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AN ARCHAEOLOGICAL STUDY OF FROGS AND TOADS FROM THE EIGHTH TO SIXTEENTH CENTURY AT REPTON, DERBYSHIRE

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ABSTRACT

During excavation work around the Church of St. Wystans at Repton, Derbyshire, a large quantity of Common frog (*Rana temporaria*) and Common toad (*Bufo bufo*) bones were discovered at several sites. The robbing holes, suspected saw-pit, crypt, drain and burial mound all appeared to have acted as historical pitfall traps (between the eighth and sixteenth century), which in some cases caught frogs and toads in large numbers. In the eighth and ninth century the Common frog was abundant compared to the Common toad which was rare or even absent from Repton. However, by the fourteenth century, toads had become well established, and in modern times, extremely abundant in the area. This change may be associated with the formation of an ox-bow lake between the ninth and sixteenth century.

A very high proportion of frog bones were recorded among the disarticulate human bones of the ninth century Viking burial mound. This mound is known to have been disturbed in the seventeenth century. However the almost complete absence of toad bones suggests that there has been little contamination to these deposits during and after the fourteenth century, since the Common toad appears to have been common in Repton from this time onwards.

INTRODUCTION

Repton has been the subject of detailed archaeological investigations from 1974 to 1988, with excavation centred around the church of St. Wystans which was used in 873-4 as the Winter camp of the Great Viking army. At several excavation trenches unusually high densities of amphibian bone were discovered. Because of the care of excavation it has been possible to give precise datings for all these samples. The bone preservation has been so good that diagnostic identification down to species level can be made on even juvenile bones.

A BRIEF HISTORICAL OUTLINE

Before the end of the seventh century a monastery was founded at Repton, which became closely associated with the royal house of Mercia. The Anglo-Saxon crypt of St. Wystans church probably served as a mausoleum, containing the body of Wystan who was buried at Repton around 839 (Biddle and Kjølbye-Biddle, 1985). In 873 the Great Viking army came up the River Trent and made their winter camp at Repton. They departed the following autumn of 874, but during this short period of occupation at least 249 Vikings died and were buried in a burial mound formed from the ruined foundations of an earlier building (Biddle and Kjølbye-Biddle, 1986). In the twelfth century an Augustinian priory was established by the Cannon of Cake (Biddle and Kjølbye-Biddle, 1985). After the dissolution of the priory in 1538, the building eventually formed part of the School at Repton.

METHODS

Bone material was separated out by searching and sieving (with a 1mm mesh) soil layers found to contain small animal bone. For extensive layers only samples were taken. Bone material from the crypt deposits were also sorted out by water floatation. Amphibian bones were recognised using features shown by Engelmann, Fritzche, Gunther and Obst (1985). Species identification was confined to the ilium, and based on features given by Holman (1985) and Engelmann *et al.* (1985). The ilium of the Common frog *Rana temporaria* has an obvious although anteriorly depressed ilial blade. The Common toad *Bufo bufo* lacks any trace of an ilial blade but has a low rounded ilial prominence.

RESULTS

Amphibian bones were found at five sites. These are referred to here as the following:

1. The Robbing holes
2. The Drain
3. The Mound
4. The Crypt
5. The Saw-pit

Table 1 shows the number of identified ilia recovered from each site. The archaeological context and specific details of each site are briefly outlined below. The trench, layer and feature reference numbers used in this excavation are given in the Appendix, Table 2. The bone material has now been deposited at the Derby Museum.

SITE	*CENTURY*	*NUMBERS OF ILIA*	
		Common Frog	*Common Toad*
Robbing holes	eighth	2	0
Drain	eighth - ninth	63	0
Mound	ninth*	64	2
Crypt	fourteenth - fifteenth	16	8
Saw-pit	sixteenth	2	1

TABLE 1: The numbers of identified ilia found at each site. * = disturbed in the seventeenth century and later (see text).

1. The Robbing Holes

Before the crypt of St. Wystans was constructed an earlier building stood just to the north of the crypt. This building (referred to as Building 'B' in unpublished reports) was demolished before the construction of the crypt in the mid-eighth century. During its demolition holes were left in the ground where timbers and possibly stone had been removed. Two of these holes contained frog bones. These deposits are probably dated to the first half of the eighth century.

2. The Drain

The crypt was probably built as a free standing mausoleum in the middle of the eighth century, possibly to take the body of King of Æthelbald who died in 757. Associated with the crypt there was a substantial drain lined with green Keuper sandstone and covered with large sandstone cover slabs (Fig. 1). The floor of the drain was soil. This drain was fed water from the crypt floor which had to flow under the lowest stone of the crypt wall with a mere 5cm clearance. Exactly where the water flowed to is not known since excavation had to be restricted to the first three metres of the drains course. The precise function of the drain is also not yet understood; it may have taken water from a baptismal basin that would have been large enough for total submersion, or have simply drained the crypt floor. Certainly by 849 when Wystan was buried in the crypt, the crypt would no longer have functioned as a baptistry.

