Head; and at its north-west extremity the Old Red Sandstone, in the neighbourhood of Peel, coming against the Skiddaw slates.

MAY 23, 1866.

The following communications were read:—

1. *Notes on the GEOLOGY of SINAI.*
By the REV. F. W. HOLLAND, M.A.

[Communicated by Sir R. I. Murchison, Bart., K.C.B., F.G.S.]

(Abstract.)

THE peninsula of Sinai may be divided into three geological districts, named from the granitic, limestone, and sandstone rocks of which they are composed.

The whole of the northern portion of the peninsula is occupied by an extensive plateau of limestone, supported on the south by the range of Jebel-et-Tyh, and sloping gradually towards the Mediterranean Sea.

A broad belt of sand, called the Debbet-er-Ramleh, separates this limestone from the southern portion of the peninsula—although small patches of it, apparently underlying the sandstone, are found further south in Wady Badera and Wady Mokatteb, and in the neighbourhood of Jebel Hummam, and also on the north-west of Jebel Serbal, there occur large tracts of a limestone more cretaceous in its character, and abounding with bands of flints. At the latter spot I observed one mountain of Nummulitic limestone; and a limestone of more recent formation, which abounds with fossils, occurs near Tor and Ras Mohammed.

The granitic district forms, as it were, the backbone of the southern portion of the peninsula. Its mountains are frequently seamed from top to bottom with veins of porphyry, greenstone, and basalt, which give them a peculiar striped appearance; this is especially remarkable on the east of Wady Mokatteb, the north-west of Jebel Serbal, and in the wadies between Jebel Musa and Ain Hudera. They are also in some parts capped by a stratum of sandstone of considerable thickness and perfectly horizontal stratification, proving that an enormous denudation has taken place. Both the limestone and sandstone, when found in close proximity to the granitic rocks, exhibit no change in their structure; and thus, as well as by their uniform horizontal stratification, they show that they must have been deposited subsequently to the upheaval of the latter. The only traces of active volcanic agency which are now to be found in the peninsula are the boiling sulphur-springs and hot caves at Jebel Hummam, and the two warm mineral springs near Tor. The mountains of the granitic district appear to be chiefly composed of syenite; but granite, porphyry, gneiss, mica-schist, and quartzose and hornblende rocks occur in many localities. I did not succeed in finding any traces of metallic ores in this district.

The sandstone formation appears to have formed the great mining-district of the ancient Egyptians in Sinai. The principal places where this formation occurs are Serabit-el-Kadim, Wady Mughâra and the south of Wady Mokatteb, the west of Serbal, and the neighbourhood of Ain Hudera. The sandstone is generally of a reddish ferruginous colour, though its surface is for the most part coated with a dark-brown oxide of iron. The principal Egyptian mines were apparently turquoise-mines, not copper-mines as has been generally supposed. Serabit-el-Kadim and Wady Mughâra were the chief stations. The turquoises appear to be distributed more or less in veins, though their occurrence is very uncertain; and Major Macdonald, who has been working the mines for several years, has often spent weeks with no success, and then suddenly found a large number together.

I do not believe that any traces of copper are to be found either at Wady Mughâra, or Serabit-el-Kadim; excepting at the latter place a thin film of silicate, too small, however, in extent for any practical purpose. The specimens which I have brought from the supposed slag-heaps on either side of the ruined temple on the summit of Serabit-el-Kadim prove most clearly that they are not slag-heaps at all, but merely a natural impure ore of iron and manganese. The siliceous brown iron-ore, however, which abounds near Wady Mokatteb and Wady Mughâra, seems to have been extensively worked both by the Egyptians and also, perhaps, by a less-civilized race after their time; and stone hammers, and flakes of worked flint are frequently found on the mountain-sides.

