robust and tenacious of our introduced plants have not established themselves there. The few individuals which we find, appear there as intruders which do not flourish, but exist as it were by sufferance. They would probably die out altogether were it not that neighbouring cultivations serve as centres of propagation. As a matter of fact, the high road alone divides the area on which I collected from another which has for a long time been under cultivation and sown with English grasses, and even in the very midst of the former there existed at the time a paddock which had been twice ploughed, and was then under a crop of oats.

ART. L.—*On the Botany and Conchology of Great Omaha.*

By T. KIRK, F.L.S.

[*Read before the Auckland Institute, 23rd September*, 1872.]

THE harbour of Great Omaha is about forty-five miles north of Auckland, lying nearly midway between Mahurangi and Pakiri. For the purposes of this paper the district may roughly be sketched as extending from the Matakana Falls to Little Omaha, the latter situate about eight miles from Point Rodney.

The district is bounded on the west by the hills known as the Omaha or Pakiri ranges, which attain their greatest altitude, 1,380 feet, at Mount Hamilton, and are chiefly composed of sandstones overlying palæozoic slates, the latter often in a decomposed condition where exposed.

An outlying range of no great altitude, extending from Mount Hamilton to the head of the Matakana River, may be considered the southern boundary, while the coast line from thence to Takatau Point, and inwards from the mouth of the harbour to Little Omaha, will form its eastern side.

Dioritic rocks occur at the entrance to the harbour and other places. Fossil shells of several species are found at Kohuroa and Little Omaha; amongst those collected in the latter locality is an immense *Ostrea* which exhibits singular and varied forms. The southern boundary is marked by a sharp conical peak of diorite which at once attracts the notice of the traveller from the contrast it offers to the rounded summits of the adjacent hills. From the base of the range, and extending to the inner waters of the harbour, is a considerable extent of flat land, much of it swampy and intersected by numerous small streams. The inner waters are separated from the ocean by Whangatau, a peninsula of blown sand with a magnificent beach three miles in length and half a mile in width at low water. The entrance to the harbour is narrowed by a conical rock, which is exposed at half tide, but

coasting craft can enter on either side, although great care is requisite. Whangatau is becoming fixed by vegetation in its widest part, but is continually varying in its outline and in the depth of water covering that portion comprised between tide marks. From the mouth of the harbour to Omaha Cove the coast is rocky, and in some places precipitous. At a low elevation there is a considerable extent of fern land.

The larger portion of the hill is clothed with dense forest, the kauri and the tarairi (*Nesodaphne tarairi*) often forming large groves. The tawai (*Fagus fusca*) is also a social tree, and attains a large size, while it does not favour a luxuriant undergrowth of shrubs. One or two ranges are covered almost exclusively with pohutukawa of the straight symmetrical habit of growth known as "inland pohutukawa," which contrasts forcibly with the huge distorted specimens growing on the margin of the sea. Fine specimens of tanekaha (*Phyllocladus trichomanoides*) are abundant, and the toa-toa (*P. glauca*) occurs in one or two localities, while the kawaka (*Libocedrus doniana*) is comparatively rare. The puriri (*Vitex littoralis*) is abundant. *Pittosporum crassifolium* and *P. eugenioides* form large specimens, and on the summit of Mount Hamilton *P. kirkii* is epiphytic on the rata and other trees. The tawa (*Nesodaphne tawa*) is found in large quantities mixed with toro (*Persoonia toro*), rimu (*Dacrydium cupressinum*), kahikatea (*Podocarpus dacrydioides*), hinau (*Elæocarpus dentatus*) and other well known trees.

The various arms of the harbour are fringed with a growth of mangroves (*Avicennia officinalis*) usually of great luxuriance, which is, however, dying off in many places from being frequently cropped by cattle. Many of the creeks have their rise far back in the ranges, and in some instances form a series of fine cascades several hundred feet in height, often decorated with tree ferns, and more than usually picturesque in effect. In some places they flow amongst fallen masses of sandstone covered with *Hypnum albicans* and other mosses not commonly met with, perchance between steep banks clothed with *Elatostemma rugosum* in vast abundance, or yet again between rocky wooded slopes often covered with masses of *Corysanthes*; nearly all the species of this charming genus occur in the district. The stream called by the settlers the Pakiri Creek has its stony bed above tide limits covered with a dense growth of *Nertera cunninghamii* to an extent rarely to be seen elsewhere.

Many small Orchids, besides the various species of *Nematoceras*, are found in the district. *Thelymitra pulchella* and *T. imberbis* are abundant. The rare *Adenochilus gracilis* and *Chiloglottis cornuta* attain their northern limit so far as at present ascertained.

