experiments of Marcet*, it is true, do not show the specific gravity of the sea water, in the strait, taken from a considerable depth, to be greater than that of the surface. With respect to this difference, we too are unable to state anything positive, on account of the quickness of our passage, and for want of a convenient opportunity of procuring water from a sufficient depth; the certainty, however, of the greater specific gravity in the Mediterranean, may serve as an explanation, whereas, the accuracy of the result of Marcet's experiments may be doubted, on account of the difficulty of obtaining sea water, from a requisite depth. But if there is a difference in the specific gravity of the water of both seas, the countercurrent must really take place as supposed, because in the collision of two fluids of different gravity, the heavier naturally flows under the lighter. Besides the most important cause of the current in the strait, which we have stated, others may contribute. Thus the revolution of our planet round its axis, which communicates to the sea that general motion from east to west, probably exercises its influence below the surface of the sea. Another cause of the lower current towards the west, may be looked for in the pressure of the many streams, some of them very

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because the water, which flows out at Gibraltar, can only come from a considerable depth, and consequently from the middle of the sea.

* Phil. Trans. in the place above quoted.

considerable, falling into the Mediterranean, and that of the Black Sea, entering it from the east; this pressure can become sensible only at the single, proportionably narrow, issue of the Mediterranean, where it easily overcomes the counter-pressure of the ocean, the force of which is broken by the coast of the two continents, by which it is bounded. Lastly, in considering the causes of this motion of the waters, we must bear in mind the possibility of a dam, which when the two seas formerly broke through the isthmus which separated them, still remained, and even now causes certain directions in the course of the water. The inconsiderable lateral currents, on the surface of the strait, towards the west, which Tofino, and others before him, have remarked, are perhaps to be considered as secondary effects of the main current, such as are observed on the banks of large rivers, and as they are chiefly observed at new and full moon, partly as caused by that planet.

It is a general opinion of the Spanish fishermen, that the strait grows gradually wider, and this perfectly coincides with the historical accounts of the breadth of the strait.* This enlargement of the

* The earliest statement of Skylax of Caryanda makes the breadth of the strait equal to that of the Thracian Bosphorus, that is only a quarter of a geographical mile. The accounts of the breadth make it greater as they approach nearer to our times. Thus, later than the time of Skylax, it is stated at three-fifths of a geographical mile; still later, at one geographical

channel, may, perhaps, be connected with the subsiding of the surface of the Mediterranean in general, a phenomenon, for which more historical and physical testimony may be found, than for the contrary one, of its increase, by encroaching on the land in some places, which probably may depend upon local circumstances. The filling up several harbours with sand, the alluvion of considerable tracts upon the coasts, and the union of islands and rocks, with the continent, which were formerly surrounded by the sea, even where there are no rivers like the Nile to produce this effect, occur on many parts of the coast.* The Black Sea and the Caspian offer a phenomenon perfectly similar, very large tracts having gradually become uncovered on their coasts; it is therefore probable that these formerly great inland seas, began to decrease in depth when they became connected with the ocean. But the hypothesis, that the great basin which was once formed by the Euxine and the Sea of Asoph, and perhaps also by the Caspian, after bursting its dam in the Bosphorus, flowed westwards into the Mediterranean, but receded on the east, from the declivities of the Steppe of Caucasus into the pre-

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mile; by Strabo, one geographical mile and a half; by Pliny, almost one geographical mile and two-fifths. At present the narrowest part is almost two geographical miles. (See Von Hoff's abovementioned work, p. 150.)

* The facts are collected with great diligence in Mr. Von Hoff's abovementioned work.

sent level of the Caspian sea, should be combined, we think, with the opening of the strait of Gibraltar; at least, there are not so many physical reasons for believing that the strait was formed by the ocean breaking through. It must be left to future investigation, to determine whether a conformation like that in the Mediterranean is found in other great gulfs, for instance, that of Mexico, which it in so many respects resembles.

