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PALEOCLIMATIC INDICATORS FROM MASON BAY, STEWART ISLAND

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Mason Bay is a rather magnificent curving bay some 15 km long, on the western side of Stewart Island. The geology is basically very simple, with a granite basement overlain first by beach sands and then by dunes. In detail there are a number of unusual features.

The granite outcrops as a series of hills around the bay. Its most interesting aspect is that, in the area behind the centre of the bay, most of the outcrops are decorated with striations, ves, or flutes.

These features have been caused by sandblasting, but are developed on a scale that is quite exceptional. In many cases the striations form fan-shaped or conical arrays. The apices of the fans point into the wind. Asymmetric pitting is also developed which also allows the wind direction to be established. In other cases the striations may be parallel. They are often developed on both sides of the outcrop, in which case it is found that the striations on each side are formed by airflows in opposite directions - towards the crest of the outcrop. Features developed on the eastern or lee side of hills or outcrops are generally more coarsely sculpted than those on the western sides.

The derived air flow from these features around Big Sand Hill has been found. It appears to be from the west on the western side and the east on the eastern side. It's also always directed up towards the top of the hill. We believe, from consideration of the dune morphology, that this pattern of air flow resulted from local eddying or turbulence of a predominantly westerly wind pattern.

Lichen growth and weathering indicate that little if any active erosion by sandblasting is occurring at the present day.

The granite is overlain by about 20 m of beach sands. They consist of a lower compact unit, capped by a layer of gravel. The upper unit is softer, unweathered and is also capped by a layer of gravel and/or peat, and then overlain by dune sands. The age of these sands is unknown, other than it is more than 10,000 years, but they were probably formed during interglacial high stands of sea level.

The gravel layers capping each sand unit are most unusual. For one thing they are highly variable in size and shape, and are also highly angular - hence they are not water laid deposits. Nevertheless they have been deposited as a thin sheet of gravel over an area of several square kilometres.

The other unusual thing about them is that they contain ventifacts - pebbles that have been shaped or faceted by wind erosion. The gravels do not contain striated boulders however. In the area behind the centre of the bay, where the hills are relatively low, the marine sands are eroded and the lower gravel layer exposed as a stony pavement which forms planar surfaces several hundreds of metres across.

These pavements can be divided into three types, of which I'll only describe the main one. Again the gravels are quite coarse, highly angular, and again include the occasional ventifact. They also however include striated boulders, clearly related to the present wind direction, and apparently striated since the gravel was exposed by removal of the overlying sand.

Higher up the hill there is another gravel layer, but this is a modern talus deposit and does not include either striated rocks or ventifacts, confirming that sandblasting is not an active process at the present day.

Dunes are also prominent features of the region. Except in the centre of the bay most of the dunes are stable - they are longitudinal dunes which extend up to 20 km inland. In some cases the sand forming them has been lifted over a substantial range of hills. It is also interesting that there is no present day sand source for many of them.

The start of dune formation however can be dated by the basal peat layer at 10,000 years ago. At this stage sea level was some 40 m below present, and a sand plain several kilometres wide would have existed around the coast forming a convenient sand source. This sand plain was locally forested, and these rata trees were swamped about 7000 years ago as sea level neared its present position.

It is worth noting that between 10,000 and 6000 years ago sea level rose at about 1 cm per year - a higher rate than is predicted in most greenhouse scenarios.

To sum up, dune formation at Mason Bay began about 10,000 years ago. Field relationships suggest this event was accompanied by erosion of the beach sands in the centre of the bay, exposure of the lower gravel as a stony pavement, and sandblasting of granite outcrops on a spectacular scale. The ventifact-bearing gravels indicate at least one earlier period of accentuated wind erosion also occurred and some features may have been initiated during this earlier phase, and accentuated 10,000 years ago. Nevertheless it appears that much windier conditions existed 10,000 years ago than those pertaining at the present time.