At a short distance from the mouth of Wady Shellal, on its southern side, Major Macdonald has discovered a large heap of undoubted copper-slag, which still retains a considerable quantity of copper in it. I also obtained a small specimen of a rock containing a very large proportion of carbonate of copper, and some pieces of malachite; but I could not discover the locality whence they had been procured. The sandstone abounds with salt and natron, and the water obtained from it is always more or less brackish. In some of the wadies considerable beds of curiously crystallized salt are found. From the limestone I collected several specimens of fossils, consisting chiefly of Echinodermata and *Exogyra*; but in the sandstone I found but one organism, a portion of the stem of a fossil plant. A considerable elevation of the western coast of the peninsula has apparently taken place. A few miles to the north of Tor, large quantities of shells in a semifossil state, but similar to the existing species, are found at a height of 20 to 30 feet above the present level of the sea, and large blocks of coral occur at a still higher elevation; considerable raised beaches also occur at Ras Mohammed. Yet I do not suppose that any extensive elevation of the land at the head of the Gulf of Suez has taken place in modern days; nor does it appear from the formation of the ridge of Chalouf-et-Terraba, which separates the Bitter Lakes from the Red Sea, that the two were ever naturally connected, except indeed it were in prehistoric times.

Of the agencies which are still at work in modifying the surface

of the country at the present day, frost and rain appear to play the most important part in the higher mountains of the granitic district; but the chemical action of the atmosphere seems to affect to a greater degree the sandstone, by destroying the ferruginous cement which binds together its particles, and thus decomposing it. Yet the changes that are taking place are apparently so gradual and slow, that I feel convinced that the peninsula of Sinai is to this day but little altered in its nature from what it was when the children of Israel wandered in its wilderness more than 3500 years ago.

-
2. *On the oldest known BRITISH CRAB* (*Palæinachus longipes*) *from the FOREST MARBLE, MALMESBURY, WILTS.* By HENRY WOODWARD, Esq., F.G.S., F.Z.S. (of the British Museum).

[PLATE XXIV. fig. 1.]

I AM indebted to my friend Professor Thomas Bell, F.R.S., of the Wakes, Selborne, Hants, for the opportunity of describing this new and beautiful crustacean.

The specimen is from the Forest Marble of Malmesbury, and was discovered several years ago by the well-known collector of Oxford-Clay and Oolitic fossils, Mr. Wm. Buy. It will be seen to have nearly all its limbs *in situ*; and it shows the carapace with four segments of the abdomen united to it, resting upon a slab of Forest Marble covered with the remains of *Pentacrin*i, *Acrosalenia hemicidaroides*, shells of *Avicula*, *Rhynchonella*, and traces of the drift-wood to which the Oolitic Pentacrinites (like the barnacles of our modern seas) were attached.

The limbs of this crustacean are extremely long and slender; and in this respect, and also in their form and in that of the carapace, with its remarkable prominent tubercles in front, it closely resembles the common "Spider Crabs" (the *Maiadæ* and *Leptopodidæ*) living on our own coasts at the present day, and the Great Japanese Crab, the *Inachus Kämpferi*, of De Haan. The Upper White Jura of Germany has yielded carapaces of several minute crustacea, which are either Brachyurous or Anomurous; but as no limbs or abdominal segments have been met with, it is more doubtful where to place them in a classification of the fossil forms.

Professor Reuss* and H. von Meyer† have described three genera and twenty-five species of these forms (some of which have been reproduced in Mr. Lowry's 'Chart of Fossil Crustacea'‡); but none of them are comparable with the carapace of *Palæinachus*.

* Sitzungsab. K. Akad. d. Wiss. in Wien, xxxi., 1858.

† Palæontogr. Cassel, 1859-61, Bd. vii. p. 183, t. 23 (Monograph on the *Prosopeonidæ*).

‡ *Palæinachus longipes* is there figured with the generic name *Protocarcinus* which had been given to it (in MS.) by Prof. Bell; but it is not adopted here, first, because the fossil has no affinity to *Carcinus*, and secondly, because the prefix "*Proto*" is objectionable in Palæontology.