STRATIGRAPHY AND SEDIMENTOLOGY

OF THE

TE KUITI GROUP IN WAITOMO COUNTY,

SOUTH AUCKLAND

BY

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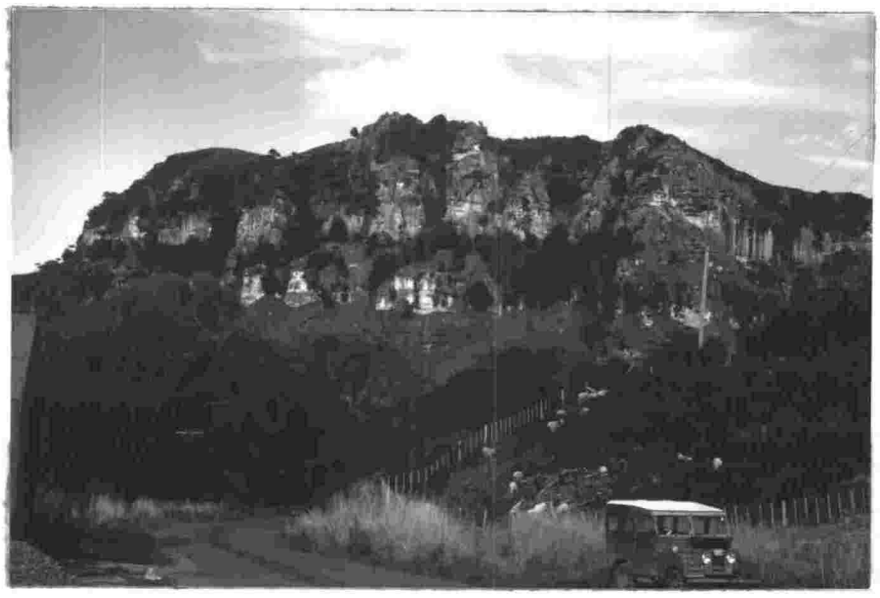
"... when I try to imagine a faultless love

Or the life to come, what I hear is the murmur

Of underground streams, what I see is a limestone landscape".

Wystan Auden

"In Praise of Limestone".



Hautapu Hill, Hauturu (C4)

ABSTRACT

The Oligocene Te Kuiti Group in Waitomo County, North Island, New Zealand, is divided into two subgroups, six formations and seven limestone members; six of the members are new. The stratigraphic definition, distribution, thickness, lithology and contacts of major rock units, and the three dimensional relationships between them, are described and figured in detail. Rapid lateral and vertical lithologic variation in strata is accomodated by recognition of 31 lithofacies.

Te Kuiti sediments, which include mainly bioclastic lutites, bioclastic arenites and biocalcarenites, were deposited in sublittoral waters, from a few to about 100 metres depth, as seas transgressed south over a topographically subdued, but locally varied landscape cut in Mesozoic lutites and arenites. Distribution of major paleotectonic elements indicates the gross sedimentary environment was one of a north-facing, partly enclosed basin with a prominent north-trending median basement ridge (Piopio High) in the south. Deposition continued until this ridge was almost completely buried, at which time the Te Kuiti embayment expanded rapidly and linked with more southerly basins. The contact with the overlying Mahoenui Group is generally conformable in Waitomo County.

Formations and members are commonly bounded by unconformities, mainly disconformities, some of which preserve features consistent with their interpretation as submarine hardgrounds. The unconformities record periods of erosion or non-deposition during major downward shifts in base level controlled partly by eustatic sea level changes.

Comprehensive paleontological charts are prepared for each formation and age relationships established. Macrofossils are generally scarce, and dominated by thick-shelled, epifaunal bivalves. Foraminifera are more abundant and are mainly benthonic forms. Formations may straddle New Zealand stage boundaries and, within Waitomo County, are not strongly diachronous.

Primary sedimentary structures in arenites and calcarenites include mainly thinly bedded wavy-, lenticular-, and cross-stratification formed by the spreading and interfering of sand sheets, sand ribbons and sand waves across extensive areas of flat shallow sea floor, possibly under the influence of tidal currents. Lutites and muddy arenites are massive and bioturbated.

A new classification for mixed terrigenous-allochemical rocks is proposed and an X-ray technique developed for modal analyses of lutites. The petrography of individual lithofacies is described and illustrated in detail and summarised on pie diagrams. Variations in the kind, quantity, size, sorting and abrasion of bioclasts, in

the kind and quantity of matrix and/or cement, and in the content of glauconite and terrigenous sand and mud serve to distinguish the various lithofacies.

Bioclasts are derived principally from bryozoans, echinoids and benthonic foraminifers and, to a lesser extent, from coralline algae, planktonic foraminifers, molluscs and brachiopods. Siliciclasts include mainly quartz,oligoclase - andesine plagioclase, potash feldspar, montmorillonitic clays and glauconite. Quartz and feldspar were detritally inherited from Mesozoic basement rocks; montmorillonite formed from the marine diagenetic transformation of vermiculite and degraded chlorite and illite derived from Oligocene soils; glauconite developed from montmorillonitic clays under specific environmental conditions. Complete chemical analyses of seven glauconite concentrates are presented and compared with published analyses. The principal non-opaque heavy minerals in the group are zircon, epidote and apatite. Sediment pores are infilled with granular and rim orthosparite cement, or by a variety of matrix materials, including micrite, calcilutite and lutite.

Petrologs display the vertical variation in petrographic properties through the group and, in conjunction with grain size analyses of insoluble residues, are used to interpret the energy level of the environment of deposition of individual rock units. Te Kuiti sediments accumulated under a spectrum of environmental energy conditions, ranging from quiet to strongly agitated waters.

The primary Te Kuiti sediment was dominated by metastable magnesium calcite and, less abundant, aragonite skeletons. These skeletons underwent syndiagenetic stabilisation reactions at, or close below, the sea floor. Large quantities of skeletal aragonitewere dissolved from the sediment before lithification. Aragonite was preserved only where anaerobic conditions were maintained in the sediment. Stabilisation of magnesium calcite grains involved the texturally non-destructive process of incongruent dissolution, which yielded a replacement product of calcite. Sources of $CaCO_3$ for cement included (a) solution of aragonite grains, (b) intergranular solution of bioclasts and, most important, (c) pervasive solution of bioclasts, under shallow burial loads,at those levels in the sediment relatively enriched in siliciclastic, and especially muddy, material. Dissolved $CaCO_3$ was precipitated as calcite cement in adjacent or nearby sediment layers. A paragenetic sequence of diagenetic events is established for the group.

Finally, Oligocene paleogeography and paleoclimate are outlined and a synthesis of the environment of formation and depositional history of sediments of the Te Kuiti Group in Waitomo County is established.

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