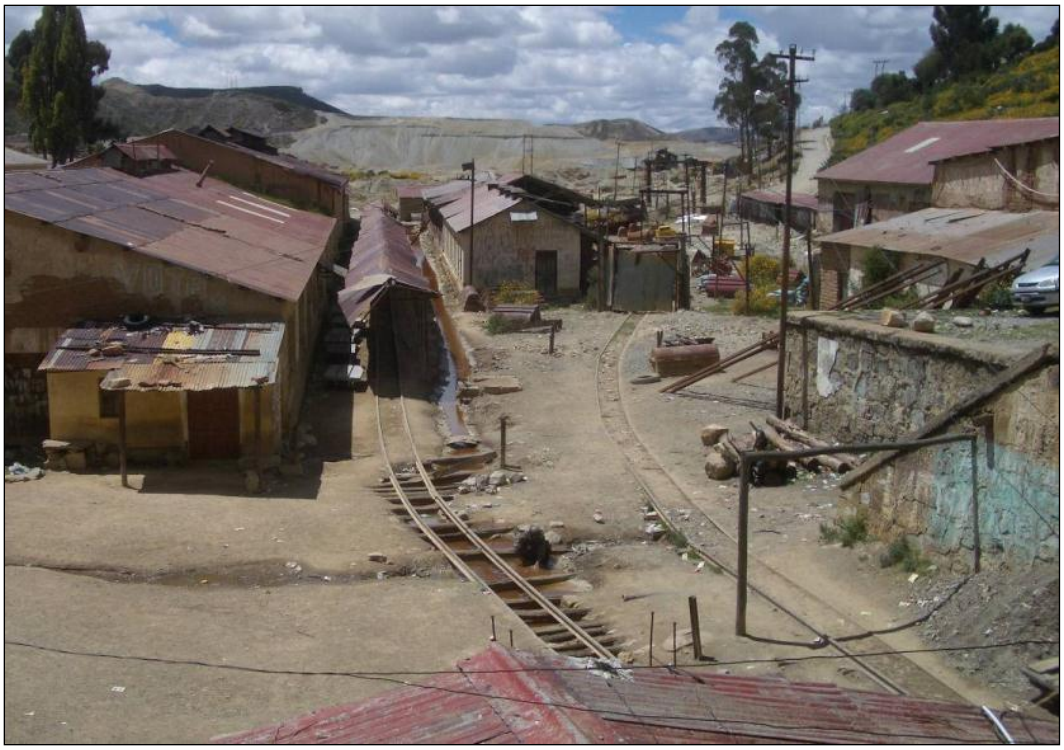
SITE VISIT 6

Site: Mina Siglo XX (lower entrance), Llallagua, Potosi

Date: 24th March 2011

A visit to the entrance to Mina Siglo XX revealed that several mine worker co-operatives were active, but at a level of activity significantly less than during the years that COMIBOL operated the mine. The entrance had rail access, although this was in an advanced state of disrepair. The rail sleepers were rotted and unstable due to erosion by mine leachate, and no train systems were evident at the site. This entrance was used only by miners from Cooperativa Siglo XX Ltda., who entered and exited the mine on foot, carrying out mineral on their backs in sacks. Approximately 20 miners were seen either entering or leaving the mine over a 2 hour period.

Most of the miners had safety helmets and helmet mounted electric lights. Few had gumboots and none wore gloves. The younger miners tended to wear street clothes (i.e. tracksuit and training shoes), while older miners (presumably ex-COMIBOL) tended to be more appropriately dressed for mine work, with gumboots and heavy duty trousers. Each miner carried a small sack on their back to carry mineral that they recovered. Short discussions with these miners confirmed that there were some female miners working inside the Siglo XX mine. No women were seen entering or leaving via the entrance during a 2 hour period.



