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I.—NOTES ON THE GEOLOGY OF THE EAST COAST OF CHINA. By THOMAS W. KINGSMILL, B. A.

[Read April 2, 1862.]

Hong Kong, January 18, 1862.

As I am sure that a slight sketch of the geology of an interesting and comparatively unexplored country, like China, will not be unacceptable to the members of the "Geological Society of Dublin," I have endeavoured to throw together a few remarks on the subject, partly from personal observation, and partly from the scanty notes I have been able to glean in various quarters. Many portions have been illustrated better and more fully before, but I have not been able to obtain access to any of these notices, and have had to rely on what means of information respecting the later deposits chance has thrown in my way—my own observations having as yet been confined to the neighbourhood of Hong Kong, the Canton River, and the district immediately about Foochow, with a passing glance at the intermediate coast.

Commencing with the igneous rocks, there stretches from the neighbourhood of the island of Hainan, in a N.N.E. direction, as far as the Chusan Archipelago, a range of low granite mountains, varying in height from a few hundred to perhaps three thousand feet, and averaging in breadth from twelve to thirty miles. These hills form, in most of the intermediate districts, the coast line; seldom receding more than a few miles inland, and only flanked at intervals, next the sea, by patches of a later formation. Commencing at Canton, and running parallel to these, there is another range of similar hills, but for what distance these extend I cannot now tell. From the maps they would

appear to join the Me-ling-shan or Plum mountains, another range running east and west, north of the province of Canton, and which likewise are described as composed of granite. The rock of which these ranges are composed appears throughout to be of similar structure and composition. The chain running along the coast is at all events similar, at its extremities, and wherever I have seen it in the intermediate portions. If I mistake not, some specimens from Hong Kong have been analyzed by the Rev. Professor Haughton, who has pronounced them to be very similar to the same rock from the county Dublin—to which in appearance, when undecomposed, it bears a striking resemblance.

This granite, wherever it occurs, has been deeply disintegrated, sometimes to a depth of one or two hundred feet; whilst everywhere, imbedded in the soft yielding matrix, there occur nodules of more quartzose character, which have resisted the effects of time and chemical change. These masses are usually of a lozenge shape, and vary in size from a few feet to several hundred. The original quartz veins of the granite, broken into small fragments by the forces which have operated on the surrounding rock, still traverse the disintegrated mass in all directions; whilst round the enclosed nodules the concentric structure of the rock can generally be traced. In the higher grounds the soft yielding matrix has generally been removed by denudation, leaving these pseudo-boulders perched all over the granite hills, presenting an aspect, to a passing eye, not unlike the boulder formations of more northern latitudes. I have been particular in describing the character of these, as they produce a marked feature in the scenery of the granite districts, and have led to erroneous ideas on the southern limit of the glacial drift, which, in Professor Ansted's "Elementary Treatise," is described as reaching as far as Macao.

This same disintegrated rock, too hard for the roots of plants to penetrate, and yet yielding enough to allow its surface to be continually washed away by the heavy rains of summer, causes the coast of South China to present a peculiarly barren and uninviting aspect, sadly belying the fertility of the great plains of the interior. Long lines of bare white sand, with scanty herbage between, stretch down from the mountain summits to the water's edge; these masses of sand are intersected in all directions by deep narrow ravines, worn by the tropical rains, which wash down their sides frequently with sufficient force to bear down large masses of rock, and which render walking through these districts unpleasant and dangerous.

In the province of Quan-si, west of Canton, a gneissose rock is described as occurring, of which more anon. I find the ranges of this district described as running in a direction nearly east and west, a direction also taken by the Me-ling range, and some of the chains in the extreme north. This appears also to be the direction of the gaps in the coast line through which the rivers in the southern provinces find their way to the sea.

Resting immediately on the granite occurs a stratified formation,

most likely of early Silurian date. It may be seen to advantage in the island of Hong Kong, though it appears to occur along the flanks of the granite for its whole extent; in a few spots being found at the sea, as well as on the land side. It is to be seen on the Canton River, below Whampoa; in the neighbourhood of Amoy; at Foo-chow; on the Yang-tze-Kiang; at Chi-Kiang, below Nan-King; and in the island of Hong Kong, preserving all through the same general character. A rock has likewise been described in the flanks of the Me-ling mountains, of apparently similar character. In Hong Kong a strip about two miles wide, entangled in the granite, runs across the island from W. N. W. to E. S. E. It is composed of masses of quartz rock, traversed by cleavage planes in all directions, alternating with beds of slate and quartz, plainly stratified. The strike of the beds generally appears to approach east and west—the inclination of the beds being high, about 80° at Hong Kong and Foo-chow; however, it is generally difficult to distinguish the bedding from the cleavage. At Aberdeen, at the south side of the island, immediately behind Lamont's graving dock, I found a few fossil shells, apparently of the one species, imbedded in very soft slate; they were badly preserved, and too soft to bear carriage.

In some places this rock might be mistaken for an igneous formation, and in others it approaches conglomerate, containing small crystals of quartz, slightly water-worn. The colour is generally a light yellowish-brown, but runs into a blueish stone, and in some places becomes black. Although the general aspect is similar through large districts, it would be difficult to obtain two specimens alike, even from the same neighbourhood.

Over this is found a red sandstone formation, but whether conformable to it or not I am unable to state, as I have nowhere seen their junction. From the usual strike of the formations, I should judge not, as the strikes of the two formations apparently cross at nearly right angles. The composition of this red sandstone does not appear to offer any peculiarities of structure or composition. In some parts it runs into conglomerate, whilst in others it forms an even-grained stone. It is to be found at Canton; at the Bogue Forts, in the Canton River; in the West River, above Shai-Heng; and along the North River nearly to the base of the Me-ling range. It is also to be found at the city of Nan-King, and most likely stretches through the intermediate country along the flanks of the Broken Hills. So far as at present known, it is, I believe, unfossiliferous.

At the entrance to the West River (See-Kiang), there occurs a dark fine-grained aluminous schist, much used for ink-stones, and fine carved work. Of its geological position I have no data for speaking. It occurs geographically between the red sandstone and the limestone, hereafter described. It appears, however, to extend for a very small distance, and, being rather valuable, is jealously guarded by the neighbouring mandarins.

Over the red sandstone, and, I believe, lying conformably on it, is found the great limestone formation of China,—the representative, most