Bibliography
The external bank/internal ditch arrangement seen at Dùn Ailinne and the other royal sites is characteristic of ritual sites. This pattern is also seen at henge monuments, ceremonial sites of the Neolithic and Early Bronze Age in Britain and Ireland (Waldb 1982:19).

In the final phases of Iron Age occupation, Dùn Ailinne seems to have been the site of periodic ritual feasts; animal bones formed a major portion of the archaeological evidence found there. Nearly 19,000 animal bones and fragments were recovered during the eight excavation seasons. As might be expected, cattle bones were the most numerous, followed by pigs, and small numbers of sheep and horses (Fig. 2). The larger numbers of pig bones were not unexpected either. Historical sources, including sagas, tales, and lives of saints, indicate that bacon and pork were favorite foods in early Irish society (Lucas 1965:10).

Mutton, on the other hand, was not commonly eaten. There are few references to the use of mutton in the early Irish sources (Lucas 1960:7). Horseflesh was not eaten in early Christian times. One reason for the ecclesiastical ban on its consumption may have been that early churchmen associated it with pagan rites (Lucas 1960:12).

**Identification of a Dairying Economy**

As noted above, historical sources indicate that cattle in ancient Ireland were kept primarily for dairying, not for meat. (See Lucas 1958, Ryan 1985, and McCormick 1983 for detailed discussions of this evidence.) If the Dùn Ailinne cattle were in fact dairy cattle, we would expect to find the bones of a large number of very immature animals. Since the yearly production of calves was essential for the population, a large number of excess calves was produced each year (Legge 1981:91). Since only a few bulls were needed for reproductive purposes, most male calves were killed at young ages. In 18th-century rural Ireland male calves were killed soon after they were born, and their skins were stuffed and placed near the cows to encourage milk production (Lucas 1958:81). In a dairying economy most of the adults will be elderly females, killed after their milk production has declined.

In order to identify a dairy herd archaeologically, we need to be able to determine the age structure of the population. Faunal analysts have developed several techniques for determining the ages at death of cattle bones. One which is commonly used is based on the analysis of teeth and jaws (Grant 1975). All mammals, including cattle, have two sets of teeth: (1) deciduous or milk teeth and (2) permanent teeth which replace the milk teeth in a known sequence for each species. Once all the permanent teeth have erupted, they continue to wear throughout an animal's lifetime. A juvenile animal's age at death can be estimated quite precisely by the extent to which the deciduous teeth have been replaced by the permanent ones. For an adult animal the degree of wear on the permanent teeth can provide a somewhat less exact estimate of age.

Estimates of ages at death for archaeological cattle are usually based on complete mandibles or lower jaws. Unfortunately, the Dùn Ailinne faunal assemblage was heavily fragmented, and complete lower jaws were rare. Of the 17 nearly complete mandibles that were recovered, however, 9 were from newborns and young juveniles up to six months of age (Fig. 3), 7 were from elderly adult cattle, and 1 was from a young adult. This age distribution is consistent with a dairying pattern. When individual tooth wear stages are examined, the results are even more striking (Fig. 4). Most of

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*Figures:

3. Mandible of a very young calf from Dùn Ailinne. The deciduous or milk teeth are unerupted, and the first permanent molar has not yet erupted. This calf was less than six months of age when it was killed. (Acc. no. E79:187; overall length 14.5 cm)

4. Graphic representation of the degree of wear present on the bovine deciduous fourth premolars (DP4) and third permanent molar (M3) of cattle from the final stratigraphic phase at Dùn Ailinne. The numbers of milk teeth showing no wear (DP4-I), minimal to moderate wear (DP4-2), and heavy wear (DP4-3), and the numbers of permanent teeth showing no wear (M3-I), light wear (M3-2), and heavy wear (M3-3) are indicated. DP4-I and DP4-2 indicate calves that were less than or equal to six months of age at time of death. M3-3 indicates mature and elderly adults which were well over 4 years of age at time of death. Very few older juveniles, adolescent, and young adult cattle were killed.
the loose teeth are milk teeth with little or no wear; the rest are permanent teeth showing heavy wear which may have come from elderly animals.

In a farming herd we would also expect most of the adult cattle to be female. In general it is difficult to determine sex from most cattle bones. The pelvis, however, is the most useful bone for sex determination since the female pelvis is shaped to allow the calf to pass through the birth canal. Although a few complete pelvis were recovered from Dén Afflème, those that did survive do seem to be predominantly female (Fig. 5).

Thus the archaeological evidence from Dén Afflème is consistent with a pattern of dairy production. A high proportion of the calves were killed early in life, and most of the adults were elderly, probably female, because they were no longer able to produce milk. If milk feeding had been a major goal of the subsistence strategy, we should have found a higher number of adolescent and young adult cattle.

The zooarchaeological evidence from Dén Afflème indicates that the site was not occupied on a year-round basis. No houses or other permanent residential structures were found there. The faunal data, when combined with the botanical evidence (Crabtree 1981), can also provide some information about the times of the year when ritual feeding may have taken place at Dén Afflème. The plant remains included hazel nuts, blackthorn and sallow (Prunus spinosa), both of which would have been available in September/October. A number of juvenile cattle seem to have been killed when they were about six months old. If these cattle were born in the spring (as cattle are born in the modern day), they would have been about six months old in September/October. Another large group of cattle milk teeth show little or no wear at all. These calves must have been killed shortly after birth, possibly in May or June. The faunal evidence therefore indicates that Dén Afflème may have been used as a site of ritual feeding in the late spring or early summer and again in the fall.

These faunal data may help us understand the economic role of ritual sites in early Iron Age Ireland. In the late spring and early summer there would have been a surplus of young male calves. In the fall female calves not needed for future breeding and elderly females whose milk production had declined might have been culled. Ritual feeding may have served to use seasonal surpluses of animals produced by a dairying economy.

While raising, and especially cattle feeding, has played a major role in European subsistence practices since the advent of food production (Bogucki 1984), in northwest Europe there is also a tradition of building ritual and ceremonial structures beginning in the Neolithic period. These sites include megalithic tombs, causewayed camps, and barrows. Excavations at a number of these sites have produced large quantities of animal bones, possibly indicating ritual feasting (see, for example) (Irish). If we are to understand fully the economic basis of Neolithic Europe, we must consider the animal remains from these ritual sites and their possible relationship to seasonal surpluses in farm production.

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IN MEMORIAM

Mabel Eiseley, wife of the late Loren C. Eiseley, inspiration for the Loren Eiseley Associates of The University Museum