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# PRELIMINARY MODEL FOR CLIMATIC AND ECOLOGICAL CONTROLS OF SETTLEMENT IN AND NEAR TE TOTO AMPHITHEATRE, WHAANGA DISTRICT, WEST COAST, NORTH ISLAND

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## INTRODUCTION

The area on and near the Tasman Sea coast southwest of Raglan on the North Island is now sparsely settled. After one leaves Whale Bay via Whaanga Road travelling west, it is common to spend an entire day, even in the summer, doing fieldwork and see no more than two or three other humans, typically in vehicles on the road (see Figure 1). In particular, no one lives in Te Toto amphitheatre, the large erosional embayment across which Te Toto Stream flows after debouching from its narrow gorge. Yet, the amphitheatre gives clear evidence of extensive human occupation in pre-historic times (Goles 1992; observations reported below). Doubtless, to a considerable extent this contrast reflects concentration of population in towns and villages, such as Raglan itself, because of evolution of efficient transportation systems and other features of modern New Zealandic lifestyles. Here I suggest that it also reflects control of favoured sites of settlement by climate and ecological factors. A model based on that hypothesis can provide testable inferences about the age of Maori occupation of Te Toto amphitheatre, and also a guide to exploration for possible other sites in the vicinity which preserve evidence of ancient lifestyles.

## SUMMARY OF OBSERVED ARCHAEOLOGICAL REMAINS

In my 1992 paper in this journal, I described briefly two stonework features in Te Toto amphitheatre (Figure 1). They are i) stone walling to convert a steep-sided hill in the amphitheatre into a defensible, though small, pa, and ii) an oval stone-walled enclosure, presumably the footings for a small hut, with an opening on the leeward side. Other stonework features, apparently less carefully constructed initially or less well preserved, are very common in places on the floor of the amphitheatre. They may well also be related to now-vanished structures. An area of the central and north-central floor of the amphitheatre, about 400 by 200 metres in map view, exhibits numerous human-made or humanly modified terraces and platforms, commonly delineated by rows of piled stones. I concur with an interpretation by Nigel Prickett (pers. comm. 1992) that these are horticultural enclosures and cleared ground.

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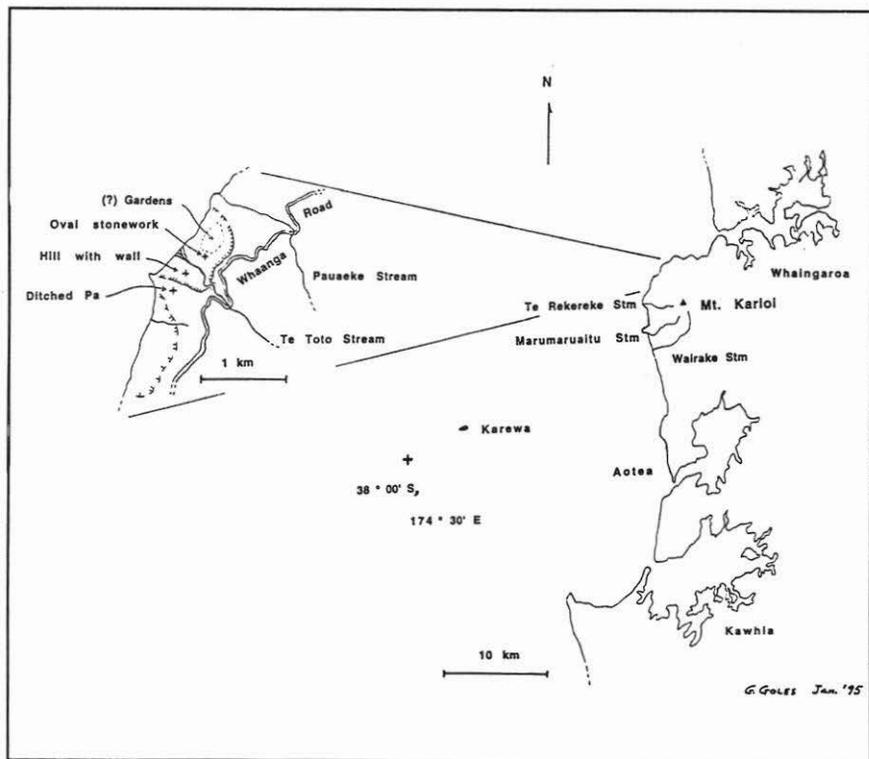


Figure 1. Location map of Te Toto amphitheatre, Whaanga District.

