

is north and south, whilst to the south of the hill the strike is a few degrees on either side of east and west. At Wadi dur Nabadi are ancient gold-workings, indicated by M. de Bellefonds on his map of the Etbai. The crystalline rocks are both massive and schistose. On the crystalline mass of Jebel Raft, and apparently overlain by the Nubian Sandstone, is a very coarse conglomerate containing fragments of crystalline rock, which appears to be older than the Nubian Sandstone.

The Nubian Sandstone has little or no dip, and shows very slight variation in composition. The water-supply of the Nubian Desert is directly dependent on the rainfall, which is very irregular. The wells are sunk in the detritus of the valleys, and contain a large amount of mineral matter in solution, which renders them almost undrinkable; whilst the second source of supply—the rain-water reservoirs—are deep holes in the ravines which intersect the crystalline hills. These holes must be attributed to water-action; and in the reservoir of Medina in Jebel Raft the spherical stones which assisted in forming the pothole still occur. The author believes that these ravines and reservoirs were formed at an earlier period than the present, when the rainfall was heavier.

Miss Raisin gives accounts of both massive and schistose crystalline rocks, and also of sedimentary rocks. The massive crystallines occur around Murrat and Jebel Raft, and these two areas are separated by the southern mass of schists. Another area of massive crystallines is formed beyond these schists, extending to the head of Wady Allaki. The crystalline rocks described include gneiss, hornblendite, gabbro, diabase, quartz-diorite, granite, felsite, certain schists, and sediments. None of the igneous rocks can be stated with certainty to have originated as a lava-flow. Many of them have undergone much alteration since their consolidation, and the results of this are described. There is clear evidence in many cases of erosion by mud and desert-sand and the formation of a weathered coating. The crystalline schists do not present a very modern facies, and might be late Archæan or early Palæozoic. The massive crystallines may belong to different epochs.

Miss Aston gives two tables, one of which shows the actual amounts of substances found in the wells of Murrat, Bir Tilat Abda, and Bir-Ab-Anaga, whilst the second shows their approximate constitution.

CORRESPONDENCE.

FOREIGN BOULDERS IN THE CHALK.

SIR,—Mr. Martin in your last number suggests that the granite boulders from the chalk-pit at Betchworth, described by Mr. Stebbing, may have come from the south-west. Permit me to say that I know the granites of this part of England, especially that of Hey Tor, fairly well, and for reasons which I think will be obvious to any petrologist who reads my description, consider this place of origin most improbable. Before publishing his speculation Mr. Martin would have done well also to consider the following

matters: (1) the height to which the mountains must have risen (supposing the mean temperature to have been the same as now) in order that they could have generated glaciers which would have come down to the sea; (2) whether in this case it is probable that granite would have been exposed at the surface; (3) whether it is probable (looking especially at the evidence of the breccias in the red rocks of Devon) that high mountains existed in this part of England during Cretaceous times. I may add that Mr. Stebbing, so far as I remember his excellent paper, never invoked a Glacial Epoch; that spectre was raised during the debate; nor is it necessary to create a glacier to transport the boulders. Shore-ice, such as forms in the estuary of the St. Lawrence, would be quite adequate for the work. If it started from some northern locality it might readily float down (as slab-ice still does in the Atlantic) well south of the latitude of London.

T. G. BONNEY.

FOREIGN BOULDERS IN THE CHALK, AND GASES ENCLOSED IN CRYSTALLINE ROCKS.

SIR,—(1) Referring to Mr. G. A. Martin's interesting suggestion (*GEOL. MAG.*, April, 1897, p. 169) that the Betchworth boulder came from Dartmoor, and to its alleged similarity to the granites of Hey Tor and Lustleigh Cleave, the microscope would probably answer this question decisively. Within fifty miles of Hey Tor the floor of the English Channel is strewn with detached blocks of crystalline rocks. Of these blocks I have a large collection of slides, and also a considerable number of specimens from all parts of Dartmoor; collected for the most part by myself, or sent me by the late Mr. R. N. Worth. Not a single specimen of the Channel blocks can be referred to Dartmoor. The minute characters of the Hey Tor and Lustleigh Cleave granites are well marked both positively and negatively. Three of each class of differences will probably suffice—e.g.: presence of fibrous tourmaline; of chloride inclusions in the quartzes; of soda felspar in the large potash felspars;—absence of hornblende; of dislocation of minerals; of any approach to gneissoid structure. Besides these there are others, but most granites not derived from Dartmoor will fail to meet one or other of the above tests.

(2) In the current number of the *GEOLOGICAL MAGAZINE* (p. 177) Dr. Tilden's paper on Gases enclosed in Crystalline Rocks is shortly reviewed, and mention is made of hydrogen in the Peterhead granite. On seeing this I referred to some notes made in 1890 on a collection of granites which Mr. Teall had kindly lent me to study. Among these notes occur the following, under the heading "Pink Granite of Rubislaw":—"A plane of fracture with fluid inclusions across another with only gas inclusions—order of sequence not made out. Rhombic negatives with bubbles. One negative hexagon with very active bubble. One patch of quartz full of hair-like inclusions and lines of bubbles: in one or two cases the hairs crossing the lines were distinctly divided in two, as seen with $\frac{1}{16}$. Could find no decided cubic crystal; any sort of crystal (in fluid inclusions) extremely rare. Bending in dark micas." Now it is not too much to