Chatton Series.—Marine sandstones are found in practically all the Tertiary areas in the district. North–south strips occur along the Whakaea, Otama-Wendon, and Upper Waikaka Valleys; a further strip runs from Chatton to north of Waikaka, and the rocks also appear near Greenvale. The beds include greensands, sandstones, fine conglomerates, quartz sands, and grits, while some miles north of Waikaka a seam of lignite is interbedded.

Fossils of a shallow-water type are abundant in several localities, and these, together with the conglomeratic beds and lignite, suggest that submergence was oscillatory and generally not to a great depth. The included fossils are of Ototaran age.

Waikaka Series.—Resting on the marine beds are a thick series of argillaceous sandstones, shales, and mudstones, usually greasy to the feel and containing abundant plant remains and impressions; lignite seams from a few inches up to 20 ft. in thickness are common. They are found as small strips in the north–south depressions, but have their main exposure from Chatton through Waikaka to Greenvale, whence they stretch away to the south for over ten miles. The upper members in the Waikaka district, comprising quartz-conglomerates interstratified with clays, are preserved in a syncline, south of which the lignite-bearing shales come to the surface.

These beds are post-Ototaran, but pre-deformational. Their contact with the underlying beds is visible in Otama Valley, where the marine sandstone is seen to pass gradually upwards into plant-bearing argillaceous sandstone of the Waikaka Series, which would suggest a middle-Tertiary age for the latter series.

Maori Bottom Beds.—Rusty gravels and sands containing schist, greywacke, and quartz form a veneer, approximately 40 ft. to 50 ft. thick, over beds of the Waikaka Series south of Waikaka; again a mile and a half east of the Pyramid, in the Winding Creek–Wakaia gap, and in several patches southward, thence along the eastern side of the Whakaea Valley, are patches of similar gravels. They were probably laid down by streams consequent on the uplift and deformations at the close of the Tertiary. They were later involved in faults and are probably late-Tertiary in age.

Recent and Pleistocene.—Recent deposits are confined to flood-plain accumulations of gravel, sands, and silts, together with tailings. In the western part of the area, skirting the Waimea Plains, are extensive terraces of well-consolidated river gravels, quite distinct from the rusty Maori Bottom gravels. They represent large accumulations of rivers in the depressions caused by post-deformational earth movements; owing to later uplift the streams have cut down through them, periods of rest being indicated by well-defined terraces at several levels. Along the foot of the hills are accumulations of angular schist and greywacke debris of similar age shed from the fault-blocks as slope deposits and alluvial fans. They are early Pleistocene and possibly even late-Pliocene in age.

Loess of varying thickness covers uplands and valleys alike in the lower portions of the area, but it is absent from the higher parts of the elevated blocks.

Igneous Rocks.

Glassy vesicular basalt was traced northwards for five miles from a point near Waikaka Township, the outcrops being usually a quarter of a mile west of the main fault. It is either intruded along a subsidiary fault or has come to the surface from the main fault along a zone of weak shale which it has baked to porcellanite and hornstone along the contacts. At an old lignite-mine a neck of scoriaceous basalt seems to mark the site of a former volcano.

A small outcrop of similar basalt occurs one mile south-west of Maitland. North-east from Chatton, basalt has come to the surface for a mile along the fault, trending thence towards Waikaka, again baking shales to porcellanite. Porcellanite half a mile north of Trig. P at Wendon indicates a similar intrusion at this point, where lignite-bearing beds are faulted in against greywacke.

The intrusions are apparently connected with the faulting movements that occurred during the late Tertiary.

From Pyramid Bridge eastward to the gorge in the Waikaka Stream, a distance of eight miles, are outcrops of plutonic rocks referred to by Macpherson as the Otama intrusive. The northern boundary passes from Wendon School eastwards to within a mile of Wakaia Hill, and its southern boundary is in the vicinity of Trig. F. A fault along the Otama Valley crosses it, and Tertiary beds have been infaulted against the igneous rock on the east. Petrographical work has not yet been done on the rocks present, field classifications being used in this report.

The greater part of the mass consists of diorites and gabbros. Syenites and more acid types occur as lighter belts, one passing from the Pyramid to Wakaia Hill and another farther south occurring at the Geodetic Station near Otama. Quartz-lodes are present, mostly connected with the lighter belts. The elongation of the lighter belts and the intrusion as a whole is east and west. The quartz-lodes strike in the same direction and usually dip steeply to the north. Pegmatites and mineralized belts are common, and basic dykes not infrequent.

Patches of hornfels and almost unmetamorphosed rocks surrounded by igneous rocks indicate roof pendants and suggest that the present surface is not far from the roof of the batholith. A zone of highly altered rock, quartzites, and hornfels surrounds the mass, and near the actual contact it is hard in the field to distinguish between intruding and intruded rocks.

The more basic portions are highly sheared and crushed along east–west lines, though the lighter rocks are comparatively fresh, suggesting that earlier basic injections were sheared and crushed during the later injections of more siliceous magma; the pegmatites and quartz veins mark the closing stages in the history of the formation of the batholith.

Until further work is done, in the field, to establish the age of the mudstones to the south and, petrographically, to ascertain whether they have been affected by the intrusion or whether they post-dated its injection, little can be said about the age of the Otama Intrusive. It was intruded into rocks of the Taupeka Series occurring to the north, and eroded with them to form the surface on which the Tertiary sediments were deposited.