Photograph G12 **Miner washing his boots in acid leachate, Mina Siglo XX, Llallagua (Potosi)**

Photograph G13 **Abandoned *Palliri* and *Relavera* workings, Mina Siglo XX, Llallagua (Potosi)**

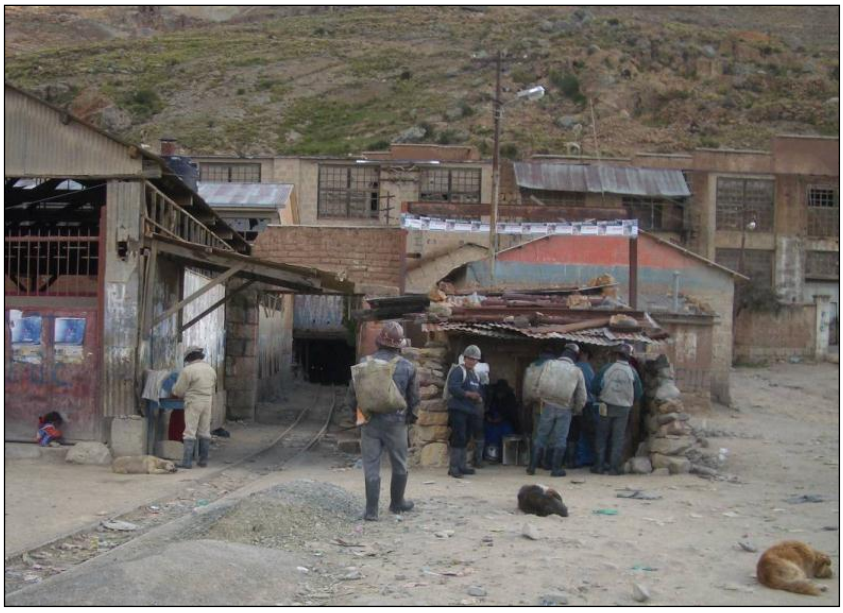
SITE VISIT 7

Site: Mina Siglo XX (upper entrance), Llallagua, Potosi

Date: 24th March 2011

There was more activity around the mine entrance than at the lower entrance, with approximately 30 miners were seen entering or leaving the shaft over a one hour period. This entrance also had rail access, although again it was not functioning. There was no sign of mine locomotives, and the rails were badly damaged by erosion and rot. Miners entered and left the shaft on foot. The upper access was used by nine mine worker co-operatives (Cooperativa Siglo XX Ltda., Cooperativa 20 de Octubre Ltda., Cooperativa Juan de Valle Ltda., Cooperativa Wisiri Ltda., Cooperativa 23 de Martes Ltda., Cooperativa Dolores Ltda., Cooperativa Cancanire Ltda., Cooperativa La Carmen Ltda., and Cooperativa 20 de Octubre Ltda).

Miners wore similar clothing to those seen using the lower entrance. Two female miners were seen leaving the mine, and they went to change immediately. When they had changed, they wore traditional 'Cholita' clothes, which made them indistinguishable from *Campesinas* selling food in the local plaza. Once changed, the two female miners ate a meal bought from food vendors gathered around the mine entrance.



Photograph G14 Mine workers at Mina Siglo XX (upper entrance), Llallagua (Potosi)

Photograph G15 Female underground mine workers from Mina Siglo XX (Llallagua)

SITE VISIT 8

Site: Mina Siglo XX waste rock piles, Llallagua, Potosi

Date: 24th March 2011

On observing the waste rock piles below the entrance to Mina Siglo XX, only one *Palliri* was seen to be working (according to Maria Morales, there would normally be several *Palliris* active in this area). On speaking with the *Palliri*, she indicated that she had worked underground, but considered it too dangerous, and preferred to work on the rock piles. However, she also acknowledged the danger of working as a *Palliri*, and noted that a friend had been dug out from under a rock fall the previous day. She stated that there were no workstations on the rock piles available for new *Palliris*, despite the large expanse of waste rock being empty apart from herself. This suggests that many socios are not actively using their membership of the co-operative.

Photograph G16 **Waste rock pile below Mina Siglo XX, Llallagua, Potosi**

Photograph G17 ***Palliri*** **working alone on the waste rock pile at Mina Siglo XX, Llallagua, Potosi**

SITE VISIT 9

Site: *Ingenio*, Uncia, Potosi

Date: 24th March 2011

Although the mine itself was not functioning, mine workers of Cooperativa 20 de Octubre Ltda. were actively concentrating mineral in the *ingenio*. Mineral was transported from the Siglo XX mine 20km away, and also from the waste rock piles below the Siglo XX mine at Llallagua. The co-operative used the old COMIBOL building, but had replaced some of the plant as it no longer functioned (although the old separation tables are still operational). Zinc recovered by this process was sent to Uncia foundry.