The formation of the mountains in the vicinity of the town of Tarifa, agrees with that about Gibraltar; the limestone, however, is in thin strata, and the slabs are therefore used for domestic purposes. On the limestone lies a slaty bluish sandstone, of a finer grain than that of St. Roque. On the most southern point of the continent, which runs out from the harbour, towards a small rocky island, on which a tower is built, we observe a massy conglomerate of rolled fragments of limestone, and remains of still existing sea animals, such as cardium, mytilus, and the large flat edible *Ostrea jacobæa* (the Mediterranean scallop), which are sometimes heaped together in thick layers, united only by a little stalactic limestone. There are also petrified alcyonia, corallines, sponges, madrepores, &c. in this alluvial land, which has evident traces of a very recent origin; it appears to be constantly on the increase, as the sea daily brings a sufficient quantity of marine animals, and calcareous cement.

After we had viewed the environs of Tarifa, the company, including Baron Von Neveu, resolved to return, in a small fishing boat, to Algesiras. We all felt ourselves in an agreeable frame of mind, at the view of this southern country, and delighted with the peculiar romantic spirit of the Spanish people, which is more freely manifested here, as it generally is in the warmer countries, and our longing after the tropical regions was increased. The evening was delightful, the night clear and serene, and the constellations of the northern hemisphere, reflected in the gently agitated waves of the strait, appeared to us here at the mouth of the ocean, to beam upon us with their friendly rays, as if to bid us a last farewell. We had scarcely arrived at Algesiras, when the ambassador received orders from the Court of Vienna, for the Austria to proceed alone to Rio de Janeiro, without waiting for the rest of the convoy. As the news of the troubles of Pernambuco had just then been received at Gibraltar, we congratulated ourselves on thus escaping a further loss of time, which might be caused by the continued delay of the Portuguese squadron. We had been only one day in Algesiras, when the east wind suddenly set in, and we were summoned on board by a gun fired from the Austria, and the hoisting of the signal flag. Towards noon a boat appeared, with the news that the frigate would sail in an hour, and immediately conveyed us on board.

All was ready for sailing; only our colleague, Professor Mikan, who had gone too far from Algesiras, on a botanical excursion, had not yet returned; we therefore began to be uneasy on his account, when just as the anchor was weighed, and the sails spread, he fortunately came on board.

NOTE TO CHAPTER III.

The animals collected at Gibraltar and Algesiras are —Amphibia: *Testudo* Mydas; *Lacerta* lepida, viridis, ocellata, bosciana, maculata; *Scineus* algira; *Gecko* fascicularis; *Seps* tridactylus. Pisces: *Muræna* Anguilla, Helena; *Esox* Sphyraena, Belone; *Pleuronectes* Solea; *Labrus* microlepidotus, maculatus, carneus; *Epinephelus* ruber; *Trigla* pini; *Raja* Torpedo; *Syngnathus* Typhle; *Blennius* viviparus, Pholis; *Trichiurus* ensiformis. Insecta: *Scarabæus* stercorarius, vernalis; *Geotrupes* punctatus; *Copris* hispana, Paniscus; *Onites* Bison, Sphinx; *Oniticellus* flavipes; *Onthophagus* Taurus, medius, Schreberi; *Hister* æqualis, bipustulatus, unicolor; *Ateuchus* sacer, semipunctatus, variolosus, flagellatus; *Trox* granulatus; *Cetonia* Morio, stictica, hirta; *Omaloplia* terricola, ruricola, brunnea; *Anisoplia* fruticola, horticola; *Hoplia* argentea; *Silpha* rugosa, lunata; *Scarites* Gigas, subterraneus, levigatus; *Proscus* cephalotes; *Staphylinus* olens; *Zuphium* olens; *Aptinus* Ballista? *Buprestris* villosa; *Akis* acuminata; *Tentyria* orbiculata; *Erodius* gibbus; *Scaurus* striatus, punctatus; *Pimelia* muricata, bipunctata; *Helops* caraboides; *Ditomus* sphærocephalus; *Cistela* ruficollis; *Lagria* hirta, læta; *Lixus* ferrugatus, angustatus; *Pachygaster* goerzensis; *Chrysomela* eumolpa; *Colaspis* areata; *Clythra* longimana, humeralis; *Cossyphus* Hoffmanseggii; *Coccinella* mutabilis; *Forficula* auricularia, Panorpa halterata; *Xylocopa* violacea; *Andrena* plumipes; *Scolia* flavifrons; *Bombus* terrestris; *Sphex* spirifex; *Scorpio* australis, europæus; *Scolopendra* morsitans; *Julus* Indus, terrestris;

