

yielded an abundant fauna, in which the apes are absent, the antelopes have dwindled in size and number, the deer have grown very abundant, true elephants for the first time appear, associated with a species of hippopotamus, nearly if not quite identical with the living African one, two kinds of hyæna, and the hipparion and machairodus that had survived from earlier times. This fauna indicates a decided change of climate to a more temperate character. Among the volcanic products of Haute Loire remains of *Mastodon arvernensis*, *Rhinoceros leptorhinus*, *Equus Stenonis*, and *Machairodus pliocænus* have been collected.

Along the southern coast of France, marine Pliocene deposits lying unconformably on every series older than themselves bear witness to the elevation of that region since Pliocene time, some of the beds reaching a height of 1150 feet above the present sea-level. These marine strata extend for some distance up the valley of the Rhone, where they mark the final deposits of the sea in that part of the mainland of Europe. They cap the plateaus and rise toward the north and west, indicating a maximum of elevation in that direction. The marls of Hauterives (formerly regarded as Miocene) are remarkable for their beds of coarse conglomerate, which represent some of the torrential deposits swept down from the neighboring hills. These marls contain land and fresh-water shells.

The whole series of Pliocene deposits in southern France has been divided into the following groups.<sup>107</sup>

Arcusian.	{	Fresh-water and volcanic groups of Auvergne, etc. (St. Prest, Perrier <sup>108</sup> ) with <i>Elephas meridionalis</i> in the younger and <i>Mastodon arvernensis</i> in the older deposits.
Astian.		Sands and clays of fluvatile or lacustrine origin, with a few shells ( <i>Unio</i> , <i>Anodonta</i> , <i>Planorbis</i> , <i>Helix</i> ) and a large and varied assemblage of terrestrial and fluvatile vertebrates ( <i>Dolichopithecus</i> , <i>Machairodus</i> , <i>Caracal</i> , <i>Hyæna</i> , <i>Mastodon arvernensis</i> , <i>Rhinoceros leptorhinus</i> , <i>Tapirus arvernensis</i> , <i>Hipparion</i> , <i>Helarctos</i> , <i>Gazella</i> , <i>Cervus</i> , etc., Montpellier, Rousillon). Yellow sands with <i>Potamides Basteriotti</i> , <i>Cerithium vulgatum</i> , <i>Congeria</i> , <i>Ostrea cucullata</i> , <i>Pecten benedictus</i> , <i>Cardium</i> , <i>Venus multilamella</i> .
Plaisancian (200-250 metres).	{	Sandy blue micaceous clays (with a large marine fauna, 233 species, comprising <i>Nassa semistriata</i> , <i>Mitra striatula</i> , <i>Conus pelagicus</i> , <i>Cerithium vulgatum</i> , <i>Cytherea chione</i> , <i>Pecten benedictus</i> , <i>P. scabrellus</i> , <i>Ostrea cucullata</i> ).
		Lower conglomerates sometimes 80 feet thick.

<sup>107</sup> Fontannes, "Études Stratigraph. Paleont. pour servir à l'histoire de la Période, Tertiaire dans le Bassin du Rhône," Paris, 1875-89; Deperet, *Ann. Sci. Geol.* xvii. 1885; *Mem. Soc. Geol. France*, I. fascie. 1, 1890.

<sup>108</sup> Pottier, *Bul. Soc. Geol. France*, vii. 1879, p. 937.