

employment of the Miller-Casella thermometer. They will be specially applicable to the area in which the work of the expedition will commence; but the thermal conditions of other areas may prove so different, that the method may need considerable modification.

The following strata appear to be definitely distinguishable in the North Atlantic: (a) A "superficial stratum," of which the temperature varies with that of the atmosphere, and with the amount of insolation it receives. The thickness of this stratum does not seem to be generally much above 100 fathoms; and the greatest amount of heating shows itself in the uppermost fifty fathoms. (b) Beneath this is an "upper stratum," the temperature of which slowly diminishes as the depth increases down to several hundred fathoms: the temperature of this stratum in high latitudes is considerably *above* the normal of the latitude; but in the intertropical region it seems to be considerably *below* the normal. (c) Below this is a stratum in which the rate of diminution of temperature with increasing depth is rapid, often amounting to 10° or more in 200 fathoms. (d) The whole of the deeper part of the North Atlantic, below 1000 fathoms, is believed to be occupied by water not many degrees above 32° . With regard to this "Glacial Stratum," it is exceedingly important that its depth and temperature should be carefully determined.

It will probably be found sufficient in the first instance to take, with each deep *bottom* sounding, *serial* soundings at every 250 fathoms, down to 1250 fathoms; and then to fill up the intervals in as much detail as may seem desirable. Thus, where the fall is very small between one 250 and the next, or between any one and the bottom, no intermediate observation will be needed; but where an abrupt difference of several degrees shows itself, it should be ascertained by intermediate observations whether this difference is sudden or gradual.

The instrument devised by Mr. Siemens for the determination of submarine temperatures is peculiarly adapted for serial measurements, as it does not require to be hauled up for each reading. It should, however, be used in conjunction with the Miller-Casella thermometer, so as to ascertain how far the two instruments are comparable: and this point having been settled, Mr. Siemens's instrument should be used in all serial soundings; and frequent readings should be taken with it, both in descending and ascending.

A question raised by the observations of the U.S. Coast Surveyors in the Florida Channel, and by those of our own surveyors in the China