noted in the flakes of mica or any other mineral of somewhat like form scattered through the mass of the rock, sometimes approximating to a banding of the constituents, without any indication of this being the result of crushing. In regard to this particular structure, it is worth notice that it often lies in planes making a low angle with the horizon.

(3.) The same result may help to explain the assertion so frequently made, that among the older rocks the foliation (or minor mineral banding) is commonly parallel to the (apparent) stratification (or major mineral banding). This also I have noticed in cases where either there was no indication of subsequent crushing, or the latter had not effaced, and its effects could be distinguished from, the earlier structure of the rock. I once supposed this parallelism and tendency to horizontality to be due to the weight of superimposed beds, but for some time have been dissatisfied with this explanation, because I could find no evidence that any heavy burden had been laid upon the older rocks till long after they had assumed a foliated structure. Tension, however, would probably produce the structure at least as readily as pressure, and the former of course would, as a rule, act parallel with the surface of the earth's crust, while compression should be exhibited commonly in planes making a high angle with it.

V. "Note on some Experiments on the Viscosity of Ice." By J. F. Main, M.A., D.Sc. Communicated by Prof. W. C. Unwin, F.R.S. Received April 13, 1887.

(Abstract.)

The paper contains an account of some experiments on the continuous extension of bars of ice subjected to tension, made during the last winter in the Engadine. To eliminate the influence of regelation, the experiments have been carried on at such low temperatures as preclude the possibility of any effect being produced by this cause. The highest temperatures during the experiments were $-2{\cdot}6^\circ$ C. in Experiment I; $-1{\cdot}0^\circ$ C. in Experiment II; and $-0{\cdot}5^\circ$ C. in Experiment III. These maximum temperatures only obtained for a very short time on one or two days.

The bars were tested in a compound lever testing machine with accurate knife edges, the load being a known weight of shot. The whole apparatus was enclosed in a double wood box. A delicate thermometer graduated to tenths of degrees, attached inside the box, gave the temperature at any given time, and the range of variation of temperature was recorded by two maximum and minimum thermometers, fixed inside to the roof of the inner box. To obtain ice

free from air, water was boiled and then frozen. It was then melted and again frozen in a mould. Some difficulty was found in holding the ice-bars in the testing machine. The mode which answered best was to freeze the ends of the ice bar into conical metal collars, which fitted the shackles of the machine. Extensions were measured by vernier callipers reading to one-fiftieth of a millimetre between marked points on the metal collars. To determine if any appreciable effect was due to distortion of the enlarged ends of the bars in the metal collars, pieces of paper were gummed on the ice, and the extensions also measured between fine pencil marks on these pieces of paper. It was found that nearly all the stretching observed in measuring between the metal collars was due to stretching of the bar of ice, and only a very small part to shearing action in the collars. In consequence of rapid evaporation from the surface of the ice bar, the stress with a fixed load on the lever increased from day to day.

Three experiments are given on bars initially about 234 mm. in length, loaded to stresses of from 4·3 to 2·0 kilos. per square cm., and lasting from four to nine days.

The three experiments show that ice subjected to tension stretches continuously by amounts which depend on the temperature and the tensile stress. When the stress is great and the temperature not very low, there are extensions amounting to 1 per cent. of the length per day. So continuous and definite is the extension, that it can even be measured from hour to hour. These extensions took place at temperatures which preclude the possibility of melting and regelation.

The author hopes that on resuming the experiments next winter at St. Moritz, he may be able to determine more exactly the law of the extension. He has shown already that the extension increases continuously with all stresses above 1 kilo. per square cm., and at all temperatures between $-6°$ C. and freezing. When ice is in a condition such that the point of a needle will cause a set of radiating fractures to pass from the point of contact in all directions, it stretches as certainly, though not by so great an amount, as when it will permit the passage through it of the same needle without showing flaw or scar.

In the first experiment there was a total extension of 11 mm. in nine days; in the second of 1·8 mm. in five days; in the third of 1·7 mm. in three days. If we assume the extension proportional to the time, there was a mean daily extension of 1·2 mm., 0·36 mm., and 0·56 mm. respectively. The stress in No. 1 was greater than in Nos. 2 and 3, and the temperature not so very low in the day, though low at night. In No. 3 there was a low stress, but comparatively high temperature.