the Recherche Archipelago, western Australia, from the South Nepture Islands, south Australia, and from Seal Rocks, Victoria. From all the specimens thus available it became evident that there are two kinds of fur seal along the southern Australian coast—a smaller one and a larger one. The smaller one is to be found certainly on Eclipse Island and Recherche Archipelago, western Australia, and on the South Neptune Islands and Four Hummocks, south Australia. The main distribution of the larger animal includes such well recognized sites as Lady Julia Percy Island, Seal Rocks off Phillip Island, Victoria, the Tasmanian coasts and Montague Island, New South Wales.

Comparison of the skulls of the large and small animals shows that this difference is unconnected with age or sex. While adult male skulls of the smaller animal may reach a condylobasal length of up to about 246 mm, skulls of this length from males of the larger animals are definitely immature and, when adult, reach a condylobasal length of up to about 304 mm. In the size, shape and detail of the skull and teeth, skulls of the smaller Australian animal come within the range of variation of those of the New Zealand fur seal *A. forsteri* and must be taken as belonging to this species. The occurrence of this animal in breeding colonies, away from what is normally considered to be its typical range, is thus noteworthy. It was suggested more than 40 years ago that the fur seals present in Australia were *A. forsteri* and *A. doriferus*[5], but the description of *A. tasmanicus* in the following year[2] made for subsequent confusion.

Many recent authors, while suggesting or recognizing two kinds of fur seals, use *A. doriferus* for the smaller one and *A. tasmanicus* for the larger one. From the synonymy that Wood Jones[1] gives in the paper in which he names *A. doriferus*, and also from the drawing of a skull in a subsequent paper[4], it is obvious that he was using *A. doriferus* for the large fur seal of Victorian, Tasmanian and New South Wales coasts, but probably saw only immature skulls, whereas Scott and Lord based *A. tasmanicus* on adult skulls. Thus *A. tasmanicus* should now be included in the synonymy of *A. doriferus*, and the two fur seals present in Australia recognized as *A. forsteri* and *A. doriferus*. A more extensive paper on this subject, dealing in greater detail with the skulls, is in preparation.

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Zooidal Dimorphism in the Polyzoan *Hippopodinella adpressa* (Busk)

THE phenomenon of sexual polymorphism of zooids in cheilostomatous polyzoa is well known but not widespread, and so far only a few families are known to contain species whose zooids are modified according to their sexual condition. The occurrence of sexual polymorphism of zooids has been reviewed by Hyman[1].

In some species, notably *Hippothoa hyalina* (Linnaeus) and *H. bougainvillei* (d'Orbigny), there are male and female zooids and feeding autozooids. Male zooids have reduced non-feeding polypides with a small number of tentacles.
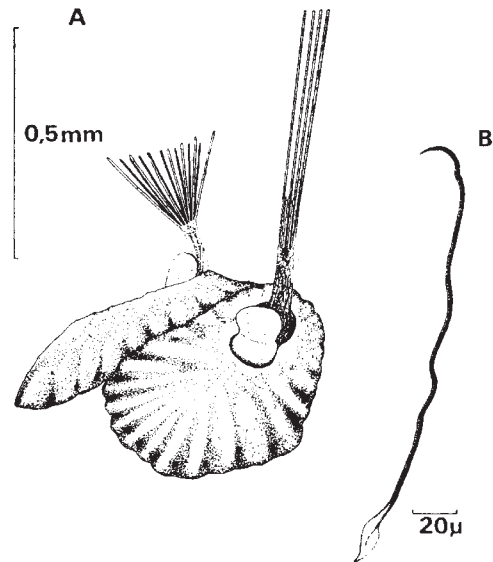

Fig. 1. *A*, *Hippopodinella adpressa*, two zooids. Autozooid with feeding crown (left); male zooid with eight modified tentacles (right). *B*, Mature spermatozoon from neck region.

