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QUATERNARY WARPING AT GORGE SADDLE, WESTERN SOUTHLAND

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Abstract

Gorge Saddle is one low point on a drainage divide between Fiordland and the Southland Plain. Eastward sloping Quaternary terraces east of the divide and westward sloping terraces to the west contain granitic pebbles which could have been derived only from the west. This suggests doming at the present divide concurrent with transport from the west.

INTRODUCTION

The present Oreti and Mararoa drainages are divided by the Burwood Plateau and Gorge Saddle. East of Gorge Saddle a set of Quaternary terrace surfaces, of which the Burwood Plateau is the highest, slope to the east; the area is drained by Weydon Burn. West of Gorge Saddle a set of terraces slope north-westward away from the Takitimu Mountains. Gorge Saddle is probably migrating eastward due to the rapid headward erosion of Gorge Creek, a tributary of the Mararoa River. Near Gorge Saddle, both the east-sloping and west-sloping terrace surfaces are underlain predominantly by Tertiary bedrock (Wood, 1966). Farther away in both directions, continuations of the same terraces are covered by Quaternary gravels.

Large granitic boulders have long been known from the Centre Hill area east of Gorge Saddle but have not been fully explained. McCraw (1949) mentioned these boulders and granite pebbles in nearby terraces and suggested that Gorge Saddle was overridden by Fiordland debris in the Pleistocene. Cotton (1948, pp. 252-253) considered the evolution of drainage east of Gorge Saddle.

In June, 1968, the writers, accompanied by John Bruce of the New Zealand Soil Survey, examined the Quaternary terraces east of the divide (fig. 1) near Highway 94 between Gorge Saddle and Mossburn. We tested the idea of sediment transport through the Gorge Saddle from west to east during the Pleistocene, using granitic pebbles as tracers.

DISTRIBUTION OF GRANITIC PEBBLES

The possible sources of granitic pebbles in this area are Fiordland granites, MacKay Intrusives, and Triassic and Tertiary conglomerates. Fiordland granites crop out over large areas west of Gorge Saddle and are thus the most obvious source of granitic pebbles. MacKay Intrusives are drained by the Eglington and Upukerora Rivers which flow into Lake Te Anau, and for purposes of this study can be considered in the same category as the Fiordland granites. Triassic conglomerates in the Wairaki Hills and Mount Hamilton are relatively rare and contain few granite pebbles. Tertiary conglomerates crop out on the flanks of the Takitimu Mountains, and some of these conglomerates contain granitic pebbles as important constituents. In the immediate vicinity of Gorge Saddle, Tertiary conglomerates which contain granitic pebbles are almost exclusively in the drainage basin of the Mararoa River (Read, personal communication, 1968). Thus, all the sources of granitic pebbles are west of Gorge Saddle except for a small amount of Tertiary conglomerate, and Triassic conglomerates containing negligible granitic material.

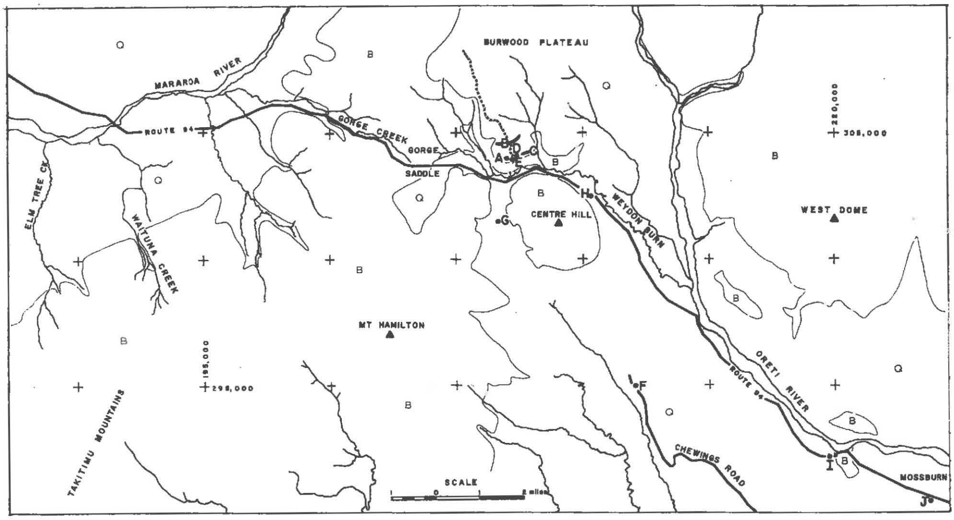

Figure 1 Locality map: A-J, sample stations or traverses.

Table 1 Abundance of granitic pebbles in Quaternary terraces east of Gorge Saddle.

Locality (Figure 1)	Elevation (feet)	Terrace (after Wood, 1966)	Granitic pebbles (abundance*)
A	1550 – 1610	Unmapped intermediate between H1 - H2.	Common - rare
B	1870 – 1960	H1	Rare
C	1560 – 1610	Unmapped intermediate between H1 - H2.	Common - rare
D	1610 – 1680	Unmapped intermediate between H1 - H2.	Rare - common
E	1660	Unmapped intermediate between H1 - H2.	Common
F	1300	H1 (Higher of two H1 terraces in this area)	Absent
G	1590	H2	Common
H	1400	H2	Abundant
I	1100	H1 (Lower of two H1 terraces in this area)	Common
J	950	H2	Rare

* Rare: infrequent, isolated granitic material.
Common: granitic pebbles one to nine per cent of total pebbles.
Abundant (only at H): 9½ per cent of total is granitic pebbles.