A very large collection of frog bones were collected from a soil sample taken from within the drain. The sample of bones contained all skeletal components and included 96 femova and 63 ilia. This gives a minimum estimate of 48 frogs; however, since it was not possible to sample the entire drain, the actual number of individuals would certainly have been considerably greater. The femur length varied from a minimum of 9mm to a maximum of 26mm, mean 14.4mm, S.D. 3.63.

3. The Mound

A two-room stone building, sunk to about 80cm, was found during excavation, less than 100 metres west of the crypt. This sunken building pre-dates the crypt and already had been long abandoned when the Great Viking Army came in 874. Following the death of at least 249 individuals, the building was cut down to ground level and the disarticulated bones stacked neatly around the walls of the eastern compartment. Timbers were laid side by side over the burial chamber which was then covered by a low cairn of irregular stones and possibly a thin (less than 30cm) layer of top soil.

The burial mound was discovered and opened up around 1686 by Thomas Walker, opened up again in 1787, and briefly excavated in 1914 (Biddle and Kjølbye-Biddle, 1986).

Amphibian bones were found (during sieving of all soil excavated from the mound) in the disturbed human bone deposits, in the undisturbed and disturbed squatter deposits left while the building had been neglected, and lastly in the robber trenches made by Thomas Walker. Almost all of this amphibian bone was frog. A total of 64 Common frog ilia were found compared to just two Common toad ilia. The vast majority (79 per cent) of amphibian bone were found amongst the disturbed human bone. Because of the later disturbances to the mound the dating of most of these bones is uncertain (however see discussion).

4. The Crypt

In the late middle ages a stair had been inserted in the eastern recess of the crypt to give direct access from the outer court of the adjacent priory. The removal of the bottom step (the only surviving part of the stair) during archaeological excavations revealed a wedge of untouched deposits lying on and against the original eighth century structure of the crypt. Within these deposits were found a chip of red tile (dated not earlier than the thirteenth century) and a chip of glazed ceramic (not earlier than fourteenth century). These two items, taken in conjunction with the insertion of the stair which sealed these layers, suggest that the deposits should be dated at the earliest to the fourteenth century: they are unlikely to be much later.

Within these deposits many frog and toad bones were found. A total of 16 Common frog ilia and eight Common toad ilia were counted. The surviving wedge of soil would have only represented a tiny fraction of the total area of the crypt floor, which suggests that many more frog and toad bones would have been deposited in the crypt during this period.

5. The Saw-pit

North of the crypt, in the open besides the north-east corner of the north aisle, a large rectangular pit

Fig. 1 The excavated drain from Trench 3, Repton. View looking westwards towards the crypt of St. Wystans Church. The cover slabs are still in position for most of the drains length. The ranging rods are 50cm in total length.

(4m x 2m at the top, 1 m wide at the bottom) was discovered cutting through the remains of a priory-period trackway and cemetery. The pit was probably associated with some industrial process, and may be interpreted as a saw-pit. It probably belonged to the period after the dissolution of the priory in 1538, but the pottery and other finds suggest a date later not later than the mid-sixteenth century.

From the bottom of the saw-pit a small number of amphibian bones was found among a very large collection of larger (mainly domestic) animal bones. The identified amphibian bones consisted of two frog ilia and a single toad lilium.

DISCUSSION

The most obvious question is, how did these frog and toad bones get into these archaeological features? The simplest and most likely explanation is that these amphibians became trapped. The robbing-holes, the saw-pit and the crypt with its drain could all have acted as large pitfall traps from which escape was not possible for these amphibians. The mound is discussed later in this section.

The crypt floor had been sunken by about two metres from the original ground level (Biddle and Kjølbye-Biddle, 1985) and frogs and toads may frequently have fallen down the entrance steps and become trapped in the building. The density of bones (representing at least 12 individuals) in the small wedge of soil under the step demonstrates that many frogs and toads may have been trapped in the crypt around the fourteenth century. In the drain, the very high density of frog bones (at least 48 frogs in the sample examined) suggests that these deposits probably built up over a number of years. About 50 per cent of these were juveniles. The body length can be approximately calculated from the femur length in *Rana temporaria* (see Esteban and Sanchiz, 1985). Smith (1973), Paris (1985) and Engelmann *et al.* (1986) agree that this species of frog matures at a minimum body length of 40-45mm, and we have concluded that femurs below 14mm in length are juveniles.

