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DOWNSTREAM FINING IN THE WAIPAOA RIVER; AN AGGRADING, GRAVEL - BED RIVER, EAST COAST, NEW ZEALAND.

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Abstract

The Waipaoa River, East Cape, New Zealand, drains a catchment from the Raukumara Ranges into Poverty Bay, near Gisborne. Conversion of the catchment from indigenous forest to pasture, between 1880-1920, initiated a phase of intense erosion in the hill country. The underlying geology consists of crushed and sheared sandstone, siltstone, argillite, and mudstone of Cretaceous and Tertiary age. Channel aggradation occurred in response to the influx of bed material load. Suspended sediment yields in headwater catchments are as high as 7 000 - 17 000 t km⁻² yr⁻¹. For the period 1948 to 1988, aggradation in the upper reaches was > 5 m, while in the lower reaches it was ~0.5 m. The Waipaoa River is a gravel-bed river. Its morphology changes from a braided to a meandering configuration in the downstream direction.

A bed material survey of the Waipaoa River in 1995/6 investigated the fluvial transfer of coarse bed material through the river system. Bed material samples were collected at 1 km intervals along the mainstem, as well as from major tributaries, near their confluence with the Waipaoa River. Surface and subsurface samples were systematically collected between the coast and 104 km upstream. The results of this survey were compared with earlier bed material surveys undertaken in 1950, 1956, and 1960.

Results of the 1996 bed material survey indicate that the bed material in the Waipaoa River is polymodal. The gravel-sand transition occurs approximately 8 km upriver from the coast. Over the remaining 96 km reach, the median particle size (D_{50}) declined from 5 mm in the headwaters, to 2 mm near the coast. The coarser particle size fractions exhibited a greater rate of downstream fining, and, over the same distance, the coarsest 10% (D₉₀) declined from 48 mm to 6 mm. The bed material is dominated by fine sediment, which is illustrated by the fine median particle size over the length of the river, as well as the low fining coefficients for the finer particle size fractions ($< D_{50}$). No downstream change in the proportion of each main pebble lithology was observed, and each pebble lithology exhibited a similar rate of downstream fining. No downstream alteration in particle shape was observed, although particle roundness did increase downstream. Close relationships were observed between the bed slope and particle size. The highest degree of correlation was observed between slope and the coarsest particle size fractions, representing the limiting condition of channel competence. Selective transport is the dominant process that produces downstream fining in the Waipaoa River, however, particle fragmentation, sediment supply or abrasion may be important processes within specific reaches. The rate of downstream fining was consistent for the period 1948 to 1996.

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iii.

TABLE OF CONTENTS

Title page	
Abstract .	
Acknowled	gements
List of Figu	res
List of Tabl	les
1. INTROI	DUCTION
2. STUDY	AREA
2.1	Geology
2.2	Geomorphology
2.3	Vegetation and erosion history
2.4	Climate and hydrology
3. METHO	DOLOGY AND SAMPLING
3.1	Review of sediment sampling techniques
3.2	Bed material sampling in the Waipaoa River
3.3	Laboratory analysis
3.4	Previous bed material surveys
3.5	Statistical analysis 49
3.6	Associated data 51
5.0	
4. THE BA	ASIC DATA 52
5. DISCUS	SSION
51	Bed material lithology 60
5.2	Structure and composition of bed material
53	Particle size trends
5.4	Temporal variation in particle size
5.5	Particle size and morphological variables
5.5	ratione size and morphological variables

5.6	Pebble shape	5
5.7	The influence of catchment geology	2
5.8	Summary of Results	5
6. CONCI	LUSION	ł
7. BIBLIC	OGRAPHY)
APPENDI Grid re	X ferences of sampling sites)

LIST OF FIGURES

Figure 2.1	Location of the Waipaoa River, East Cape, New Zealand 19
Figure 2.2	The upper braided reach of the Waipaoa River at high flow, overlooking the confluence with the Te Weraroa Stream, to the left. The Waipaoa River flows from the right
Figure 2.3	The middle reaches of the Waipaoa River at low flow, approximately 63 km upriver from the sea. The channel exhibits a tendency to braid at low flow, but at high flow is essentially single thread. The flow direction is from the top to the bottom of the photo
Figure 2.4	An aerial photo of the middle reaches of the Waipaoa River at Te Karaka (~50 km). The flow direction is from the top to the bottom of the photo. The river changes from a transitional to a meandering configuration near the bottom left corner.
Figure 2.5	The lower meandering reach of the Waipaoa River, at low flow. This photo illustrates the single thread configuration of the channel through the lower reaches
Figure 2.6	The sand-bed portion in the lower reaches in the Waipaoa River, at low flow and low tide. The photo was taken 2 km upriver from the coast 22
Figure 2.7	An aerial photo of the lower reaches of the Waipaoa River, illustrating the single-thread, meandering configuration of the channel. The gravel-sand transition occurs near the bottom of the photo, and the 9 km sampling site is located just upstream of the road bridge (NZAM, March 1988). 23
Figure 2.8	Generalised lithology map of the Waipaoa River catchment (modified from Mazengarb <i>et al.</i> , 1991)
Figure 2.9	Major faults in the upper Waipaoa River catchment that divide the area into fault bound blocks (from Black, 1980)
Figure 2.10	An aerial photo illustrating the change in width and channel planform pattern of the Waipaoa River at the boundary between Cretaceous and Miocene sediments at the upstream end of the gorge
Figure 2.11	A generalised geological cross section through the gorge, parallel with the general flow direction of the Waipaoa River (modified from Mazengarb <i>et al.</i> , 1991)
Figure 2.12	Sediment storage change for each major reach of the Waipaoa River, and for the Te Weraroa Stream (Data source: Hosking, 1985).

iv.