Pebbles described by the writers as "granitic" include only light-coloured plutonic rocks containing quartz and/or biotite. Rock names we applied in the field include alaskite, syenite, gneiss, granodiorite, and granite. Diorites could possibly have come from the Takitimu Mountains and so were specificially excluded.

East of Gorge Saddle, granitic pebbles are common in several Quaternary terraces at intermediate elevations, including the lower H1 and higher H2 terraces of Wood (1966). Locality information and relative abundance are shown in Table 1 and figure 1. At two localities the proportions of lithologies were obtained by identifying and counting all the pebbles in a measured grid; elsewhere, the proportions were estimated.

West of Gorge Saddle McCraw (1949) and Fitzharris (1965) reported granite boulders and pebbles in north-westward sloping Quaternary terraces. In the Waituna area, gravels are found in four terraces; the three highest (and oldest) contain appreciable granitic material and slope to the northwest at 2°-3°. The lowest (and youngest) terrace contains no granitic debris and is about level. In nearby Tertiary conglomerates, Fitzharris found granitic pebbles with a maximum diameter of eight inches; he also observed granitic boulders up to two feet in diameter in Quaternary gravels. We infer that at least some of the Quaternary granitic material was not derived from Tertiary conglomerates.

QUATERNARY WARPING

The presence of granitic pebbles on terraces east of Gorge Saddle shows that Fiordland-derived material was transported through that drainage divide. The granite pebbles west of Gorge Saddle were also derived from the west and thus were not deposited on a westward paleoslope, but are now found on terraces sloping to the north-west. The tectonic warping which this implies probably formed the present drainage divide.

The absence of granitic material in the lower terraces suggests that glacial retreat coupled with the rising of the present divide cut off the granitic sources from the present Oreti drainage near the end of the glacial period. The absence of granitic pebbles in the highest terraces implies that overriding of the Burwood Plateau by a high glacier is not the cause of the present granite pebble distribution. A slightly lower glacier breaching Gorge Saddle in only one spot could have produced the distribution observed east of Gorge Saddle, but in this case one would expect that the terraces west of Gorge Saddle at the same elevation would be covered by moraine. Fitzharris (1965: personal communication, 1970) stated that they are outwash.

Another pass through which glacial or glaciofluvial transport was possible is near Big Hill, north of the Burwood Plateau. It is unlikely that much granitic material would have passed Big Hill, as the Mararoa River does not drain granitic terrane. The granite-bearing terraces along Weydon Burn cannot be explained by transport across the present divide except at the Gorge Saddle, but granitic pebbles may have been transported farther down the Oreti drainage through several routes and processes.

In some places the writers observed that north-west sloping Waituna terrace surfaces are cut on Teritary bedrock. The physiographic break between the terraces and the Takitimu Mountains is sharp, and does not fall at the lithologic boundary between soft Tertiary and hard Permian rocks. The terrace surfaces were probably cut by a river with a moderately gentle gradient, and tilted to their present attitude. South of the Waituna area, Fitzharris (1967) discussed other westward sloping surfaces. These, however, were interpreted as fan deposits and may be completely unrelated to those being discussed in this paper.

Additional support for doming is provided by the absence of gravel deposits on terraces near Gorge Saddle and their presence farther away. Locally, deposition may have been prevented by concurrent warping.

The eastward slope of the terraces east of Gorge Saddle could be partially explained by isostatic rebound or by the greater stream gradients during glacial stages due to a lower sea level. However, the north-westward slope of the western terraces is opposite to the sense which would be explained by these factors.

On the other hand, there is indirect evidence of Quaternary tectonism in the vicinity of Gorge Saddle. In the Wairaki Hills, several parallel faults, upthrown to the east, one with a modern scarp, are mapped within ten miles of Gorge Saddle and strike directly toward it (Mutch, 1964).

There is some indication that terrace slope away from the present drainage divide is greatest in the higher terraces. If so, warping occurred concurrently with terrace formation.

Outcrop patterns and attitudes of Tertiary rocks around the Takitimu Mountains (Wood, 1966) suggest that the Quaternary movements were only a continuation of an older process.

Other Implications

Cotton (1948, pp. 252-253) hypothesised that during the Pleistocene the Oreti River drained alternately through its present course and the Waimea Plain. Aerial photographs show old Oreti-Waimea channels cut by modern Oreti channels near Lumsden. Thus it is possible that granitic detritus was transported down the present Mataura, Oreti, and Aparima Rivers during the Pleistocene.

Cullen (1966, 1967) concluded that granitic pebbles found offshore near the mouths of the three rivers were derived from Stewart Island (20-30 miles to the south). It seems probable that some of this material was derived from Fiordland *via* the three mainland rivers during the Pleistocene.

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