ADDITIONS and Corrections to the Article, Of Seas and Lakes, vol. i. p. 290.

I.

Of the Limits of the South Sea.

THE South Sea is much broader than the Atlantic, and appears to be bounded by two chains of mountains, which correſpond as far as the Equator. The firſt chain is compoſed of the mountains of California, of New Mexico, of the Iſthmus of Panama, of the Cordeliers, of Peru, of Chili, &c. The other chain ſtretches through Kamtſchatka, Yeſſo, and Japan, and extends as far as the Larron iſlands, and even the New Philippines. The direction of theſe chains of mountains, which appear to be the ancient limits of the Pacific Ocean, is preciſely from north to ſouth; ſo that the Old Continent was bounded on the eaſt by one of theſe chains of mountains, and the New Continent by the other. Their ſeparation happened at the period when the waters, proceeding from the ſouth pole, began to run between theſe two chains of

of mountains, which ſeem to unite, or at leaſt to make a very near approach to each other towards the northern regions. This is not the only indication of the ancient union of the two continents on the north. This continuity of the two continents between Kamtſchatka and the moſt weſtern lands of America, ſeems now to be proved by the new diſcoveries of navigators, who have found, under the ſame parallel of latitude, a great number of iſlands lying ſo near each other, as to leave only ſmall intervals of ſea between the eaſt of Aſia and the weſt of America under the Polar Circle.

II.

Of double Currents in ſome Parts of the Ocean, vol. i. p. 313.

I Had too generally and too poſitively aſſerted, that, in no part of the ſea, a ſuperior and inferior current are to be found.

I have ſince received information, which ſeems to prove, that this effect actually exiſts, and can even be demonſtrated, in certain parts of the ſea. On this ſubject, M. Deſlandes, an able navigator, obligingly communicated to me the following accurate remarks, in two letters, the one

one dated December 6, 1770, and the other November 5, 1773.

'In your *Theory of the Earth*, Art. XI. *Of Seas and Lakes*, you ſay, that *a double current has been alleged to run through the ſtraits of Gibraltar; but that thoſe who ſupport this opinion have been deceived by the regorging of the water near the ſhores, which often produces a motion oppoſite to that of the principal current.*

'After reading this paſſage, I determined to tranſmit you my obſervations on the ſubject.

'Two months after my departure from France, I reconnoitered the land between Capes Gonſalvas and Saint Catharine. The force of the currents, the direction of which is to the north north-weſt, correſponding exactly with the ſituation of the lands, obliged me to caſt anchor. The general winds of this region blow from the ſouth ſouth-eaſt, ſouth ſouth-weſt, and ſouth-weſt. I ſpent two months and a half in making fruitleſs attempts to change my ſituation, and to reach the coaſt of Loango, where I had ſome buſineſs to tranſact. During this time, I remarked, that the ſea deſcended in the above direction from half a league to a league in the hour, and that, at certain depths, the currents aſcended below with the ſame rapidity as they deſcended above.

'I aſcer-

'I aſcertained the depth of theſe oppoſite currents in the following manner: Being moored in eight fathoms water, and the ſea extremely clear, I fixed a lead of thirty pounds weight to the end of a line. At about two fathoms from the lead, I tied a table napkin to the line by one of its corners, and allowed the lead to ſink in the water. As ſoon as the table napkin entered, it took the direction of the firſt current. Continuing to obſerve it, I made it deſcend. Whenever I perceived that the current diſcontinued, I ſtopped. It then floated indifferently around the line. In this place, therefore, the run was interrupted. I then ſunk the table napkin about a foot lower, and it aſſumed an oppoſite direction. By marking the line at the ſurface of the water, I found that the table napkin was at the depth of three fathoms; from which I concluded, after different examinations, that, of eight fathoms water, three ran north north-weſt, and five ran in the contrary direction of ſouth ſouth-eaſt.

'The ſame day, I repeated the experiment in fifty fathoms water, being then diſtant from the land ſix or ſeven leagues. I was ſurpriſed to find that the upper current was deeper in proportion to the depth of the bottom. Of fifty fathoms water, I reckoned that from twelve to fifteen ran in the firſt direction. This

‘ phænomenon did not take place during the
‘ whole two months and a half that I remained
‘ on this coaſt, but nearly one month only, and
‘ at different times; during theſe interruptions
‘ the whole water ran into the gulf of Guiney.

