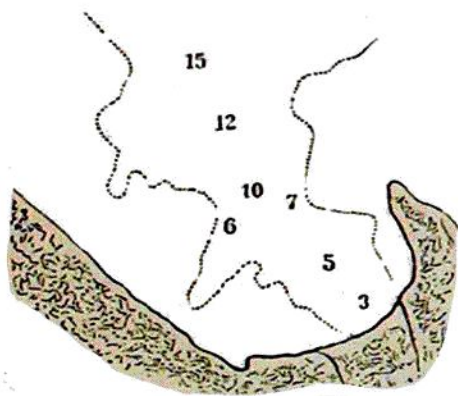


presented may be taken as those of an independent witness, as they were written out before the publication of his work.

There are usually strong tidal currents through the reef channels and openings. These currents are modified in character by the outline of the coast, and are strongest wherever there are coves or bays to receive the advancing tides. The harbour of Apia, on the north side of Upolu, affords a striking illustration of this general principle. The coast at this place has an indentation 2,000 yards wide and nearly 1,000 deep, as in the accompanying sketch, reduced from the chart by the Expedition. The reef extends from either side, or cape, a mile out to sea, leaving between an entrance for ships. The harbour averages ten feet in depth, and at the entrance is



HARBOUR OF APIA, UPOLU.

fifteen feet. In this harbour there is a remarkable out-current along the bottom, which, during gales, is so strong at certain states of the tide that a ship at anchor, although a wind may be blowing directly in the harbor, will often ride with a slack cable; and in more moderate weather the vessel may tail out *against* the wind. Thus when no current but one inward is perceived at the

surface, there is an undercurrent acting against the keel and bottom of the vessel, which is of sufficient strength to counteract the influence of the winds on the rigging and hull. The cause of such a current is obvious. The sea is constantly pouring water over the reefs into the harbour, and the tides are periodically adding to the accumulation; the indented shores form a narrowing space where these waters tend to pile up: escape consequently takes place along the bottom by the harbour-entrance, this being the only means of exit. There are many such cases about all the islands. In a group like the Feejees, where a number of the islands are large and the reefs very extensive, the currents are still more remarkable, and they change in direction with the tides.