We do not know if the frogs in the drain were actually trapped or if they used the drain as a refuge from which they ventured out at night via the drain outflow (if there ever had been one). It is most likely frogs which become trapped in the crypt entered the drain from the crypt floor. Inside the drain, escape would have been impossible if the outflow became blocked once the drain fell into disuse.

The complete lack of toad bones from the drain and robbing holes of the eighth and ninth century contrasts the situation seen in the fourteenth and sixteenth century when Common toads were obviously present, representing 33 per cent of the total sample. The modern day situation is even more interesting, with the toad now extremely common in Repton, especially around the excavation trenches. Indeed the Common toad *Bufo bufo* is so abundant that Thorn (1989) records that each summer baby frogs (in fact toadlets) are allowed to migrate through the Hall at Repton school. These toadlets are all migrating from the breeding pond, the Old Trent Water. During the peak period of toadlet migration an archaeological trench 10 x 10 metres, about 85 metres south of the Old Trent, caught approximately 0.5 litres of toadlets each day, which had to be carefully gathered up and released before excavation work could proceed. The Smooth newt *Triturus vulgaris* in also common in the area with several animals having been found in the terrestrial phase during excavation work in the Cloister Garth and around St. Wystans Church. We have never seen Common frogs *Rana temporaria* at Repton during the Summer though it is reported by the local people to be present.

It can be argued that toads were not represented in the robbing holes, drain and mound because of an associated trap bias for frogs at these sites. The importance of archaeological trap bias for frogs or toads is not known but we note that the bone material at these sites contained a broad spectrum of small mammal species which suggets that these pitful traps were surprisingly unselective. We suspect that the frogs and toads simply fell into these archaeological features by accident and therefore the bone material does provide an unbiased picture of local anuran abundance.

Why has the anuran population in Repton changed so drastically from frogs to toads since the eighth and ninth century when only frogs appear to have been present? The Common toad had already become well established by the fourteenth century. A possible explanation may be the formation of an ox-bow lake produced when the Trent River changed its course.

The Viking army sailed up the Trent River which in 874 flowed past the seven metre high bluff on which Repton stands. However by 1576 the River had changes course to its modern channel some 850m to the north (Saxton, 1576 in Cameron, 1973), leaving an ox-bow lake (the Old Trent Water) which has gradually silted up since this time. This change in the river may have been produced as a result of serious flooding known to have occurred at the end of the thirteenth or early fourteenth century (Cameron, 1973). By 1699 Gilbert Thacker of Repton House was already concerned that the old channel would turn into a standing pond, although it would appear that water still flowed freely in the Old Trent at this time (Kitching, 1988).

The Common toad in modern times breeds successfully in the Old Trent despite it being well stocked with fish. The large pond appears to provide ideal breeding conditions for toads which are known to prefer deep water and permanent ponds, contrasting the Common frog which breeds in temporary or shallow ponds (Smith, 1973). Common toads will even breed at the edge of large reservoirs (Raxworthy, pers. obs.). Beebee (1979) reports that the Common toad is able to dominate the Common frog in larger older ponds which have fish populations. This probably reflects the unpalatable nature of toad tadpoles to fish. Perhaps the increased abundance of the Common toad in the fourteenth century can be attributable to the formation of the ox-bow lake during the floods of the late thirteenth or early fourteenth century. Provided the water was slow flowing, the old meander of the river could have provided a suitable breeding habitat which previously would not have been available.

We cannot offer a firm explanation for the apparent decline in the Common frog at Repton in modern times. There is no evidence of direct competition between the Common frog and Common toad therefore the most likely explanation is a change in the local habitat. Possible frog breeding sites such as smaller ponds in marshy areas close to the Trent river may have been drained in recent times. Certainly we were unable to find shallow ponds around the excavation sites at Repton, and breeding sites for the Common frog may now be scarce in the area.

The Mound

There are several questions associated with the amphibian bones found in the mound. Firstly how significant was the disturbance made by the previous excavations and secondly how were these bones deposited?

Considering the first question it is clear that some frog bones had never been disturbed after the mound was first formed in the ninth century. Eight frog ilia were found in the undisturbed squatter occupation layers and in the clean Keuper marl of the burial chamber. The remaining 58 ilia were found in Thomas

Walker's disturbed deposits of the seventeenth century. 56 ilia were Common frog and just two ilia were Common toad.

The evidence from the deposits of the fourteenth century crypt and the sixteenth century saw-pit both demonstrate that the Common toad was well established in Repton at this time. This contrasts the eighth and ninth century when only frogs were found in the robbing holes and drain. The rarity of the Common toad bones from the mound suggest that these bones from the mound do belong to the ninth century and have received little contamination during later excavation work. If the mound bones had been subject to contamination in the sixteenth century or more recently we feel certain that many more toad bones would have been discovered. However we can not say that no contamination has occurred, only that it appears that most of the amphibian bones are contemporary with other eighth and ninth century deposits.

