CHAPTER III.

Oceanic Temperatures—Modes of Determination—Self-Registering Thermometers of Six, Aimé, Negretti & Zambra, and others—Electrical Thermometer—Sources of Error—Professor Tait's Experiments—Piezometers—Compressibility of Water—Specific Gravity Determinations—Collection of Samples of Water—Slip Water-Bottle—Buchanan's Water-Bottle—Combined Water-Bottle and Sounding Rod—Method of taking Temperatures.

ONE of the chief objects of the Expedition was to collect information as to the distribution of temperature in the waters of the ocean. It was therefore important to observe the temperature, not only at the surface, but at the bottom, and at intermediate depths. The determination of the temperature of surface water is simple. It suffices to collect a sample in a bucket, taking care that it is not contaminated with water, either from the scuppers, or from the discharge pipes of the engine, to plunge a good thermometer into it, and observe it carefully. The thermometers[1] supplied for this purpose were very sensitive, and divided into single degrees of Fahrenheit's scale.

For the purpose of observing the temperature of the waters below the surface in lakes and seas, three classes of thermometers have been used—namely, ordinary thermometers, self-registering thermometers, and electrical thermometers.

Ordinary Thermometers.—The earliest observations were made with the ordinary thermometer, and it was used in one of two ways—either it was sunk itself to the desired depth, and was so enveloped and protected by badly conducting material, that in bringing it up again through the layers of water of different temperature it had not time to alter its own temperature, or a quantity of the water at the desired depth was enclosed in a bucket of suitable construction and brought to the surface, and then immediately tested with the thermometer. Many very excellent and trustworthy observations exist which were made in one or other of these ways. Our first knowledge of the temperature of the deep water of freshwater lakes was obtained from the observations of Saussure on the lakes of Switzerland, made with a thermometer so padded and protected that it could be drawn up through 1000 feet of water of any temperature likely to be found in nature without sensibly altering its temperature.

At an earlier date, observations had been made at sea on the temperature of the water below the surface. Captain Ellis[2] was the first to attempt this line of investigation. In 1749, in lat. 25° 13′ N., he fetched samples of water from 3900 and 5346 feet in an apparatus devised by Dr. Hales,[3] and took their temperature when brought to the surface. The method of bringing a sample of the water to the surface, and then testing its

[1] For list of Thermometers, see Appendix C to Chapter I., p. 42.

[2] *Phil. Trans.*, vol. xlvii. p. 214, 1752.

[3] *Ibid.*, p. 213.