The waste from this process is used by local artisanal miners from the same co-operative, who concentrate it in nearby buddles. Three *Relaveras* were seen working in the river at the time of visit, in addition to approximately 20 artisanal miners working the buddles. Manual crushing equipment was also present at the site, indicating that other concentration work was also done here. Two *Relaveras* were seen in the local river, and were concentrating fine mineral (presumably from this crushing process) using small sieve boxes held over oil drums filled with river water.

Photograph G18 Ex-COMIBOL *Ingenio* at Uncia (Cooperativa 20 Octubre Ltda), Potosi

Photograph G19 Shaking tables in the *Ingenio* Uncia, Potosi

Photograph G20 Crushing apparatus (*Trituradora*) at *Ingenio* Uncia, Potosi

Photograph G21 ***Lamera*** **beside the river at** ***Ingenio*** **Uncia, Potosi**

SITE VISIT 10

Site: Mina Kori Chaca (or Playa Iroco), Oruro

Date: 29th March 2011

The private company Empresa Minera Inti Raymi SA was using an open cast operation to extract gold at this site. The company also had a similar operation at Kori Kollo, which was referred to as *La Joya* (the jewel). However, access to site operations was declined by the shift supervisor. There was no evidence of cooperativas working on the fringes of this mine site, or downstream of the wastewater lagoons. This is consistent with anecdotal evidence heard in Oruro that cooperativas had been removed from their downstream workstations by Empresa Minera Inti Raymi SA.

SITE VISIT 11

Site: Downstream of Mina Huanuni

Date: 31st March 2011

This visit involved a walk along the banks of the river below Mina Huanuni, to observe any mine-related activity for a distance of approximately 2km downstream. Many *cuadrillas* (work teams of up to 7 people) were seen using buddles to separate mineral residues from *ingenio* waste. These workers confirmed that some *Lameras* who used to work in the river are now working in this area, where they do not have to work in the river itself, and can earn a wage of over5,000 Bolivianos (US$729) per month.

Photograph G22 ***Ingenio*** **at Mina Huanuni (and discharge to river)**

Photograph G23 Looking downstream from Mina Huanuni *Ingenio*

Photograph G24 *Relaveras* working immediately downstream from Huanuni

Photograph G25 Extensive *Relavera* workings appear as small lagoons beside the river

Photograph G26 Mina Huanuni (Aerial Photograph)

Source: Google Maps

SITE VISIT 12

Site: Machacamarca *Ingenio*

Date: 31st March 2011

This concentration plant is owned and operated by COMIBOL, and concentrates mineral mined at Mina Huanuni. The visit was accompanied by the Inspector de Seguridad Industrial revealed that although many *Palliris* had apparently worked at this plant in the past; only three ex-*Palliris* were now employed at the site, working in cleaning, inspection and maintenance roles. A woman was seen to be monitoring the separating tables, and according to the supervisor was an ex-*Palliri*. Two other women did administrative work, but were not ex-*Palliris*. Most of the male workers at the *ingenio* came from Mina Huanuni after they were made redundant in 1985.COMIBOL subsequently closed the *ingenio* at Machacamarca but re-opened it in response to rising export demand for tin and growing production at Mina Huanuni. The adjacent *Ingenio* Unificada (also owned by COMIBOL) remained closed.

Photograph G27 Female worker maintains shaking tables (*Ingenio* Machacamarca)

The plant process involved crushing, grinding, flotation, separation (via separating tables), drying and packaging. Tailings waste generated from the process contains approximately 0.5% tin, and is discharged

into a recently constructed, lined lagoon to prevent contamination. However, there was no attempt to contain historical discharges of tailings waste.Three mine worker co-operatives work outside the *ingenio* boundary fence to recover tin from old tailings, using buddles to separate tin from the waste. Many of the workers from the co-operatives previously worked at the adjacent *Ingenio* Unificada, which had been closed in 1985. The cooperativas had asked for *Ingenio* Unificada to be returned to them, so they could recover tin from the tailings piles. However, this request had been declined by COMIBOL.

SITE VISIT 13

Site: Machacamarca Tailings Piles

Date: 31st March 2011

Between *Ingenio* Machacamarca and a nearby stream was a large area dominated by historic tailings piles from which three mine worker co-operatives were recovering minerals using buddles, and discharging their wastewater into the stream.