‘ This oppoſition of currents ſuggeſted the
‘ idea of a machine, which, being ſunk as
‘ far as the inferior current, and preſenting a
‘ great ſurface, might force my veſſel againſt
‘ the ſuperior current, I made the experiment
‘ in miniature upon a boat; and I proceeded
‘ ſo far as to produce an equilibrium between
‘ the force of the ſuperior current, joined to
‘ that of the wind, upon the boat, and the force
‘ of the inferior current upon the machine. I
‘ had not an opportunity of making trials on a
‘ larger ſcale. What I have related, Sir, is a
‘ truth which may be confirmed by every navi-
‘ gator who has viſited theſe climates.

‘ I imagine that the winds, as well as the ri-
‘ vers, which diſcharge themſelves into the ſea
‘ along this coaſt, and carry great quantities of
‘ earth into the gulf of Guiney, are the princi-
‘ pal cauſes of theſe effects. Beſides, the bottom
‘ of this gulf, which, by its declivity, obliges the
‘ tide to run retrograde whenever it arrives at a
‘ certain level, and is inceſſantly preſſed by freſh
‘ quantities, while the wind acts in a contrary
‘ direction upon the ſurface, and conſtrains part
‘ of the water to obſerve its ordinary courſe.
‘ This ſeems to be the more probable, becauſe

‘ the ſea enters from all quarters into this gulf,
‘ and iſſues only by revolutions which ſeldom
‘ happen. The moon has no apparent effect;
‘ for the ſame thing takes place during all its
‘ phaſes.

‘ I had occaſion to be ſtill farther convinced
‘ that the preſſure of the water, when it comes
‘ to its level, joined to the inclination of the bot-
‘ tom, are the ſole cauſes of this phænomenon.
‘ I found, that theſe currents exiſt only in pro-
‘ portion to the ſmaller or greater declivity of
‘ the ſhores; and I have every reaſon to believe,
‘ that they are not perceived beyond twelve or
‘ fifteen leagues from land, which is the great-
‘ eſt diſtance along the coaſt of Angola, where
‘ we can be certain of finding the bottom.....

‘ The following circumſtances ſeem to prove,
‘ that ſimilar changes in the currents take place
‘ in the open ſea. I made one of my experi-
‘ ments at a mean depth, namely thirty-five fa-
‘ thoms. I found, at the depth of ſix or ſeven
‘ fathoms, that the courſe of the water ran
‘ north north-weſt. On ſinking two or three
‘ fathoms more, my line ſtretched to the weſt
‘ north-weſt. At three or four fathoms deeper,
‘ the courſe was weſt ſouth-weſt, then ſouth-
‘ weſt, and ſouth. Laſtly, at twenty-five and
‘ twenty-ſix fathoms, the courſe was ſouth
‘ ſouth-eaſt, and towards the bottom it was
‘ ſouth-eaſt and eaſt ſouth-eaſt. From theſe
‘ experiments I drew the following concluſions:

'That I might compare the ocean between 'Africa and America to a great river, the courſe 'of which is almoſt conſtantly directed to the 'north-weſt; that, as it runs along, it carries 'down ſand and mud, which it depoſits on its 'banks. Theſe banks are, of courſe, heighten-'ed, and neceſſarily raiſe the level of the water, 'and oblige it to run retrograde in proportion 'to the declivity of the ſhore. But, as the wa-'ter is directed by a primitive impulſe, it can-'not return in a ſtraight line: Obeying the 'original movement, and yielding reluctantly to 'the laſt obſtacle, it muſt neceſſarily deſcribe a 'curve of greater or ſmaller extent, till it meets 'the middle current, with which it may partly 'unite, or which may ſerve it as a fulcrum, and 'give it a direction contrary to that impreſſed 'on it by the bottom. As the maſs of water is 'in perpetual motion, the water towards the 'bottom, being nearer the cauſe and more preſ-'ſed, muſt always undergo the firſt changes, 'and run in a direction contrary to the ſuperior 'current, while the ſame cauſe reaches not dif-'ferent heights. Theſe, Sir, are my ideas. 'I have frequently taken advantage of theſe in-'ferior currents; by ſinking a machine to dif-'ferent depths, according to the number of fa-'thoms water I happened to be in, I was en-'abled to ſail againſt the upper current. I 'found, that, in calm water, and with a ſurface 'three

