from Lake George falls here about 30 ft., providing water-power, and among the manufactures are paper pulp, paper-making machinery and lumber. Flake graphite was discovered in this vicinity as early as 1815, and for years two mines (with quartzite veins, respectively 1-5 and 2-15 ft. thick) at Ticonderoga were the principal source of supply of good crystalline graphite. Commanding a portage on the line of water communication between Canada and the English colonies, Ticonderoga was a place of considerable strategic importance during the Seven Years’ War. On a commanding elevation overlooking the present village and Lake Champlain the French began building a fort of earth and timber in 1755 and called it Fort Carillon; later it was named Fort Ticonderoga. Sir William Johnson led an expe­dition in the same year against this fort and Crown Point; though he failed to capture the forts he defeated Baron Ludwig August Dieskau in the battle of Lake George and erected at the head of the lake Fort William Henry, which was captured by the marquis de Montcalm in 1757. On the 8th of July 1758 less than 4000 Frenchmen were confronted at Fort Carillon by about 6000 British regulars and 10,000 provincials under Lieut.-General James Abercrombie and Brigadier-General George A. Howe, but Howe, the controlling spirit of the British force, had been killed on the 6th of July, and Abercrombie, after an ineffective attack which cost him nearly 20∞ men killed or wounded, retreated. In 1758, however, when Montcalm had gone to Quebec to oppose Wolfe and a force of only 400 men was left at Ticonderoga, Lord Amherst with n,o∞ men invested it, and on the 26th of July the garrison blew up and abandoned the fortifications. At the beginning of the War of Independence, on the 10th of May 1775, the fort was surprised and captured by Ethan Allen. It was recovered by the British on the 5th of July 1777, during Burgoyne’s campaign, was abandoned immedi­ately after Burgoyne’s surrender in October 1777, but was re-occupied by the British in 1780. After the close of the war it was allowed to fall into ruins. In 1909, on the occasion of the tercentenary celebration of the discovery of Lake Champlain, the restoration of the fort was begun under the direction of the owner of the site. The settlement of this region was begun soon after the close of the Seven Years’ War, and the township of Ticonderoga was set apart from the township of Crown Point in 1804. The village of Ticonderoga was incorporated in 1889. The name “ Ticonderoga ” is a corruption of an Indian word said to mean “ sounding waters.”

TIDE (O. Eng. *tid,* cf. Ger. *Zeit,* time or season, connected with root of Sanskrit *a-diti,* endless), a term used generally for the daily rising and falling of the water of the sea, but more specifically defined below.

I.—General Account of Tides and Tidal Theories

§. 1. *Definition of Tide.—*When,@@1 as occasionally happens, a ship in the open sea meets a short succession of waves of unusual magnitude, we hear of tidal waves; and the large wave caused by an earthquake is commonly so described. But the use of the adjective “ tidal ” appears to us erroneous in this context, for the tide is a rising and falling of the water of the sea produced by the attraction of the sun and moon. A rise and fall of the sea produced by a regular alternation of day and night breezes, by regular rainfall, and evaporation, or by any influence which the moon may have on the weather cannot strictly be called a tide. Such alterations may be inextricably involved with the rise and fall of the true astronomical tide, but we shall here distinguish them as meteorological tides. It is well known that there are strongly marked diurnal and semi-diurnal inequalities of the barometer due to the sun’s heat, and they may be described as atmospheric meteorological tides.1 These movements both in the case of the sea and in that of the atmosphere are the result of the action of the sun, as a radiating body, on the earth. True astronomical tides in the atmosphere would be shown by a

regular rise and fall in the barometer, but such tides are undoubtedly very minute, and we shall not discuss them in this article, merely referring the reader to the *Mécanique céleste* of Laplace, bks. i. and xiii. We shall in the present article extend the term “ tide ” to denote an elastic or viscous periodic deformation of a solid or viscous globe under the action of tide-generating forces.

§ 2. *General Description of Tidal Phenomena.@@2*—If we live by the sea or on an estuary, we see that the water rises and falls nearly twice a day; speaking more exactly, the average interval from high-water to high-water is about 12h 25m, so that the average retardation from day to day is about 50m. The times of high- water are then found to bear an intimate relation with the moon’s position. Thus at Ipswich high-water occurs when the moon is nearly south, at London Bridge when it is south-west, and at Bristol when it is east-south-east. For a very rough determination of the time of high-water it is sufficient to add the solar time of high-water on the days of new and full moon (called the “ establishment of the port ”) to the time of the moon’s passage over the meridian, either visibly above or invisibly below the horizon. The interval between the moon’s passage over the meridian and high-water varies sensibly with the moon’s age. From new moon to first quarter, and from full moon to third quarter (or rather from and to a day later than each of these phases), the interval diminishes from its average to a minimum, and then increases again to the average; and in the other two quarters it increases from the average to a maximum, and then diminishes again to the average.

The range of the rise and fall of water is also subject to great variability. On the days after new and full moon the range of tide is at its maximum, and on the day after the first and third quarter at its minimum. The maximum is called “ spring tide ” and the minimum “ neap tide,” and the range of spring tide is usually nearly three times as great as that of neap tide. At many ports, however, especially non-European ones, two successive high-waters are of unequal heights, and the law of variability of the difference is somewhat complex; a statement of that law will be easier when we come to consider tidal theories. In considering any single oscillation of water level we find, especially in estuaries, that the interval from high to low-water is longer than that from low to high-water, and the difference between these two intervals is greater at springs than at neaps.

In a river the current continues to run up stream for some considerable time after high-water is attained and to run down similarly after low-water. Much confusion has been occasioned by the indiscriminate use of the term “ tide ” to denote a tidal current and a rise of water, and it has often been incorrectly inferred that high-water must have been attained at the moment of cessation of the upward current. The distinction between “ rising and falling ” and “ flowing and ebbing ” must be maintained in rivers, whilst it is unnecessary at the seaboard. If we examine the progress of the tide-wave up a river we find that high- water occurs at the sea earlier than higher up. If, for instance, on a certain day it is high-water at Margate at noon, it is high-water at Gravesend at a quarter past two, and at London Bridge a few minutes before three. The interval from low to high-water diminishes also as we go up the river; and at some distance up certain rivers—as, for example, the Severn—the rising water spreads over the flat sands in a roaring surf and travels up the river almost like a wall of water. This kind of sudden rise is called a “bore”@@3 *{q.v.).* In other cases where the difference between the periods of rising and falling is considerable there are, in each high-water, two or three rises and falls. A double high-water exists at Southampton.

When an estuary contracts considerably, the range of tide becomes largely magnified as it narrows; for example, at the

@@@1 Lord Kelvin shows that the attraction of the sun on these tides must produce an excessively small acceleration of the earth's rotation. See *Société de physique* (September 1881), or *Proc. Roy. Soc. Edin.* (1881-1882), p. 396.

@@@2 Founded on G. B. Airy’s “ Tides and Waves,” in *Ency. Metrop.*

@@@3 See a series of papers bearing on this kind of wave by Sir W. Thomson (Lord Kelvin) in *Phil. Mag.* (1886-1887).