Whangatau beach affords a fine habitat for littoral plants. Most of the New Zealand species which occur in littoral situations are found here; amongst them *Atriplex billardieri* attains its southern limit, and is plentiful in

certain seasons. In 1863 it was growing near the mouth of the harbour in a peculiar manner, the blown sand gathering about the plant formed little hummocks through which the branches pushed their way to the surface, so that at a short distance the low white mounds appeared dotted over with green rosettes. A change in the outline of the beach in 1864 destroyed the plant in this part, and I have only seen it at the further end of the beach during recent visits. About the middle of the beach, but far back from high water-mark, is a clump of noble specimens of the pohutukawa and the tarata (*Pittosporum crassifolium*) which doubtless mark the site of the old margin. A peculiar variety of *Carex raoulii* has arched and procumbent culms sometimes more than six feet in length, and accompanies a slender sub-erect form of *Pratia angulata*.

The preceding sketch of the chief physical characteristics of the district, and of the more prominent features of its vegetation, although very far indeed from being complete, is yet sufficient to show that the district is well adapted to support a large variety of molluscous life, and such is found to be the case. The enumeration at the close of this paper is not offered as a complete account of the shells to be found within its boundaries, but is the result of a cursory examination made nine or ten years ago, supplemented by a few species collected during recent visits, and especially by additions made by Mr. Charles Matthews, who is well acquainted with the plants and shells of the district, and to whom I take this opportunity of acknowledging my indebtedness for many rare specimens and much valuable information relative to habitats, etc.

The beach at Whangatau is exposed to the force of north-east gales, after which high water-mark is fringed with large specimens of *Turbo cookii*, *Pectunculus laticostatus*, *Struthiolaria papulosa*, *Cassis pyrum*, *Pecten laticostatus*, with more rarely the fine *Triton australis* and others. *Spirula peronii* is washed or rather blown amongst the sand-hills in countless thousands, whilst the beautiful *Janthina exigua*, and numbers of smaller shells, mark the extreme limits of the waves. Still more rarely *Imperator heliotropium* and the large *Janthina communis* may be collected. *Mactra discors* and *M. ventricosa* are not uncommon, and may be procured by digging beyond low water-mark. In the calmest weather, *Mesodesma cuneata* may be picked up between tide marks, and the common long pipi, *M. chemnitzii*, below low water-mark. *Pecten laticostatus* formerly occurred on a shoal accessible at neap tides, but the site is now covered by deep water, and the shell is found only after gales. The pretty *P. zealandicus* is frequently thrown on the beach, often associated with another interesting shell, *Scalaria zelebori*. *Solenomya australis*, the representative of the European razor-shells, with its periostraca produced beyond the margin of the shell, is often thrown up, but I never obtained

living specimens. *Ancillaria australis* is exposed at extreme low water-mark during neap tides. The rozy *Psammobia lineolata* is common, and may be easily collected in fine condition. In short, the Whangatau beach is one of the most productive localities known to me for marine shells. Eighty species may sometimes be picked up in a morning's walk.

In the harbour, which with the exception of the deeper channels is laid bare at low water, the mud-oyster is plentiful amongst the mangroves, associated with *Cerithium bicarinatum, Amphibola avellana, Buccinum costatum, Nerita nigra,* and *Turbo smaragdus*; the opercula of the last are used in Auckland for the manufacture of cheap jewellery, but are of little value.

Usually imbedded in the mud, with its point downwards, and accessible without much difficulty at low water, *Pinna zealandica* occurs in some qaantity, and near it *Turbo cookii, T. granosus,* and *Voluta pacifica*; the long pipi is also found sparingly in the same habitat.

The common pipi (*Venus stutchburyi*) is most abundant, and forms a large portion of the food of the few natives still living on the shores of the harbour; its dead valves have raised a huge bank many feet above low water-mark. *Myodora striata, Tellina deltoidea,* and *T. albinella,* with many other shells, occur in the same locality.

The rocks between tide marks afford favourable habitats for many species; *Littorina diemensis* and *Purpura rugosa* are usually sprinkled over their surface, as if sown broad-cast; *Littorina cincta* is comparatively rare. The rock oyster and limpets of various species abound, but the species of the latter rarely intermingle. *Siphonaria australis* is common in two or three localities, but local; the singular *Lottia fragilis,* which resembles a fragment of greenish membrane adhering to the rock, is found at Matakana and Little Omaha, but is far from common. *L. pileopsis* is also found near Little Omaha, with *Purpura haustum, P. textiliosa,* and *P. succincta.*

On the sea-weeds may be seen *Bulla nova-zealandica, Trochus margaritiferus,* and other molluscs, which live almost entirely on marine vegetation. *Triton spengleri* is chiefly found amongst *Zostera,* but is local. *Haliotis iris* may be observed from projecting rocks, as it moves along the sea-bottom, presenting a somewhat attractive appearance.

