LOWER MIOCENE GEOLOGY OF THE WAITAKERE HILLS, WEST AUCKLAND,

WITH EMPHASIS ON THE PALEONTOLOGY

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OVERALL ABSTRACT

The west Northland, lower Miocene, carpet-bag formation, Manukau Breccia, is declared obsolete and replaced by the Waitakere Group (new). This group is established to contain the igneous and proximal sedimentary products of the lower to mid Miocene west Northland volcanic arc and is divided into three subgroups. The northern, Waipoua, Subgroup (new), consists of the Waipoua Basalt and associated volcaniclastic sediments of the Hokianga - Kaihu area. The central, Hukatere, Subgroup (new), contains volcaniclastic and igneous rocks of the Tokatoka - Okahukura Peninsula area, Kaipara. The southern, Manukau, Subgroup, contains igneous rocks and associated volcaniclastic sediments of the Waitakere Hills and adjacent areas.

The Waitakere Hills and their northern extension to Helensville (c.500 km^2) have been systematically mapped at a scale of 1:25000 and found to consist of a number of tilted or gently folded blocks of Manukau Subgroup having a low, overall, west to north-west tilt. Five formations and thirteen members are established. The oldest sediments are volcanic-rich proximal turbidites (Cornwallis Formation, upper Po, lower Miocene) that overlie and interfinger with the more distal flysch of the Waitemata Group to the east. Cornwallis Formation, and many of the overlying sediments, accumulated at bathyal depths (800 - 3000 m+) on the western side of the Waitemata basin. The proximal turbidites were deposited by south-east flowing turbidity currents that passed down submarine canyons from the neritic Kaipara shelf in the north and north-west. Lenticular conglomerates (Albany Conglomerate, Helensville Conglomerate) accumulated in these canyons and distributary channels of the upper and mid fan regions.

In uppermost Otaian to mid Altonian times (late lower Miocene), an apron of coarse volcaniclastic sediments (Piha Formation) spread

eastwards over the Waitakere Hills area from a growing volcanic pile centred west of the present coastline. Piha Formation contains well-stratified rudites, subsidiary lenticular, cross-bedded and massive rudites, large slump deposits and peripheral submarine extrusions of andesite flows, pillows and hyaloclastite. This coarse volcaniclastic belt was deposited on the neritic and upper bathyal slopes of the volcanic pile and grades eastwards towards the centre of the basin into a fine volcaniclastic belt (Nihotupu Formation) containing well-bedded arenites and lutites, cross-bedded arenites, lenticular conglomerates, slump units and small piles of pillowed andesite. These were deposited at mid to lower bathyal depths.

Substantial mid Altonian uplift in the Waitakere Hills was probably connected with eastwards advancing volcanism. The northern area around Muriwai remained marine for a time and several submarine canyons were eroded through the uplifted shelf and filled with pyroclastic-rich sediments (Tirikohua Formation).

An extensive, predominantly terrestrial sheet of andesite flows and pyroclastics (Lone Kauri Formation) was erupted over the uplifted central Waitakere Hills area. This sheet was possibly erupted from the two north-north-west trending, fault-controlled lineations of volcanic necks, craters, plugs, dyke swarms and intrusions that outcrop today along either side of the hills. Volcanian, strombolian and rare pelean eruptions from these centres produced mostly andesitic products plus one dacite dome (Watchman Dacite); these were the last known phases of volcanism in the area (upper Pl - ?Sc, lower to mid Miocene).

Macrofaunas have been collected from seventy-six localities in the Waitakere Hills. These can be divided into undisplaced bathyal biocoenoses and displaced thanatocoenoses in which neritic and bathyal faunas were mixed during subaqueous mass flow transport.

Analysis of these faunas allows recognition of ten neritic and three bathyal macrofaunal biofacies.

Remains of the crustacean Callianassa are recorded from burrow networks (Thalassinoides) developed in bathyal sediments. Sparse ichnocoenoses composed entirely of feeding and dwelling structures produced by burrowing polychaetes, echinoids and possibly sipunculids occur in basin (mid - lower bathyal) and submarine canyon (outer neritic - upper bathyal) sediments around Maori Bay. A canyon wall ichnocoenosis (outer neritic - upper bathyal), produced in semi-consolidated sediments by burrowing polychaetes, decapod crustacea and possibly amphipods and other organisms, occurs south of Maori Bay.

Twelve species from nine genera of hermatypic (reef-building) corals occur in mass flow deposits. They are inferred to have come from sporadically developed communities growing on shallow-water boulder banks around volcanic islands. Comparison of the total lower Miocene hermatypic coral fauna of Northland with present day reefs indicates that seasonal sea termperatures were 5 - 7^{o}C warmer than now.

Taxonomic descriptions of fossil corals, molluscs, polychaetes, benthonic foraminifera and trace fossils are given. Archesabella bartrumi gen. et sp. nov. is proposed for fossil tubes containing the body casts of sabellid-like worms. The hermatypic coral genus Goniastrea, trace fossil genus Rhizocorallium, and molluscan subgenera Dentalium (Gadilina), Solariella (Solaricida) and Turbo (Marmarostoma), are recorded from New Zealand for the first time. A new subgenus and species of the gastropod Monilea and new species of the gastropod genera Conacmea, Notoacmea (Parvacmea), Tecticrater, Solariella (Solaricida), Turbo (Marmarostoma), Agathirses, "Bartrumella" and Vaginella are described. A new genus and species of nuculanid bivalve, and new species of the mollusca Nucula, Saccella, Dentalium (Gadilina),

Turbo (Marmarostoma), Agathirses, Argobuccinum (Ratifusus), Uttleya and Concholepas are recorded but not named. The New Zealand species of the pteropod Vaginella are redescribed and figured, and the ontogeny of the oyster Crenostrea discussed.

The foraminiferal genus Sherbornina is recorded from New Zealand for the first time, together with thirty-nine overseas species. A further seventeen unnamed foraminiferal species are described.

Planktonic foraminifera allow division of the Manukau Subgroup into three biostratigraphic units: upper Otaian, lower Altonian and mid Altonian. Three-fold subdivision of Scott's Altonian is shown to be possible in northern New Zealand. The lower - middle Altonian boundary is based on the Globorotalia (T.) zealandica zealandica datum, supported by both the temporary absence of Globoquadrina dehiscens and the measurements on the rate of chamber expansion in Globigerinoides t. trilobus populations. The middle - upper Altonian boundary is taken as the Globorotalia (G.) miozea miozea datum, supported by both the reappearance of G.dehiscens and the rate of chamber expansion measurements.

Uniformitarian and computer approaches allow the thirty-one richest benthonic foraminiferal samples to be grouped into eight neritic and bathyal thanatotopes. Separate analysis of each thanatotope enables approximate depth limits to be placed on each and gives basin depths of 1500 - 3000 m+. Multidimensional scaling technique using Edwards Great Circle distances was found to be the most useful computer method in clustering the samples.

Formations of the Waipoua Subgroup are summarised and the paleogeography and eruptive history of the Waitakere Group is inferred.

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