These features are not found within a few tens of metres of the muted seacliff that bounds the main part of the floor of the Te Toto amphitheatre to the northwest. Possible dwelling, cooking, or food storage sites are concentrated in groves of trees, in hollows left by accidents of mass wastage from the bounding cliffs of the amphitheatre, or near sheltering slopes of hills rising from its floor, especially those in the center of the amphitheatre. Probable horticultural plots are not present in the relatively exposed ground near the seacliff that marks the transition from the floor of the amphitheatre to the boulder-strewn beach below the cliff. Thus, the first point to be noted is that prehistoric human occupation was sited, as it would be now if there were any, to take advantage of any possible shelter from storms off the Tasman Sea.

Another prominent feature, not mentioned in my 1992 paper, is the remains of a ditched pa, constructed by modifying a small hill on the sloping upland surface to the south of the "South Wall" of Te Toto amphitheatre. This pa may

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readily be seen by walking a few paces into the pasture west of the car park near the head of the main trail down into the lower part of Te Toto gorge and into the amphitheatre. It is the most prominent feature on that sloping surface. I have visited it, but have not searched for surface artifacts (it is mostly heavily grassed) nor attempted any exploratory trenching.

Location of this pa invites comment. Unlike the steep-sided hill within the amphitheatre itself, it is not readily accessible from the area inferred to have held the greatest concentration of dwellings and of resources, such as food storage pits, requiring defence against aggression. A very steep trail up about the middle of the South Wall is one access, the other access to the ditched pa from the floor of Te Toto amphitheatre is by the main trail mentioned above. Both would take perhaps twenty minutes to half an hour to traverse, even under conditions of urgency. Thus, it may be that the ditched pa was used only when occupants of Te Toto amphitheatre had advance warning of the approach of aggressors. The ditched pa is readily accessible by several trails from the small, unnamed, erosional embayment centred at about map reference R14/657 715, southwest of Te Toto amphitheatre. Thus, it would have been feasible to set rear-guards on either or both of the trails up from the amphitheatre, to delay raiding parties, but aggressors familiar with the terrain would be able to circumvent such rear-guards by approaching the ditched pa from the south or southwest.

Very recently, I have seen an additional feature that I believe to be artificial, and which puzzles me. It is a few stones piled (skilfully) into a small wall, about 50 cm high and the same in length, seen at the southern margin of Te Toto Stream in its lower gorge, about 40 metres upstream from where the stream debouches onto the upper floor of the amphitheatre. It looks like the remnants of a stonework coffer dam across the stream, the rest having been washed away. Alternatively, it could have been part of an eel trap (similar to the stone patuna or whakapapa mentioned by one of J. H. Beattie's informants; Beattie 1994; 148-149). If the first interpretation, which I tentatively prefer, is correct, then the dam may have been intended to concentrate water for domestic use or washing.

### **WHEN AND WHY WAS TE TOTO AMPHITHEATRE OCCUPIED?**

Potential resources or advantages of the Te Toto area include garden plots, shelter from wind and some storms, the stream itself to supply fresh water, shellfish beds along the coast, hunting and gathering on the slopes of Mt. Karioi, gathering of chicks and eggs on Karewa, an island only a short distance offshore, and under most weather conditions a good view from the uplands bounding the amphitheatre of approach routes by sea. Under climate conditions such as those referred to by Grant as "warm erosion periods" (Grant 1994; see

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especially Fig. 8.2 on p. 169) many of these advantages are negated, and access to some kinds of resources is limited. During periods when frequent, intense storms sweep in off the Tasman Sea, biproductivity of most domesticated plants relied upon by pre-contact Maori might be adversely affected in Te Toto, though this is a debatable speculation. Such shelter as afforded by selected locations within the amphitheatre (and, as pointed out above, apparently systematically used by former occupants) would have been ineffective, and I predict that trees and huts (if present) would have been commonly blown down under such climatic conditions. Very heavy swells might transport sediment and smother filter-feeding shellfish, or tear them from their moorings, and certainly would limit access by humans to surviving shellbeds. Parts of the floor of the amphitheatre evidently flood during storms, but it is easy to avoid these areas, and I doubt that flooding by Te Toto Stream would have been a contraindication to settlement during such periods.

