

among asses distinguishes this animal from those. The transverse diameter of the skull and the form of the nasal bones conditioned thereby are like those in the horse, as is also the eye-socket. The perfectly preserved teeth show that the length of the upper jaw is 34 per cent of the length of the skull. Rütimeyer finds for the horse, elsewhere, 32 to 35.6; for the ass 35 to 38.5 per cent. Thus it should be a horse. Also, the relation of the premolar row of the lower jaw to the dental row, which in the horse is 51 to 53 per cent and 49 in the ass, is 52 per cent in the skull from the lake-dwelling, thus again as in the horse. Only the occiput, says Rütimeyer, looks like that of an ass. And he closes his observations: "Notwithstanding all the uncertainties which seem to attach to these measurements, not only on the teeth but on the skull as well, certainly derived from nature, there remains in my mind no doubt that the skull from the lake belonged to an ass."

The kindness of Doctor Lehmann, Director of the Swiss Landesmuseum in Zürich, enabled me to make a direct comparison of the skull from Auvernier with the mummified skull from Abadieh and with the skulls from the Somme which I studied in the Museum of Natural History in Paris.

During this investigation there arose again the question which I had asked myself before, during the study of the craniology of the ruminants: *What are the really decisive criteria of species, and what the incidental characteristics brought into existence by causes acting during individual life?* At last I came to the realization that a conclusive method of discrimination did not exist; that all those in use might be said to be wholly empirical, in part, indeed, dependent on the personal perception and feeling of the individual student, and therefore not scientifically established. Nor have I succeeded—through lack of material, fresh heads and numerous skulls of asses—in adding much that is new; but I believe that I have thrown some light upon the causality of some of these relations, and have tried to incite to a more scientific treatment of the question.

#### CRANIOLOGICAL DIFFERENCES BETWEEN THE ASS AND THE HORSE.

The older authors, as De Blainville in his *Ostéographie*, and Cuvier, do not supply what is really needful for the comparison in question. L. Rütimeyer has opened the way here, too, as in many other branches of paleontology. His "Beiträge zur Kenntniss der fossilen Pferde," etc.,\* was the first work worthy of note on the fossil remains of the genus *Equus*, but he did not treat of the differences between the horse and ass till in his second treatise "The Horses of the Quarternary epoch"† in the same year as the studies of Frank mentioned above. In the meantime this relation had been discussed by R. Owen in his "Description of the Cavern of Bruniquel and its Contents,"‡ in which are beautiful plates representing the teeth characteristics of the horse and ass.

\*Rütimeyer, Beiträge zur Kenntniss der fossilen Pferde u. zur vergleichenden Odontographie der Huftiere ueberhaupt. Verh. Naturf. Gesellsch., Basel, Bd. III, 4, 1863.

†Rütimeyer, Weitere Beiträge z. Beurtheilung d. Pferde d. Quaternär Epoche. Abhandl. d. Schweiz. paleontol. Gesellsch., II, 1875.

‡Owen, Philosoph. Transactions, vol. 159, 1869, pp. 517-557.