Female zooids have greatly aborted polypides with no tentacles. Each of these zooids is distinct from the other because of skeletal and opercular characters[2,3].

Observations on live colonies of the cheiloporinid *Hippopodinella adpressa* (Busk) from Leigh, New Zealand, revealed that there were two zooidal types in the colonies. First, there were typical feeding autozooids with lophophores of fifteen or sixteen tentacles. Second, there were zooids with a reduced number of tentacles (four short and four long) and aborted guts. What would be the pharyngeal region, if the gut were functional, was packed with mature spermatozoa indicating the true nature of these zooids.

There are some unique features of the zooidal dimorphism of *H. adpressa*. (1) Although the polypides of male and non-male zooids are different, the zooecia are not. Thus it is impossible to distinguish between the two zooidal types on skeletal (including opercular) features alone. Past descriptions of *H. adpressa* have been based on expedition material and live specimens have evidently not been observed before.

(2) The tentacle crown of the male polypides consists of four long and four short tentacles (Fig. 1). The significance of this arrangement is unknown. The male polypides of *Hippothoa bougainvillei* have a perfectly symmetrical crown of four small tentacles.

Male zooids were first discovered in late November 1967, and were subsequently observed during the following 5 months before the recording of these observations. The male zooids are conspicuous by the length of their tentacles and their attitude. The tentacles are unciliated and are not usually spread out as far as those of an autozooidal tentacle crown and the "lophophoral" base constantly tilts, rocking the whole crown about from side to side.

Silén[1] has found that for certain anascan polyzoans the tentacles of autozooids may serve as ducts for sperm release. The tentacles of the male polypides were watched on several occasions for spermatozoa in the tentacle lumina, but these were not seen. Aggregations of mature spermatozoa (Fig. 1), however, were obvious in most individuals. There are no special female zooids. eggs being produced by autozooids.

The fact that male zooecia are identical to the autozooecia may be explained by the degeneration of male characters at the end of the breeding season and subsequent regeneration of feeding polypides, though this has

not yet been confirmed. The reverse of this situation is known for *H. bougainvillei*[3,5] in which autozooids may regenerate as male zooids.

Sexual dimorphism of polypides without corresponding modification of the zooecia probably occurs in other species, but this cannot be verified without a more widespread study of living material.

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Identification and Interpretation of Growth Rings in the Secondary Dental Cementum of *Ovis aries* L.

GROWTH rings in the secondary dental cementum of certain wild mammalian species permit the estimation of age, and in certain cases the sex and season of death for individual animals[1].

The determination of mortality frequencies for the mandibles and limb bones of domestic and wild species recovered from prehistoric settlement sites is relevant to the study of economic prehistory. So far, mortality frequencies have been based on the sequence of tooth eruption and replacement, and the age of epiphysial closure in modern specimens[2]. These methods are unsatisfactory, because so many variable factors influence the ages at which tooth eruption and epiphysial closure occur[3].