Cymothon physodes, linearis; *Oniscus* pustulatus, Asellus, Armadillo, sylvestris; Aranea picea; *Ligæus* equestris, Tabanus bovinus; *Bombylius* melanocephalus, fuscus; *Truxalis* hungaricus; *Papilio* D. Hyali; N. Megæra; Sat. Pasiphæ, Janira, Rumina; Pleb. R. Phlaius. VERMES: *Sipunculus* nudus; *Noctiluca* miliaris; *Veretillum* cynomorium; *Actinia*, div. sp.

The plants belonging to the Downs of Gibraltar are—*Scirpus Holoschœnus*; *CYPERUS FASCICULARIS*; *Bromus rubens*; *FESTUCA ALOPECUROS*, *Calycina*, Digitaria, Dactylon; Juncus maritimus; Polygonum maritimum; *RUMEX THYRSOIDEUS*; *Plantago Lofflingii*, *Lagopus*; Salicornia fructicosa; *Convolvulus Soldanella*; *Scrophularia frutescens*, *Crucianella maritima*; Cakile maritima; *Cheiranthus trilobus*; *Cachrys Libanotis*; *Caucalis maritima*; *DAUCUS MURICATUS*; Oenanthe pimpinelloides; *ERYNGIUM ILICIFOLIUM*; *Frankenia lævis*; Anagallis cœrulea, *Monelli*; *Linum maritimum*; *Drosophyllum Lusitanicum*, *Lk.*; *Corrigiola littoralis*; *Medicago marina*; *ONONIS RAMOSISSIMA*, *viscosa*, *VARIEGATA*, *PICTA*, *HISPIDA*; Euphorbia Paralius. —The vegetation of the mostly dry hills about Algesiras agrees with that of the Queen's Chair; we found on both—*Daphne Gnidium*, *villosa*; *PASSERINA CANESCENS*; *Olea europæa*; Ligustrum officinale; *Thymus vulgaris*, *Zygis*, *patavinus*; *Eriostemum Lusitanicum*, *Lk.*; *Sideritis romana*, *subspinosa*; *Prasium majus*; *LAVANDULA MULTIFIDA*; *Phlomis purpurea*; *Teucrium valentinum*; *Rosmarinus officinalis*; Hedera Helix; *Erica umbellata*, *scoparia*, *australis*; *Cistus populifolius*, *formosus*; *Helianthemum halimifolium*, *glutinosum*, *serratum*, *guttatum*; *Tuberaria*; *Delphinium peregrinum*, *PENTAGYNUM*; Rubus fruticosus; *Polygala monspeliensis*; *Sedum arenarium*, Brot.; Ulex europæus; *Genista candicans*, *tridentata*; *Trifolium angustifolium*; *Spartium spinosum*; *Pistacia Lentiscus*.—In the meadows and pastures there were—*Cyperus longus*; Scirpus acicularis; *Schœnus*

