the heights, amounting sometimes to seven or eight feet. It appears that this inequality vanishes and changes its sign about two days after the moon’s declination does so. At Bassadore there is a very large diurnal inequality of the times, sometimes exceeding two hours, and sufficient to dis­place the tides. For instance, about the 23d November 1834, the tide-hour of the forenoon was greater by almost two hours than that of the afternoon, the former being at 5h∙ 33m∙ a. μ. and the latter at 3h∙ 41m∙ p.m. What makes this anomaly still more remarkable is, that at this place there is little or no diurnal inequality of the heights, which is a most curious tidal feature, in addition to those already re­marked in the Indian Seas.

From observations made at Petropaulofsk, in the Bay of Avatcha, latitude 53° 1' N., long. 158° 44' E. in 1827 and 1828, by the Russian Admiral Lütke, and transmitted to Mr Whewell, it appears that the high water there is affected in its time by a very large diurnal inequality, while the height is only slightly affected by an inequality of that kind. The height of the surface was carefully observed every ten mi­nutes, day and night ; and when near its maximum, every two minutes. This great care and labour, which would have been superfluous at most places, was quite neccssary in this instance; for if the observations had not been thus conti­nued, they would not have enabled Mr Whewell to detect the very curious laws of the phenomena about to be de­scribed. This diurnal inequality of the time reaches the enormous amount of above four hours. Thus the intervals between moon’s transit and high water, on October 11 and 12,1827,were as follows: 5h∙38m∙, 1h∙ 39m, 5h∙ 20m∙, 0h.56m.; on June 23 and 24, 1828, they were 7h. 9m∙, 3h∙ 9m., 7h∙ 2lra∙, 2h∙ 5lm·; on October 15 and 16, 1828, they were 5h∙ 13m∙, 2h∙ 0m., 6h∙ 7m∙, 2h. 46m·; showing an alternate increase and diminution to the extent above mentioned. The greatest alternate inequalities of the heights of high water during these series of observations, were something more than a foot. But the observations of low water are marked by ad­ditional features still more curious. For though in these the diurnal inequality of the times really appears, it is nei­ther so large nor so regular as that of high water ; it seldom exceeds an hour. The diurnal inequality of the height of low water, on the other hand, is much larger than that for high water, amounting to three or even four feet; and this in a tide of which the whole range rarely exceeds five feet. The diurnal inequality is supposed to depend principally upon the moon’s declination ; and its maximum and its dis­appearance have been found, at most places hitherto exa­mined, to follow at a short interval (one or two days) the maximum and the vanishing of the moon’s declination. On examining the Petropaulofsk observations with regard to this point, we find that the greatest and most regular of the diurnal inequalities above noticed (the inequality of the time of high water and of the height of low water) corre­spond with the moon’s declination ; so that the epoch or age is zero. On the contrary, not only is the epoch of the other two inequalities, that of the heights at high water and of the times of low water, different from that of the preced­ing, but they alternate with them, vanishing when the others reach their maxima, and showing their maxima when the others vanish. This is a very perplexing circumstance ; for if the diurnal inequality depend upon the moon’s declina­tion, it is difficult to conceive how its effect upon the height of high water and the time of low water should be greatest just when the moon is in the equator, and that the reverse should hold in respect to the other two inequalities.

The tides of Petropaulofsk show more clearly than any yet examined, how the diurnal inequality may be so large as to lead to the appearance of only one tide in the twenty- four lunar hours. The heights of the high waters are alter­nately greater and less ; as are also, in a still greater degree, the heights of the low waters. Thus some of the high waters

are depressed, and some of the low waters elevated, till there is little vertical difference between the two. On the 17th of June, the rise from low to high water in the afternoon was oιdy eight inches, although the rise in the forenoon had been four feet. In the same manner the fall from high to low water in the afternoon of June 22 was only two inches, and in the forenoon of June 23, only one inch, although the intermediate fall in the afternoon of those days was above four feet. From 6h∙ to 8h∙ on the 24th the surface remain­ed stationary. Thus one of the two half-day tides being obliterated, we have only one tide in the twenty-four hours. It is to be recollected, however, that this takes place only at a particular period of each lunation, depending upon the declination of the moon. When, therefore, a traveller meets with such a phenomenon, if he would pursue his tide obser­vations for a few days with assiduity, he would probably find the single-day tide resolve itself into the usual case of two daily tides.

The term *establishment* ceases to be applicable when the diurnal inequality affects the time of high water to so very large an amount as we have seen it does at Petropaulofsk; because at almost any time of the lunation the interval of moon’s transit and high water may vary very much from one tide to another, and this uncertainty deprives the esta­blishment of all utility in such cases, unless we also take into account the diurnal inequality.

If the usual diurnal inequality at any place be the effect of a tide-wave arriving at the shore once a day and super-imposed upon the semidiurnal tide-wave, it is natural to ask whether such a mode of representation can be ap­plied to the tides now under consideration. Mr Whewell, after attempting at considerable length to effect this, ac­knowledges that he is fairly outdone by the inequalities alternating in their vanishing and maxima, as above de­scribed.

The tides at the Isle of Sitkhoe, latitude 57° 2' N. and longitude 135° 18' W., exhibit a very great diurnal in­equality both in the heights and times. The amount of this in the time of high water reaches an hour (30m. posi­tive and 30m. negative) ; at low water it is somewhat less. The diurnal inequality of the height of high water is two and a half feet, at low water its maximum amounted to five feet ; the greatest rise from low to high water being about fifteen feet. In other respects this case is similar to that of Petropaulofsk, except that the tides never become single. The same communication of Admiral Lütke contained an account of the great diurnal inequalities of Port de la Co­quille and of Port Lloyd, as also of the establishments of several other places in the North Pacific ; but, as already stated, the term establishment becomes extremely vague, and almost unmeaning, when applied to seas in which the phenomena of the tides are such as above described.

From the account of Admiral Freycinet’s voyage, it ap­pears that at several places in the North Pacific, the tides, as observed in that expedition, exhibit features similar to those here noticed. It has often been lamented that so few tide observations have been made in distant parts of the world ; but it is now sufficiently clear, that if, in places such as those now noticed, the observations are not made with great care, and continued for a length of time, they can only serve to mislead.

The Rev. John Williams, who, from observations conti­nued during several years’ residence in the islands of the Pacific Ocean, had it in his power to furnish more certain information than could be obtained by any transient visitor, however profound in knowledge or diligent in research, has given a very intelligent account of certain tides in those regions in his “ Narrative of Missionary Enterprises in the South Sea Islands,” p. 200. It is a fact well known to the missionaries, that the tides in Tahiti and the Society Islands are uniform throughout the year, both as to the time