Two samples of ovine mandibles were therefore studied, in order to isolate and interpret such growth rings for a domesticated species. The first sample comes from fifteen ewes of known breed and age at death, raised at the Ruakura Animal Research Centre, New Zealand. The
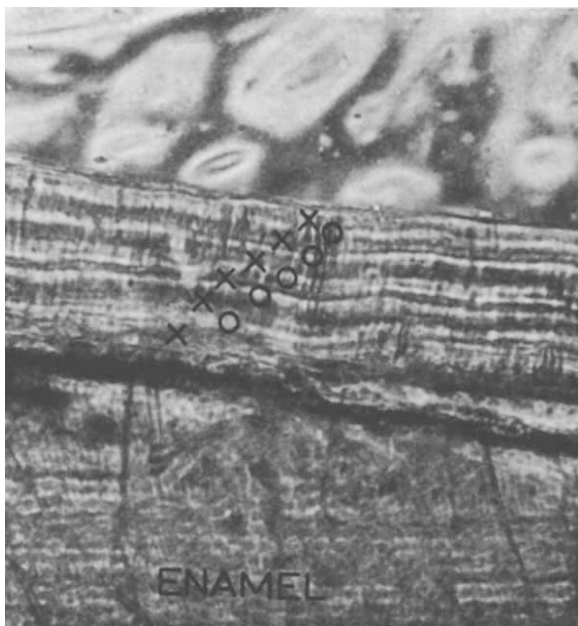
Fig. 1. Transverse section through the lower first molar of a 5 yr 7 month old ewe. Dark layers (×) represent summer deposition. White layers (○) denote lines of retarded deposition during winter. Scale: total thickness of cementum, 100μ.
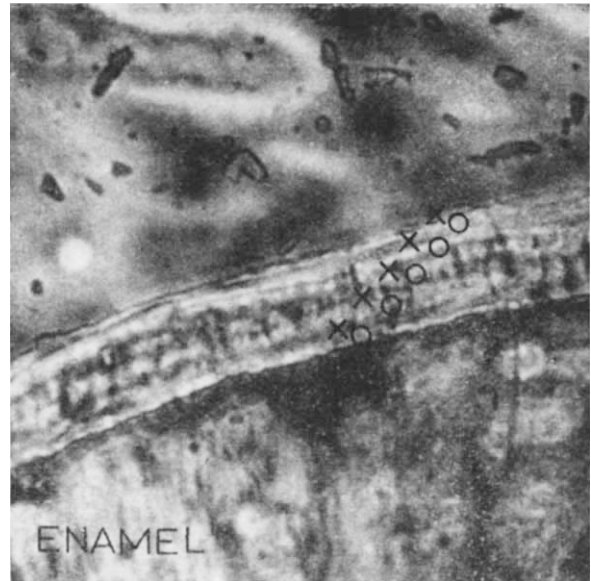
Fig. 2. Transverse section through the first molar of an Iron Age sheep from Barley. The dark layers (×) are thought to represent summer deposition, and the white layers (○) winter deposition. Scale: total thickness of cementum, 30μ.

second consists of prehistoric specimens from the late Iron Age settlement of Barley, England[4].

Both sections illustrated were cut in a transverse plane at the base of the crown. Several authors have noted that the best results for wild species are obtained through an examination of regions of maximum cementum deposition, such as the root tip[5]. This situation does not obtain for ovine teeth, because of the local cementocyte concentrations and the convoluted and hyperplasic nature of the cementum in the areas in question.

Major and minor rings were observed in both the secondary cementum and secondary dentine of the modern ovine teeth (Fig. 1). They were clearest when viewed in phase contrast conditions. Cementum was selected for further consideration, because it is continually apposed on the outside of the tooth, and the laminations are more consistent in size than those in the dentine.

Stages in the sexual cycle are prominent among potential factors causing ring formation[6]. The known occurrence of these events in individual animals, however, does not correlate with the number of observed rings in their teeth. It has been suggested that body condition is the proximal factor and diet the ultimate factor in ring formation[7]. The results reported here oppose this hypothesis, because the animals in question were provided with ample winter fodder (personal communication from R. Inkster). Yet there was restricted food intake in winter even when fodder was available at summer levels. Thus food restriction in the winter appears to be a relevant feature in the annual biological cycle of sheep, a situation suggesting that an internal metabolic factor based on a photoperiodic response is the causative factor involved.

The function of secondary cementum lies in attaching teeth to periodontal membrane. Because teeth move microscopically throughout life, secondary cementum must be continually apposed in order to re-attach the fibres of the periodontal membrane. The reduced tooth use during winter as a consequence of a smaller food intake may therefore account for the formation of the major bands. This interpretation is compatible with the formation of minor bands during other stress periods of shorter duration, such as pregnancy or the breeding season[5,6].

It therefore seems that the most acceptable interpretation for the successive layers in the cementum is that the thin white band of primary cementum located