shallow-water type, laid down near the coast-line of the old Swedish highlands, this coast-line being approximately determined by an ancient north-west-south-east fault-system. The middle part of the sandy shales always includes one or two beds containing comparatively large quartz-grains and occasionally rounded pebbles of sandstone up to 10 mm. in diameter. Pyrites, phosphorite, and calcareous layers are common, the two first especially in the coarser portions. An abnormal occurrence at Röstänga is of much interest, since here there is repetition of the series, the upper sequence being of much more shallow-water character than the lower; that is, a shallow-water facies has been thrust over strata of a deeper-water facies. This the author attributes to submarine land-slipping, which, he says, is a frequent cause of the occurrence of contorted layers, interbedded with horizontally bedded ones. He estimates that this process is possible with a slope of the sea-floor as low as 4 to 6 degrees. This striking conception is somewhat inadequately treated in the German summary. The full text describes the formation of a peculiar breccia or conglomerate due to the slipping.

On account of the marked decrease in the depth of the water at the beginning of this stage, the old fauna almost completely disappeared, and only a few new forms came in. The presence of *Climacograptus normalis* serves to correlate the beds with British strata, but, on the whole, the fauna is mainly endemic. The presence of numerous ostracods and thin-shelled lamellibranchs suggests lagoon conditions.

REPORTS AND PROCEEDINGS.

MINERALOGICAL SOCIETY.

March 22.—Dr. A. E. H. Tutton, F.R.S., in the chair.

Professor H. Hilton: "On the Vibrations of a Crystalline Medium." The paper attempts to give an indication of the kind of vibrations which the molecules of a crystal may be expected to make about their positions of equilibrium. The case of an orthorhombic crystal in the form of a rectangular parallelepiped is considered in detail, and the normal modes of the molecular motion completely determined.

Professor R. Ōhashi: "Augite from Nishigatake, Japan." The crystals have been detached from basalt by natural weathering. Sp. gr. is 3.338 at 4° C. The prism angle agrees with that of diopside but that of the pyramid does not. Etched figures show that the crystal belongs to the holosymmetric class. $a = 1.6859$, $\beta = 1.6917$, $\gamma = 1.7105$, $2v = 58^\circ 25'$. Extinction angle on (010) = 41.6° . The chemical composition is SiO_2 51.37, Al_2O_3 5.24, Fe_2O_3 2.02, FeO 2.96, CaO 21.58, MgO 16.94, TiO_2 0.58. Both the optical

properties and chemical composition show that in this augite the diopside molecule predominates.

Dr. G. T. Prior : "On the Chemical Composition of the Adare and Ensheim Meteorites." Determination of the amount and composition of the nickeliferous iron in these meteorites had shown that Adare contained 18 per cent in which Fe : Ni = 11, and Ensheim 3 in which Fe : Ni = $3\frac{1}{2}$. Analyses were made of the unattracted material in order to determine how far they supported the idea that in meteoric stones the ratio of MgO to FeO in the magnesium silicates varied directly with the ratio of Fe to Ni in the nickel-iron. The results showed that the ratios of MgO to FeO in the olivine and pyroxene respectively were about 4 and 5 for Adare and $2\frac{1}{2}$ and 3 for Ensheim.

Mr. W. Barlow exhibited models to represent the atomic structure of calcite and aragonite.

EDINBURGH GEOLOGICAL SOCIETY.

February 16, 1921.—Mr. E. B. Bailey, M.C., B.A., F.G.S., F.R.S.E., President, in the chair.

1. "Recent Contributions to the Geology of Spitsbergen." By Dr. Robert Campbell, F.G.S.

After indicating the nature of the pioneer work done during the nineteenth century, Dr. Campbell outlined the results arrived at by Nathorst in his monograph on the geology of Bear Island, Spitsbergen, and King Karl's Land, published in 1910. During the past decade notable advances, he said, had been made in our knowledge of Spitsbergen geology, particularly by Hoel and Høltedahl. It had been known that the "Archæan" of the north-west belonged to the Heclahook system. A strong case had been made, too, for regarding the Heclahook series as of Cambrian-Ordovician age, similar rocks in Bear Island having yielded a fauna of American facies resembling that found in the Durness limestones of North-western Scotland and in the Beekmantown limestone of North America. The Red Bay series of the North coast had yielded fossils suggestive of Downtonian age, and the remainder of the Devonian had been divided into three groups, comparable with the Caledonian, Orcadian, and Upper Old Red Sandstone of Scotland. They have yielded the same characteristic fishes, but, unlike their Scottish equivalents, they carried also, according to Høltedahl, several forms of marine lamellibranchs. The Carboniferous rocks were of interest because of the occurrence of coal seams in the Culm, and had been mapped in considerable detail by the geologists of various Norwegian, Swedish, and Scottish expeditions. Much new information of stratigraphical and palæontological value had been obtained. It had been established that great overthrusting movements had taken place—probably in Tertiary times—along the line of the fault that separated the Heclahook rocks of the west coast from the younger rocks to