7. In addition to the inferences stated under 6, it is obvious that extensive basaltic eruptions in certain portions of the North Atlantic depression have interfered with the regularity of the suboceanic continental slope. These are associated with terrigenous rocks on the continental side of the slope, but apparently not so on the oceanic side. Of the former case Franz Josef Land and the Hebrides supply noteworthy instances.

8. With respect to the amount of elevation undergone at various periods along the eastern margin of the North Atlantic basin, there are no very certain data. Speculation on this point should be confined within reasonable limits, and we ought to be content with the minimum divergence from present-day conditions which is required to account for the most obvious facts. Subsequent to the commencement of the Tertiary period, local changes to the extent of 500 fathoms would still leave the great depths unaffected, whilst there is no reason to believe that any changes to this extent have occurred in Pleistocene times. In Fig. 1 it will be seen that special prominence has been given to the 500-fathom line.

II.—On the Families of Sauropodous Dinosauria.[1]

By Professor O. C. Marsh, Ph.D., LL.D.

THE subclass Dinosauria, as known to-day, I have divided into three orders: the Theropoda, or carnivorous forms; the Sauropoda, or herbivorous quadrupedal forms; and the Predentata, also herbivorous, and including several suborders, namely, the Stegosauria and Ceratopsia, both quadrupedal, and the Ornithopoda, containing bipedal bird-like reptiles.[2]

The principal characters of the order Sauropoda, here discussed, may be briefly stated as follows:—

Order SAUROPODA.

External nares at top of skull; premaxillary bones with teeth; crowns of teeth rugose, and more or less spoon-shaped; large antorbital openings; no pineal foramen; alisphenoid bones; brain-case ossified; no columellæ; postoccipital bones; no predentary bone; dentary without coronoid process. Cervical ribs co-ossified with vertebræ; anterior vertebræ opisthocœlian, with neural spines bifid; posterior trunk vertebræ united by diplosphenal articulation; presacral vertebræ hollow; each sacral vertebra supports its own sacral rib, or transverse process; no diapophyses on sacral vertebræ; neural canal much expanded in sacrum; first caudal vertebra biconvex; anterior caudals procœlian. Sternal bones parial; sternal ribs ossified. Ilium expanded in front of acetabulum; pubes projecting in front, and united distally by cartilage; no post-pubis. Limb bones solid; fore and hind limbs nearly equal; metacarpals longer than metatarsals; femur longer than tibia; astragalus and calcaneum not fitted to end of tibia; feet plantigrade, ungulate; five

[1] Abstract of communication made to Section D, British Association for the Advancement of Science, Bristol Meeting, September 12, 1898.

[2] The Dinosaurs of North America, Sixteenth Annual Report, U.S. Geological Survey. 84 plates. Washington, 1896.

digits in manus and pes; second row of carpal and tarsal bones unossified; locomotion quadrupedal.

(1) Family Atlantosauridæ. A pituitary canal; large fossa for nasal gland. Distal end of scapula not expanded; coracoid quadrilateral. Sacrum hollow; ischia directed downward, with expanded extremities meeting on median line. Anterior caudal vertebræ short, with lateral cavities; remaining caudals solid; chevrons single.

Genera *Atlantosaurus, Apatosaurus, Brontosaurus* include the largest known land animals. Jurassic, North America.

(2) Family Diplodocidæ. External nares at apex of skull; no depression for nasal gland; two antorbital openings; large pituitary fossa; dentition weak, and in front of jaws only; brain inclined backward; dentary bone narrow in front. Scapula with shaft somewhat enlarged at summit. Ischia with shaft expanded distally, directed downward and backward, with sides meeting on median line. Sacrum hollow, with three co-ossified vertebræ. Anterior caudal vertebræ procœlian, with sides deeply excavated, and chevrons single; median caudals excavated below, with chevrons double, having both anterior and posterior branches; distal caudals elongate, with rod-like chevrons.

Genera *Diplodocus* and *Barosaurus*. Jurassic, North America.

(3) Family Morosauridæ. External nares anterior; large fossa for nasal gland; small pituitary fossa; dentary bone massive in front; teeth very large. Shaft of scapula expanded at distal end; coracoid suboval. Sacral vertebræ four in number, and nearly solid; ischia slender, with twisted shaft directed backward, and sides meeting on median line. Anterior caudals solid; chevrons single.

Genera *Morosaurus, Camarasaurus* (?) (Amphicœlias). Jurassic, North America and Europe.

(4) Family Pleurocœlidæ. Dentary bone constricted medially; teeth with crowns like those of *Diplodocus*. Cervical vertebræ elongate, centra hollow, with large lateral openings; sacral vertebræ solid; with lateral depressions in centra; caudal vertebræ solid; anterior caudals with flat articular faces, and transversely compressed neural spines; median caudal vertebræ with neural arches on front half of centra. Ischia with compressed distal ends, and sides meeting on median line.

Genera *Pleurocœlus, Astrodon* (?). Jurassic, North America and Europe. Include the smallest known Sauropoda.

(5) Family Cardiodontidæ. Teeth of moderate size. Upper end of scapula expanded; humerus elongate; fore limbs nearly equalling hind limbs in length. Sacrum solid; ischia with wide distal ends, and sides meeting on median line. Caudal vertebræ biconcave; median caudals with double chevrons.

Genera *Cardiodon* (Cetiosaurus), *Bothriospondylus, Ornithopsis*, and *Pelorosaurus*. European, and probably all Jurassic.

(6) Family Titanosauridæ. Fore limbs elongate; coracoid quadrilateral. Presacral vertebræ opisthocœlian; first caudal vertebræ biconvex; remaining caudals procœlian; chevrons open above.

Genera *Titanosaurus* and *Argyrosaurus*. Cretaceous (?), India and Patagonia.