Figure 2.13	Stage-discharge relationship for the Waipaoa River at Kanakania (48 km)
Figure 3.1	Positioning of the sampling grid on the bed surface of the Waipaoa River, at 28 km
Figure 4.1	Comparison of sub-surface bed material samples obtained in 1988 and 1996, from the Waipaoa River at the upper end of the Flood Control Scheme, (a) at the 25M cross section, and (b) at the 28 M cross section, near Kaitaratahi. (Source of 1988 samples; GDC).
Figure 4.2	Comparison of bed material samples obtained from the lower reaches of the Waipaoa River in 1993 and 1996, at the sampling sites corresponding to the 9 km (a), and the 7 km (b) sites in the present study, at Matawhero. (Source of 1993 samples; GDC)
Figure 4.3	Comparison of bed material samples obtained from the middle reaches of the Waipaoa River in 1994 and 1996, at the sampling sites corresponding to the 74 km site in the present study, near Whatatutu (Source of 1994 samples; GDC).
Figure 5.1	The downstream variation in the percentage of the main lithologies comprising the Waipaoa River bed material, in the a) 16-22 mm, b) 22-31 mm, c) 31-45 mm, and d) >16 mm particle size fractions 71
Figure 5.2	The percentage of 'soft' lithologies encountered in the a) 16-22 mm, b) 22-31 mm, c) 31-45 mm, and d) >16 mm particle size fractions. $$ 72
Figure 5.3	The mean intermediate axes from each fifth bulk sample, from all pebbles >16 mm
Figure 5.4	The maximum intermediate axes from each fifth bulk sample, from the >16 mm particle size fraction
Figure 5.5	Longitudinal variation in the percentage of fines, sand and gravel in the Waipaoa River bed material. Fines include all particles <250 microns in diameter
Figure 5.6	Longitudinal variation in the subsurface D_{50} , and D_{90}
Figure 5.7	Longitudinal variation in all calculated percentiles, a) employing a linear particle size scale, and b) employing logarithmic particle size scale. 78
Figure 5.8	Small alluvial fan that had formed in the Waipaoa River channel as a result of a mass movement in a hillslope underlain by the Mangatu formation, at 103 km

v.

Figure 5.9	Particle size distribution curves from the bulk samples from the tributary streams in the upper reaches
Figure 5.10	Large alluvial fan at the mouth of Gully 117, at 98 km. Note that the Waipaoa River has trimmed the fan perimeter, indicating that the fan is no longer active.
Figure 5.11	A typical mass movent in the gorge reach, that was transferred directly from the adjacent bluff to the Waipaoa River
Figure 5.12	The particle size distribution curves from the Waipaoa River above and below the confluence of the Te Weraroa stream, and compared to the particle size distribution curve from Te Weraroa Stream 83
Figure 5.13	Particle size distribution curves from the tributaries in the middle and lower reaches of the Waipaoa River. All tributaries in these reaches exhibited distinct bimodality
Figure 5.14	A desiccated siltstone particle on the surface at 77 km, adjacent to a coarse sediment input
Figure 5.15	Longitudinal variation in all measured particle size percentiles from grid-by- number sampling.
Figure 5.16	Longitudinal variation in the surface D_{50} , and D_{90} 87
Figure 5.17	A typical armoured surface at 76 km, in the middle reaches of the Waipaoa River (Dec 1996)
Figure 5.18	Relationship between surface D_{50} and truncated subsurface D_{50} . The points falling near the truncation line are assumed to be the product of winnowing
Figure 5.19	Comparison of the median particle size (D_{50}) from the surface and subsurface sediment populations in the Waipaoa River. The surface median particle size exhibited a much greater rate of decrease downstream, as compared to the subsurface median particle size
Figure 5.20	Typical particle size distributions from the Waipaoa River, illustrating the polymodal nature of the sediment, and the commonly exhibited particle size subpopulations.
Figure 5.21	The variation in particle size distribution curve along the Waipaoa River, shown in relation to the longitudinal profile of the river 91
Figure 5.22	Longitudinal variation in the (inclusive graphic) standard deviation of the subsurface bed material samples.