The forests afford shelter to a goodly sprinkling of land shells, chiefly *Helices,* many of which are minute, and have not yet been identified. *Helix zealandiæ* is not unfrequent on the nikau. *H. dunniæ,* the largest species inhabiting the district, frequents fallen timber. *H. radiaria* is common amongst moss on tree trunks; other species are found under loose bark, stones, or amongst climbing plants, and are far more common than is generally supposed.

The pretty native *Physa* occurs on weeds in fresh-water streams; an

undescribed *Paludinella* is common in similar habitats, with a spined *Melania*. *Melanopsis zealandiæ* is confined to rocky streams, where it is abundant, the upper whorls being usually much eroded. The fresh-water limpets, *Latia lateralis* and *L. neritoides* are plentiful, the latter often occurring in brackish water. Fluviatile bivalves are confined to two species, the large fresh-water mussel, *Unio menziesii*, and *Cyclas novæ-zealandiæ*; the latter appears to be extremely rare, although it is so easily overlooked that it may possibly be less rare than it seems.

In the swamps shells appear to be remarkably rare, the most noteworthy being *Vitrina zealandiæ*, which is extremely local, and apparently confined to clumps of *Astelia grandis*. In brackish swamps, *Ophicardelus australis* and *Melampus zealandiæ* take the place of the *Conovuli* of Europe.

In the upper part of the harbour, several large mounds of dead shells bear testimony of the value to the natives of molluscous animals as food; similar deposits are also common on the ranges near to the sea, where they are more scattered. All kinds except the most minute were eaten by them, and it seems clear that their efforts have resulted in the partial extirpation of at least one species, *Mesodesma chemnitzii*, which occurs in their middens and on the hills in immense quantity, and of large size; it is now comparatively rare and usually below the average size, and does not occur in anything like sufficient abundance to furnish such a supply of food as formerly. A detailed examination of the old mounds of dead shells might possibly show ground for similar conclusions with regard to other species. The ear-shell was used by the Maoris in the manufacture of fish-hooks, and for inlaying their rude carvings.

The only molluscs of economic value to the settler, so far as known to me, are the rock oyster, well known as affording a delicious article of food and the best of shell lime. The common pipi and the long pipi are most nutritious, and are often exposed in the Auckland market for food. Rats are as fond as the Maoris of the fresh-water mussel, *Unio menziesii*, and piles of shells emptied by them may frequently be seen on the banks of streams, but the settlers do not regard it with favour as an article of food. I have seen *Turbo cookii*, *Voluta pacifica*, and the ear-shell used as food by bushmen, but feel bound to say their appearance was not appetizing. The large ear-shell, *Haliotis iris*, is exported to England, where it is used for inlaying. The small shells of *Ancillaria australis*, and the opercula of *Trochus smaragdus* are used in the manufacture of ear-drops, studs, and brooches, by the Auckland jewellers.

TROPHIODA.

Teredo *sp.* In pohutukawa, &c.
,, *sp.* In dead stems of *Avicennia*.
Pholas similis, *Gray.* Dead valves only.
,, tridens, *Gray.* Ditto.
Panopæa australis, *Sow.*
Solenomya australis, *Lam.*
Corbula zealandica, *Quoy & Gaim.*
Mactra ventricosa, *Lam.*
,, cuneata, *Lam.*
,, discors, *Gray.*

TROPHIODA—*continued.*

Myodora striata, *Q. & G.*
Mesodesma cuneata, *Deshayes.*
,, chemnitzii, *Deshayes.*
Saxicava australis, *Lam.* Smaller than S. rugosa, *Lam.*, but presenting no other appreciable points of difference.
Psammobia stangeri, *Gray.*
,, lineolata, *Gray.*
,, nitida, *Gray.*
Tellina albinella, *Lam.*
,, deltoidalis, *Lam.*
Lucina divaricata, *Lam.*
,, zeylanica, *Gray.*
Cyclas zealandica, *Gray.*
Crenella impacta, *Heim.*
Venus spissa, *Q. & G.*
,, yatei, *Gray.*
,, stutchburyi, *Gray.*
,, costata, *Q. & G.*
,, corrugata, *Gmel.*
,, intermedia, *Quoy.*
Cardium pulchellum, *Gray.*
Tapes, *sp.*
Dosinia anus, *Philippi.*
,, subrosea, *Gray.*
Venericardia australis, *Q. & G.*
Arca, *sp.*
Pectunculus laticostatus, *Q & G.*
,, striatulum, *Lam.*
Nucula zealandica, *Gray.*
Unio menziesii, *Gray.*
Lithodomus truncatus, *Gray.*
Modiola australis, *Gray.*
Mytilus canaliculatus, *Mart.*
,, polyodontus, *Q. & G.*
,, ater, *Dunk.*
Pinna zealandica, *Gray.*
Lima, *sp.*
Pecten zealandica, *Gray.*
,, *sp.*
,, laticostatus, *Gmel.*
Anomia, *sp.*
Ostrea mordax, *Gould.* Rock oyster.
,, *sp.*
,, *sp.* Mud oyster.