Photograph G28 Mining Co-operatives recovering mineral from tailings waste at Machacamarca

Photograph G29 **Mining Co-operatives recovering mineral from tailings waste at Machacamarca**

SITE VISIT 14

Site: Empresa Sinchi Wayra Ltda., Poopó

Date: 31st March 2011

This modern mining operation is run by Empresa Sinchi Wayra Ltda. An interview with the *Superintendente* of Empresa Sinchi Wayra Ltda revealed that the company worked in collaboration with mining operations by COMIBOL and Cooperativa Minera Poopó Ltda., with Empresa Sinchi Wayra working the deeper levels which were more problematic due to flooding. The company had modern ventilation and pumping plant at the site.

The Superintendent also explained that the hill which represented Mina Poopó had many mine openings, and thatCooperativa San Francisco Ltda. and Cooperativa El Carmen Ltda. also had access to parts of the mine. A small private company (Empresa Minera Ferrari Ltda.) also worked at the site as a subcontractor to Empresa Sinchi Wayra Ltda.

He also stated that five women work at Mina Poopó, but did not enter the mine and no longer work on the rock piles as *Palliris*. Instead, they had support roles such as *Sirena* (guarding the mine entrance) and maintaining the compressor. Mineral was removed from the mine in metal cars pushed by miners, and tipped over onto a slip, from which trucks collected the mineral and took it to either an *ingenio* or *Commercializadora*, depending on its grade.

SITE VISIT 15

Site: Mina Poopó

Date: 31st March 2011

A visit to Mina Poopó revealed three separate mine openings were being operated by different teams from Cooperativa Minera Poopó Ltda. There was significant mining activity around the upper opening, with cars full of rock being pushed out of the mine opening by pairs of miners every 10 minutes. The contents were emptied onto a chute for collection by a truck for transit to an *ingenio* or *commercializadora* elsewhere. Activity at the other two openings was very subdued, with no movement of miners or mineral evident at the time of visit.

Informal discussion with the co-operative miners working at the top entrance (who did not want to be identified) revealed that there were five *Palliris* working for the co-operative, but they did not enter the mine and did not work on the waste rock piles. Instead, they worked in support roles such as *Sirena* (guarding the mine entrance) and maintaining the compressor. The only other role for women at the mine was to bring food for their husbands. Interestingly, the men drive up the hill to the mine opening using cars or motorbikes, while their wives walk (approximately 2km) up the hill with their food.

SITE VISIT 16

Site: Tiwanaku *Ingenio*, Poopó

Date: 31st March 2011

An interview with the *Superintendent* revealed that this facility was a private company (or *ingenio de servicio*), used by other mining companies and *Commercializadoras* to concentrate mineral on a contract basis.

Photograph G30 **Co-operative mine workers at Mina Poopó**

Photograph G31 **Secondary mine entrance tunnel at Mina Poopó**

SITE VISIT 17

Site: *Commercializadora* SRV, Oruro

Date: 1st April 2011

This site is situated beside the road between the city of Oruro and the Vinto Foundry, 8 km to the South East of the city centre of Oruro. The site purchases mineral from mines and mine worker co-operatives, and may blend or process their purchases before on-selling.

Mineral is delivered in sacks on trucks operated either by commercial hauliers or mining co-operatives that have their own trucks. Sacks with similar mineral content are weighed in batches, following which the contents are emptied into piles on the floor and classified according to mineral content. A ticket is placed on each pile indicating its mineral content, and the *Commercializadora* then pays a price according to weight and grade, after which the *Commercializadora* re-packages the mineral in its own sacks, and stores them pending sale to the foundry or elsewhere. The entire transaction was completed in approximately 30 minutes (from the truck arriving at the site, to leaving the premises empty). The *Commercializadora* also had mesh screens and crushing plant available at the site, which can be used to further process (e.g. crushing, blending) purchased mineral prior to repackaging. There were ten men working at this site, and no women.

SITE VISIT 18

Site: *Commercializadora* Kori Sonco, Oruro

Date: 1st April 2011

This site is situated close to the SRV site (see above), 8 km to the South East of the city centre of Oruro. This site had a similar operation to that at Commercializadora SRV, but this site dealt with copper ore only. The piles of mineral were much larger, and there was greater use of screening (to separate out larger fragments). There were three labourers working at this site, and three women working in administrative roles. The women had desk jobs, and no prior experience of working in the mining sector.

Photograph G32 Mineral piles being graded (Commercializadora SRV, Oruro)

Photograph G33 Commercializadora Kori Sonko (Oruro)