Alternative evidence also suggests that the small bone material of the mound is ninth century. Many small mammal bones have been recovered from the charnel, including voles, shrews, woodmice, housemice and moles. However no brown rats or rabbits have been found (Pfeiffer, 1987). Both these species only invaded England in post-Anglo Saxon times.

Assuming that the frogs are from the ninth century, how did they get into the mound and among the charnel? The mound was covered by a low cairn of irregular stones. This has never been covered by more than a thin layer of top soil and initially the cairn may have been completely exposed. Under these conditions it is not to difficult to imagine frogs finding there way between the large stones into the sunken building containing the human bones, and some individuals may easily have become trapped. As top soil accumulated on the mound, either naturally or perhaps scraped up at a later date, then the voids between the stones would have become sealed, preventing subsequent immigration.

CONCLUSIONS

The unusual quantity of frog and toad bones collected at Repton appears to have been the accidental result of the robbing holes, saw-pit, crypt, drain and burial mound all acting as historical pitfall traps. These amphibian bones suggest that in the eighth and ninth century the Common frog *Rana temporaria* was abundant at Repton, while the Common toad *Bufo bufo* was rare or even absent. However by the fourteenth century toads were well established and in modern times have become extremely abundant. This change may be associated with the formation of the Old Trent Water ox-bow lake which was formed between the ninth and sixteenth century.

The very high proportion of frog bones recovered from the charnel in the Viking burial mound suggest that these small animals bones date from around the ninth century and contain little subsequent contamination.

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APPENDIX

SITE	*TRENCH*	*FEATURE NUMBER*	*LAYER NUMBERS*
Robbing holes	4	2731, 3029	2455, 2912
Drain	3	1116	1320-1322
Mound	8	922	293-4, 303, 718, 721, 735-6, 741, 804
Crypt	3	—	2004, 2007-10
Saw-pit	5	816	322, 329

TABLE 2: The trench, feature and layer numbers which contained amphibian bones.

Pfeiffer, J. S. (1987). *The animal bones from Trench 8, Repton, Derbyshire. M.Sc. Thesis*. Philadelphia, University of Pennsylvania.

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ECOLOGICAL RESPONSES IN A POPULATION OF SMOOTH NEWTS (*TRITURUS VULGARIS MERIDIONALIS*) IN AN UNPREDICTABLE ENVIRONMENT

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ABSTRACT

The annual cycle of a population of Smooth newts (*Triturus vulgaris meridionalis*) was studied at a temporary pond in Central Italy. Timing of migration differs from that described in northern countries. Immigration and reproduction take place as soon as weather conditions are favourable (December), males arriving earlier than females. Emigration lasts a short period (April-May) and ends before pond desiccation (June). Summer drought is therefore not a limiting factor for adult activity as it is for larval survival. The aquatic period is short compared to that of northern populations and during the summer terrestrial phase probably little activity occurs. Males exceed females in the breeding population. In particularly dry conditions not all the female population reaches the pond. The average growth rate during the aquatic phase is approximately 1mm. An hypothesis on the influence of environmental conditions on adult body size is suggested.

INTRODUCTION

Many studies have been carried out in the past few years on the ecology of *Triturus vulgaris* L., mainly in North and Central Europe. This research was on population dynamics (Bell, 1977, Blab and Blab, 1981, Griffiths, 1984, Verrell and Halliday, 1985), on several aspects of reproduction (Bell and Lawton, 1975, Halliday, 1977, Verrell *et al.*, 1986), on the niche (Dolmen, 1983, Dolmen and Koksvik, 1983, Griffiths, 1987), on the age determination and growth rates (Hagström, 1977, 1980, Verrell and Francillon, 1986, Verrell, 1987). The ecology of the Italian subspecies *Triturus vulgaris meridionalis* (Boulenger) has not yet been studied. The present distribution of newts in Italy might have been influenced by historical factors however climatic conditions, such as temperature and rainfall, probably also have a strong effect (Giacoma, 1988).

The pond which we investigated lies on the President's Estate of Castelporziano, a few kilometers south of Rome. The Estate is one of the last areas on the Tyrrhenian Coast still covered by floodplain forest. It is also close to the southern limit of the distribution area of *Triturus vulgaris meridionalis*. At Castelporziano the climate is particularly dry, the long summer drought causes ponds to dry up completely, this is the most dramatic event in the newts' annual cycle but it is also affected by other variable factors such as temperature, rainfall and the succession of the aquatic invertebrate community. Average pond water level varies from year to year since water comes exclusively from rainfall.

At Castelporziano *Triturus vulgaris meridionalis* spends less time in water than northern populations and it has little terrestrial activity in the summer, thus research on growth was undertaken during its aquatic phase in a temporary pond.