mucronatus, nigricans; Panicum verticillatum; Cynodon Dactylon; *Agrostis miliacea*; Phalaris arundinacea; *Festuca uniglumis*, *ciliata*, *divaricata*; *Brachypodium distachyum*; Poa annua, trivialis; *Briza maxima*, *minima*; Phleum pratense; *Alopecurus pratensis*; *Ægilops ovata*; *Chrysurus cynosuroides*; *Cenchrus echinatus*; Lolium arvense; Elymus europæus; *Andropogon Gryllus*; *Arundo Donax*; *Dactylis hispanica*, glomerata; *Trisetum paniceum*; Danthonia decumbens; *Piptatherum* (*Milium*) *comosum*; Anthoxanthum odoratum, β. minus; *Stipa tortilis*; Gladiolus communis; Alisma ranunculoides; *Valeriana Calcitrapa*, *Fedia*, *Cornucopiæ*, *Plantago*, *Psyllium*, *Bellardi*, lanceolata; Chenopodium album; *Illecebrum Paronychia*, *echinatum*; *Prunella intermedia*; Betonica stricta; *SALVIA BICOLOR*; *Orontium siculum*, *calycinum*, *Asarina*, *Orobanche minor*; *Batschia viscosa*, *versicolor*; *Pinguicula lusitanica*; Veronica arvensis, hederæfolia; *Echium violaceum*, *creticum*; *Cerinthe aspera*; *Lithospermum fruticosum*; Symphytum tuberosum; Myosotis scorpioides, arvensis; *Anchusa italica*; *Cynoglossum pictum*; *Hyoscyamus albus*; Solanum nigrum, *miniatum*; Convolvulus *althæoides*, sepium arvensis, *tricolor*; *Anagallis Monelli*, *COLLINA*, *latifolia*; Samolus Valerandi; Hottonia palustris; *Campanula Erinus*; *Lobelia urens*; *Galium hirsutum* Nees (*ovalifolium*, Schott.); *Rubia lucida*, tinctorum; Valantia cruciata; Sherardia arvensis; Dipsacus sylvestris; *Scabiosa Grammuntia*, *grandiflora*, Columbaria; Anthemis arvensis; *Scolymus hispanicus*; *Centrospermum chrysanthemum* Spreng.; *Cynara pygmæa*; *CHICHORIUM DIVARICATUM*; *Sison Anisum*; Oenanthe pimpinelloides, *prolifera*, *apiifolia*; Viola canina; Lythrum Hyssopifolia; *Lychnis læta*; Linum usitatissimum, *Strictum*; Silene gallica, *bellidifolia*, *Cerastium dioicum*; Erythræa *conferta*, grandiflora, *maritima*; *STATICE ALLIACEA*; Chlora perfoliata; Hypericum perforatum, *ciliatum*; Papaver Rhœas; Euphorbia segetalis, *retusa*, Esula; *Lotus edulis*, *intermedius*, *Lois*; *Medicago*

Terebellum uncinata, orbiculata; Scorpiurus vermiculata; Vicia hirta, sulcata, atropurpurea.—Lastly, the plants which we have noticed as most characteristic on the rock of Gibraltar are—*Daphne Gnidium; Anarrhinum tenellum; Prasium majus; NEPETA RETICULATA; Phlomis purpurea, Teucrium valentinum; Lavandula multifida; Thymus patavinus; Sideritis subspinosa; Statice cordata, sinuata; Verbascum sinuatum; Vinca major; Cotyledon Umbilicus; Fumaria capriolata; Genista candicans;* and lastly, *Chamærops humilis*, the European Dwarf Palm, the fruit of which is a favourite food of the monkeys.—The species whose names are printed in Roman characters belong to the temperate part of Europe, those in *Italics* to the south of Europe, and those in *ITALIC SMALL CAPITALS* to the latter, and particularly to the north of Africa.

CHAPTER IV.

VOYAGE FROM GIBRALTAR TO MADEIRA, AND ACROSS THE ATLANTIC OCEAN TO RIO DE JANEIRO.

On the 3d of June, at noon, we left the bay of Gibraltar, accompanied by above fifty vessels of various sizes, which, like ourselves, had waited for a favourable wind to proceed from the strait into the ocean. There was a fresh east wind, and our vessel, which was a remarkably quick sailer, soon got the start of all the other ships. In an hour we had already doubled the most easterly point of Cabo Carnero, and were in the middle of the strait where the two continents are only a few miles from each other. The current from the west is here very remarkable, and every experienced eye readily perceives its effects on ships coming from the ocean. According to the general opinion, it runs from four to five leagues in an hour, which are therefore deducted from the ship's reckoning in sailing out. While we proceeded over the dark green waters of the strait, the Spanish coast appeared in a blue mist; we could clearly distinguish two chains of mountains running from the E.N.E. to W.S.W. The most