BRACHIOPODA.

Terebratula sanguinea, *Lam.*
,, zealandica, *Des.*
Waldheimia, *sp.*
Magas cumingi, *Davidson.*

GASTEROPODA.

Chiton longicymba, *Q. & G.*
,, quoyii, *Desh.*
,, pellis-serpentis *Q. & G.*
,, *sp.*
Acanthocetes hookeri, *Gray.*
Patella radians, *Gmel.*
,, stellifera, *Gmel.*
,, inconspicua, *Gray.*
,, *sp.*
Lottia pileopsis, *Q. & G.*
,, fragilis *Q. & G.*
Siphonaria zealandica, *Q & G.*
,, australis, *Q. & G.*
Parmophorus australis, *Lamark.* Dead shells only.
Emarginula, *sp.*
Fissurella, *sp.*
Crepidula costata, *Desh.*
,, contorta, *Quoy.*
Trochita tenuis, *Gray.*
Calyptræa dilatata, *Sow.*
,, *sp.*
Haliotis australis, *Mont.*
,, iris, *Gml.*
,, virginea, *Chem.*
Vermetus roseus, Q. & G. On dead shells.
,, vermiferus, Q & G.
Siliquaria, *sp.*
Aplustrum, *sp.*
Bulla quoyii, *Gray.*
,, australis, *Gray.*
,, nova-zealandica, *Gray.*
Limax bitentaculatus, *Quoy.*
,, agrestis, *L.* Naturalized.
Vitrina zealandica.
Helix dunniæ.
,, brownii.
,, dimorpha.
,, hypopolia.
,, hystrix.
,, zealandiæ.
,, radiaria.
,, coma.
,, subrugata.
,, vitrea.
,, compressivoluta.
,, igniflua.
,, greenwoodii.
Megalostoma zeylanica.
Physa novæ-zealandiæ.
Latia lateralis.
,, neritoides.
Melania zeylanica.
Melampus zealandiæ.
Paludinella, *sp.*
Ophicardelus australis.
Assiminea australis.
Amphibola avellana, *Gray.*
Nerita atrata, *Chem.*
Natica zealandica, *Quoy.*
Janthina exigua, *Lam.*
,, fragilis, *Bon.*
Rissoa, *sp.*
Scalaria australis, *Lam.*
,, zelebori, Q. & G.
Rotella lineolata, *Desh.*
Imperator heliotropium.
,, cookii, *Gmel.*
Turbo granosus, *Mont.*
,, smaragdus, *Lam.*

GASTEROPODA—*continued.*

Trochus margaritiferus.
Polydonta elegans, *Gray*.
,, *sp.*
Zizyphinus cunninghamii, *Gray*.
,, tigris.
Elenchus iris.
Monodonta lineolata.
Littorina diemensis, *Quoy*.
,, cincta, *Q. & G.*
,, *sp.*
Turritella rosea, *Quoy*.
Cerithium bicarinatum, *Gray*.
,, australe, *Gray*.
Fusus zealandicus, *Q. & G.*
,, nodosus, *Mont.*
,, dilatatus, *Q. & G.*
,, triton.
Pleurotoma rosea, *Sow.*
,, novæ-zealandiæ, *Reeve.*
Murex zealandicus.
,, nova-zealandica, *Gray*.
Ranella argus, *Lam.*
,, leucostoma, *Lam.*
Triton australis, *Lam.*
,, spengleri, *Chem.*
Triton, *sp.*
Struthiolaria vermes, *Mont.*
,, nodulosa, *Lam.*
,, papillosa, *Desh.*
Strombus troglodytes, *Lam.* A dead shell only, doubtless introduced by accident.
Cassis pyrum, *Lam.*
,, *sp.*
Ricinula, *sp.*
Purpura rugosa, *Q. & G.*
,, scobina, *Q. & G.*
,, haustum, *Lam.*
,, succincta, *Lam.*
,, textiliosa, *Lam.*
Dolium variegatum, *Lam.*, fragments only.
Buccinum turgidum, *Gray*.
,, melo.
,, lineolata, *Q. & G.*
,, maculosum, *Mart.*
,, costatum, *Q. & G.*
Ancillaria australis, *Sow.*
Voluta pacifica.
,, fusus.
,, *sp.*

CEPHALOPODA.

Spirula peronii.