

another effect of air, namely, fluid friction, the coefficient for which they believe to be independent of the tension ; and as far, therefore, as this effect is concerned, little is gained by diminishing the amount of the residual air. It would appear, however, that the fluid friction of hydrogen is much less than that of atmospheric air ; so that, were the heating effect due to fluid friction, it ought to be less in a hydrogen vacuum. An experiment was made with this purpose ; and, other circumstances being precisely similar, it was found that in a hydrogen vacuum the heating effect due to rotation was 22·5, while in an air vacuum it was 23·5. These numbers may probably be considered as sensibly the same, and this experiment would therefore appear to denote that the effect is not due to fluid friction.

15. The authors, in submitting these remarks to the Royal Society, do not suppose that their experiments have yet conclusively decided the origin of this heating effect, but they hope by this means to elicit the opinions of those interested in the subject, which may serve to direct their future research.

VIII. "On the Fossil Mammals of Australia.—Part II. Description of an almost entire Skull of *Thylacoleo carnifex*, Ow." By Professor OWEN, F.R.S., &c.

(Abstract.)

In this Part the author gives additional cranial and dental characters of the extinct marsupial carnivore, *Thylacoleo*, deduced from examination of better-preserved fossils, obtained from freshwater deposits in Darling Downs, Queensland, Australia.

The forepart of the skull, wanting in the first-described specimen from similar deposits in the province of Victoria, is preserved in the present specimen, showing the premaxillary bones, which are relatively larger than in placental felines. Each bone has three teeth, of which the foremost is developed into a tusk, the second and third being very small. There is no canine, or no tooth developed as a laniary in the maxillary bone. In the short extent of the alveolar border of this bone between the great carnassial molar and the maxillo-premaxillary suture, there are two approximate small round sockets, which lodged either one double-rooted tooth or two small single-rooted teeth. But dental development has mainly expended itself upon the perfection of a pair of laniary incisor tusks, in both upper and lower jaws, for piercing, tearing, and holding, and a pair of carnassials in both jaws for flesh-cutting. These, in the present specimen, closely agreed with those described in the former one, but were more worn: they are the largest examples of these peculiarly modified shear-blade teeth in the mammalian class. Although the tusks are incisors—not, as in placental carnivora, canines—they possess, through the singular shortness of the facial part of the skull in *Thylacoleo*, the same mechanical advantage, in their proximity to the biting-power of the enormously deve-

loped temporal muscles, as in *Felis*. In the lower jaw there is, anterior to the carnassial, either a socket for a small double-rooted premolar, or two approximate sockets for as many single-rooted ones; and, as in the upper jaw, these cavities do not range in the same longitudinal line with the carnassial, but extend obliquely inward and forward, from the inner side of its fore part. There is no other alveolus in the lower jaw between the premolar one and that of the large lower tusk. The small 'tubercular' molar on the inner side of the hind end of the upper carnassial, and the two 'tuberculars' behind the lower carnassial, are indicated by their sockets in the present specimen. The author sums up, from acquired data, the dental formula of *Thylacoleo* as follows:—Incisors $\frac{3-3}{1-1}$, Canines $\frac{?}{?}$, Premolars $\frac{1-1}{1-1}$ or $\frac{2-2}{2-2}$, Carnassials $\frac{1-1}{1-1}$, Tuberculars $\frac{1-1}{2-2}$. Of the incisors, the foremost above are long and large tusks, like the pair below: of the other teeth, the carnassials, of unusually large size, are functioned as flesh-cutters, and the small tuberculars would serve for pounding gristle or tendon, as in *Felis*: the premolars indicated by sockets, and the small upper incisors, represent a remnant of the dental family type under its extreme adaptive modifications in *Thylacoleo*.

In the rest of the skull of the subject of the present Part, many particulars are yielded in addition to those deduced from the fragmentary fossils which indicate the genus. They confirm the deductions of the marsupial nature of the large extinct Australian carnivore; determine the alternative expressed in the author's first communication as to the homologies of the inferior tusks, and show that the genus *Thylacoleo* ranges, not with the series now including *Didelphys*, *Dasyurus*, and *Thylacynus*, but with the Diprotodont group, more eminently characteristic of the Australian continent, and which is at present represented by, or reduced to, the genera *Phascolarctos*, *Phalangista* with its subgenera, *Macropus* with its subgenera, and *Phascolomys*. The carnassial of *Thylacoleo*, in its large proportional size, absence of the tubercular part, and indications of subvertical groovings of the enamel, most closely resembles that tooth of the more ancient marsupial carnivore *Plagiaulax*, and is associated, in the lower jaw, as in that genus, with two small posterior tuberculars, one or two small premolars, and one large incisive tusk, similarly directed obliquely upward and forward. Few facts in mammalian palæontology are more interesting and suggestive than the occurrence in our hemisphere, during secondary geological periods, of Marsupial forms, which find their nearest representatives in existing or tertiary extinct *Marsupialia* of the continent of our Antipodes.

The present Part of the author's series of Papers on Extinct Australian Mammals is illustrated with drawings of the entire skull of the *Thylacoleo carnifex*.