distant rises considerably above the nearer verdant hills, which gently ascending, rest on the steeper and more naked ridges of the others, and intersected by many little valleys, extend without any abrupt declivities towards the sea. On two of the extreme points of this cape there are still standing some Moorish watch-towers, and further to the west, we saw the sandy cape of Trafalgar, celebrated for the victory of Nelson. A blue streak higher towards the N. W. which terminates in the narrow Cabo de S. Sebastian, was the last point of the European continent which we were able to see. The mountains on the African side of the strait were, for the most part, enveloped in mist; they, however, appeared to us in their general outline to resemble those of the Spanish coast. At four o'clock we passed Tangiers at a distance of three or four leagues; we could clearly distinguish the town with its small, flat-roofed houses, surrounded with walls, and low square towers, behind which are steep limestone hills, and here and there detached masses of rock. At five o'clock, Cabo Spartel lay about six leagues distant in E.S.E.; the thought of leaving two quarters of the world to proceed to a third, affected us all. The vicinity of ancient Africa, which has remained the same for centuries, without improvement, the recollections of the boundaries which antiquity believed were set by these straits to its enterprises; the tradition of the happy Atlantis, which we

hoped to find again in the luxuriant America, so rich in the wonders of nature; the idea of bidding farewell to Europe, the seat of civilisation and intellectual superiority; every thing combined to make the passage between the Pillars of Hercules into the ocean, a moment in our lives never to be forgotten.

At six o'clock in the evening the last points of the European and African coasts vanished from our eyes, and we were in the midst of the ocean; the waves rose majestically over each other, and seemed to swallow up the vessels as they glided down into their deep hollows; the ocean itself, like the serene firmament above it, showed as it were, in its deep blue, an image of its unfathomable depth. Each of the ships that had sailed with us, henceforth guided by the compass, pursued upon the ocean which divides and unites all the continents, the way to its own destination; our frigate, which was a-head of all the rest, advanced with incredible rapidity towards the west. The wind still continued to blow briskly from the east, and the sails and deck were covered with dew; we sailed upon an average nine miles an hour. Though the first sight of the boundless element, of the rising and setting sun, of the moon and the starry heavens, transported the imagination of the beholder, the mode of life on board offered but little variety and amusement. The phosphorescence was very inconsiderable in this latitude, and, proceeding from only a few

single animals, did not present the splendid sight which had gratified us in the Mediterranean. The greater was our pleasure that the stronger and more favourable the wind became, and the more rapidly the ship sailed, the sea-sickness, from which so many of us had suffered during our passage through the Mediterranean, gradually disappeared, and we were all able to remain upon deck without any inconvenience.

The sea-sickness is extremely troublesome to people at sea. All are not attacked in the same degree; in general, persons of strong constitution, and dwelling on the sea-coast, appear to suffer less from it than such as are weakly, and inhabitants of inland or mountainous countries. Instances of the contrary are, however, to be met with; nay, even sailors inured by many voyages, are attacked by it during violent storms. It is certain that the cause of this disorder is not so much the sight of the boundless ocean, the fear of danger excited by it, and the disagreeable smell proceeding from the water in the hold, which immediately corrupts, longing for home, &c. but principally, if not entirely, the unsteady motion of the ship. The sensation which the voyager experiences from the heaving of the immense fluid element, is exactly similar to that which many persons feel from the motion of a carriage by land, and many continue to feel it even after they have been several hours on shore. This sickness generally commences with

an oppression and pain in the head, and proceeds through a series of the most disagreeable sensations to more or less painful contractions in the stomach, which terminate in continued and violent vomitings, which sometimes even cause the bursting of a blood-vessel; or it happens that the patients, from the disgust excited by the smell or sight of food, fall into consumption for want of proper nourishment, and in long voyages are often in danger of their lives. He who has experienced the torments of this disorder, knows that a person attacked by it would willingly exchange all earthly happiness, for a single hour on shore, and will therefore consider it as no unimportant object in the journal of a voyage. Several remedies have been proposed to remove or to alleviate this disagreeable sickness. Seafaring people especially recommend oranges, and the rust of the anchor. The most approved means against this evil are dietetical, and require above all things to remain as much as possible upon deck in the open air, and near the main mast, where the rocking of the vessel is least felt; not to look at the surface of the sea at all, or not steadfastly; to accustom yourself, instead of fluid, and especially warm nutriment, to solid, cold, particularly acid food, and such as requires good digestion; for instance, salt fish, ham, &c., but principally to overcome the first attacks of the sickness, and even the disposition to vomit, by immediately taking heavy food, however re-