Grant (1994; 166-170) points out that during warm, wet, stormy periods large-scale blow-down of forests occurs, especially in exposed or elevated areas of New Zealand. It seems likely that during such a period destruction of forests on Mt. Karioi by storm winds would have been severe, leading both to loss of habitat for lifeforms used as resources by pre-contact Maori and to formation of a tangle that, unless burned off, would restrict ease of passage into and through collecting areas. Finally, Karewa is named after its shape (its Pakeha name is Gannet Island, indicating its potential for gathering seabird chicks and eggs) -- it lies low and flat, like a huge bobber or fishing float on the Tasman Sea. M. D. Rosenberg has visited Karewa, and informed me that it is difficult of access in even a small sea (Rosenberg, pers. comm. 1992). Thus, in periods of frequent storms, in addition to the difficulties of launching waka from the beach at Te Toto or nearby beaches, Karewa likely would at many times be inaccessible to gathering parties without great risk.

Consider now likely conditions during cool, dry times with infrequent storms. Horticulture in Te Toto amphitheatre would probably be favoured in such climates, especially if plots were artificially irrigated with water carried from the stream. In contrast to inland sites or those at higher elevations, frost damage would have been very unlikely in the amphitheatre. Shelter, though always a consideration in a location so exposed to the Tasman, would be less critical. Presumably choices of locations of dwellings, etc., as outlined above would have allowed human communities to live in Te Toto amphitheatre in reasonable comfort at such times. Access to shellfish beds would have been more reliable, and perhaps filter-feeding shellfish would have been more abundant under such climatic conditions than under stormy ones. Access to Karewa would have been more reliable, as probably would have been access to resources on the slopes of Mt. Karioi.

Of greatest significance, most likely, is reliability of fresh water supplies.

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When I visited the area in January 1995, while most of the North Island was experiencing a summer drought and, according to newspaper reports, flow of the spring supplying water to Raglan had decreased to about half normal, I noted that both Te Toto and Pauaeke Streams were at good flow, closely comparable to flows observed while I was working in the area in late 1991 and early 1992. Those streams draw upon aquifers within the upper western part of the Karioi edifice, according to a model of the volcanic history of Karioi devised by R. M. Briggs of Waikato University and myself. It is the western part of the Karioi edifice that tends to intercept rain from weak storms off the Tasman, so in periods of minimal precipitation those aquifers are recharged better than are the ones feeding streams and springs on the north, southeast, and especially the east side of the mountain. It seems likely that at the beginnings of dry climatic periods, populations in the region dependent on simple technologies for obtaining water must migrate to areas near the lower courses of perennial streams. When climates change, their descendants may become more widely dispersed. In particular, if during dry periods populations become established (to maintain access to reliable water supplies) in locations exposed to storms off the Tasman Sea, then as climates change those communities have strong motivations to move to more sheltered locations.

### WHAT MAY WE INFER FROM THIS MODEL?

In this model of control of settlement by climate change and ecological factors, the little that is known about pre-contact settlement of Te Toto suggests that the archaeological features there have ages within the Maunder Minimum, 1645 to 1715 AD according to Grant (1994). Occupation of Te Toto amphitheatre during the preceding cool period, the Sporer Minimum (1400-1510 AD according to Grant 1994) is not excluded, but the presence of two defensible pas and the good condition of some of the stonework structures suggest to me that most or all of the archaeological remains date to the later cool period.

The tentative model outlined above, in conjunction with present insights into volcanic history and hydrology of Karioi, also suggests that occupation of sites near the lower courses of Pauaeke Stream (NNE of Te Toto) and, probably, Te Rekereke, Marumaraitu, and Wairake Streams (S of Te Toto) might have been favoured during the Sporer and Maunder Minima. In contrast, during warm periods occupation of areas near shores of Whaingaroa (Raglan Harbour), Aotea, and Kawhia may well have been favoured.

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