'three times larger than that part of the prow 'which is below the water, we could run from 'a third to half a league in the hour. Of this 'fact I was aſcertained by my latitude, by boats 'which I anchored, and from which I found 'myſelf at a great diſtance an hour afterward; 'and, laſtly, by the diſtance of certain points 'along the coaſts.'

Theſe obſervations of M. Deſlandes ſeem to be deciſive, and I accede to them with pleaſure. I cannot ſufficiently thank him for demonſtra-ting not only that my ideas on this ſubject were, in general, juſt, but that, in particular circum-ſtances, they were liable to exceptions. It is not leſs certain, however, that the ocean forced open the ſtrait of Gibraltar, and, conſequently, that the Mediterranean ſea received a great aug-mentation by this irruption. I reſted this opi-nion not only on the current of the ocean into the Mediterranean, but on the ſituation of the land and the correſpondence of the ſtrata on the oppoſite coaſts, which has often been remarked by intelligent navigators. 'The irruption which 'formed the Mediterranean is evident, as well 'as that of the Black Sea by the ſtrait of the 'Dardanelles, where the current is always vio-'lent, and the correſpondence of the angles of 'the two coaſts ſtrongly marked, as well as the 'ſimilarity of the ſtrata, which are preciſely the 'ſame on the oppoſite ſides*.'

* Part of a letter written to M. de Buffon in 1772.

Beſides, the idea of M. Deſlandes, who conſiders the ſea between Africa and America as a great river, the courſe of which is toward the north-weſt, agrees perfectly with what I advanced concerning the water's running in greater quantity from the ſouth than from the north pole.

III.

Of the Northern Parts of the Atlantic Ocean.

ON viewing the iſlands and gulfs, which are very numerous round Greenland, it is difficult, as navigators remark, not to ſuſpect that the ſea falls back from the Poles towards the Equator. What favours this conjecture, the tide riſes eighteen feet at Cape des Etats, and only eight feet in the bay of Diſko, *i. e.* at ten degrees of higher latitude *.

This obſervation, joined to that of the preceding article, ſeems ſtill farther to confirm the movement of the waters of the ocean from the ſouthern to the northern regions, where they are forced, by the reſiſtance of the lands, to regorge or flow back toward the ſouth.

In Hudſon's Bay, veſſels have to preſerve themſelves from mountains of ice, which are

* Hiſt. Gen. des Voyages, tom. xix. p. 2.

ſaid

ſaid to be from fifteen to eighteen hundred feet thick, and which, being formed by a ſucceſſion of long winters, in ſmall gulfs perpetually filled with ſnow, have been detached by the north-weſt winds, or by ſome other powerful cauſe.

The north-weſt wind, which prevails perpetually during winter, and often in ſummer, excites, in the ſame bay, dreadful tempeſts. Theſe are ſtill more to be apprehended, becauſe ſhoals are here very frequent. In the countries which bound this bay, the ſun never riſes nor ſets without a great cone of light. When this phænomenon diſappears, it is ſucceeded by the aurora borealis. Here the heavens are ſeldom ſerene. In ſpring and autumn the air is generally replete with thick fogs; and, during winter, with an infinity of ſmall threads of ice, which are viſible to the eye. Though the ſummer heats are conſiderable during two months or ſix weeks, thunder and lightning are rare *.

The ſea along the coaſts of Norway, which are bordered with rocks, is commonly from a hundred to four hundred fathoms deep, and the water is leſs ſalt than in warmer climates. The number of oily fiſhes with which this ſea is filled, renders it ſo fat that it is almoſt inflamma-

* Hiſt. Philoſ. et Politique, tom. vi. p. 308, 309.

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