Figure 5.23	Longitudinal variation in the skewness of subsurface bed material samples
Figure 5.24	Tessellated particles from the fragmentation of large siltstone particles on the surface of Te Weraroa Stream (Dec 1996)
Figure 5.25	Siltstone particle on the surface of Te Weraroa Stream in the initial stages of fragmentation by desiccation (Dec 1996)
Figure 5.26	The downstream variation in each particle size subpopulation in subsurface bed material samples
Figure 5.27	The change in proportion of each subpopulation present in the subsurface bed material samples
Figure 5.28	Variation of a) slope and b) particle size at the gravel-sand transition, highlighting the abrupt change from a gravel-bed to a sand-bed channel99
Figure 5.29	Subsurface particle size distributions from a) >5 km upstream of the gravel- sand transition, b) 0-5 km upstream of the gravel-sand transition, and c) downstream from the gravel-sand transition
Figure 5.30	Particle size distribution curves for the sand-bed reach in 1988 and 1996, at; a) 5 km and b) 11 km, illustrating the temporal variation in particle size
Figure 5.31	Downstream fining in the surface particle size in the Te Weraroa Stream (Data source: Banbury, personal communication 1996)
Figure 5.32	Longitudinal variation in the D_{50} and D_{90} for bed material samples collected in 1950, 1956, and 1960 (Data source: GDC).
Figure 5.33	Particle size distribution curves obtained from the upper reaches of the Waipaoa River, and the Te Weraroa Stream in 1950 and 1996 (Data source, 1950 samples: GDC)
Figure 5.34	The longitudinal profile of the Waipaoa River, illustrating the underlying catchment geology at each sampling site
Figure 5.35	The longitudinal profile of the Waipaoa River, showing the mathematical function that best describes the profile.
Figure 5.36	The longitudinal profile of the Waipaoa River as measured in 1996, and 1948. Although aggradation has occurred, the overall shape of the profile has remained the same (Data source: GDC)
Figure 5.37	Longitudinal variation in a) reach slope, and b) local bed slope 118

vii.

viii.

Figure 5.38	The relationships between D_{50} and a) reach slope and b) local slope 119
Figure 5.39	The relationships between D_{90} and a) reach slope and b) local slope 102
Figure 5.40	Relationship between drainage area and reach slope
Figure 5.41	The relationship between the ratio of D_{50} to drainage area, and reach slope
Figure 5.42	Longitudinal variation in width and depth along the Waipaoa River 125
Figure 5.43	Roundness of particles in the 22-31 and 4-8 mm particle size fractions from the 18 km sampling site, illustrating that smaller particles exhibited a higher degree of rounding than larger particles in the lower reaches of the Waipaoa River. This suggests that selective transport is an important process occurring in the Waipaoa River
Figure 5.44	Longitudinal variation in maximum projection sphericity of the a) 16-22, b) 22-31, c) 31-45, and d) >16 mm particle size fractions
Figure 5.45	Average particle shapes from each fifth sampling site, for a) sandstone, b) siltstone, c) argillite, and d) all lithologies, presented on Folk Form Triangles (Folk, 1947).
Figure 5.46	The downstream increase in particle roundness for sandstone, siltstone, and argillite pebbles in the 22-31 mm particle size fraction. Pebbles are compared from a site in the upper reaches (102 km), and in the lower reaches (18 km) of the Waipaoa River. The downstream increase in roundness is clearly evident
Figure 5.47	Changing particle size distribution curves upstream, through and downstream of the gorge, shown in relation to local bed slope
Figure 5.48	The longitudinal variation in aggradation rate in the period from 1948 to 1960, as well as from 1986 to 1996. Note the dramatic decrease in aggradation rate downstream from 92 km, in the period from 1948 to 1960, when aggradation was occurring at a much faster rate (Data source: GDC)

.

×

LIST OF TABLES

Table 3.1	Verbal limits for correlation coefficients used in this thesis 49
Table 3.2	Pebble shape parameters used in this thesis
Table 4.1	Drainage basin, river, and reach characteristics
Table 4.2	Bulk sieve analysis - Waipaoa River
Table 4.3	Particle size statistics of tributary streams of the Waipaoa River 57
Table 4.4	Particle size statistics for grid-by-number samples - Waipaoa River 58
Table 4.5	Particle size statistics for 1950, 1956, and 1960 bed material surveys . 59
Table 4.6	Pebble shape results for a) 16-22 mm, b) 22-31 mm, c) 31-45 mm particle size fractions, and d) all particles >16 mm
Table 4.7	Percentage of sandstone, siltstone, argillite, and other particles in the >16 mm particle size fraction
Table 4.8	The a) maximum axes and b) mean axes of sand, siltstone, and argillite particles of the >16 mm particle size fraction
Table 4.9	The percentage of each lithology comprising the >16 mm particle size fraction
Table 5.1	Fining coefficients for individual lithologies in the Waipaoa River 74
Table 5.2	Sediment inputs adjacent to the sediment sampling sites
Table 5.3	Fining coefficients for each particle size fraction over the gravel-bed portion of the Waipaoa River
Table 5.4	Fining coefficients for the D50 and D90 percentiles in different reaches of the
	Waipaoa River
Table 5.5	Variation in key variables before and after the gravel-sand transition 107
Table 5.6	Correlation coefficients for different particle size percentiles with slope 117
Table 5.7	Fining coefficients obtained for each of the three main lithologies. The method employing the mean b axis of >16 mm pebbles, and the D_{50} , appear to give the most consistent results

ix.