Malacological records from the Upper Pleistocene at Portelet (Jersey, Channel Islands): comparisons with western and central Europe

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BOREAS

Rousseau, Denis-Didier & Keen, David Henry 1989 03 01: Malacological records from the Upper Pleistocene at Portelet (Jersey, Channel Islands): comparisons with western and central Europe. *Boreas*, Vol. 18, pp. 61–66. Oslo. ISSN 0300-9483.

New sampling of Mollusca from Portelet, Jersey, Channel Islands, has allowed characterization of local conditions during deposition of the pre-Kesselt Weichselian loess. The Portelet fauna also allows a re-assessment of the distribution of the *Columella* fauna in western Europe. Comparison of the Portelet fauna with those of eastern France and central Europe shows a decrease of the number of species present in this far-western locality which appears to be either a result of the operation of a typical 'peninsula' effect comparable to that seen in other zoological groups or a consequence of their occurrence in a marginal part of the European loess belt.

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Cold climate Pleistocene land Mollusca are recorded at only a small number of sites on the south shores of the Channel: at Nantois, Port-Morvan, Bréhat, Mont-Dol and Val André in Brittany (Puisségur in Monnier 1980; in Chaline & Monnier 1976; Rousseau in Monnier & Bigot 1987), at Le Havre, Tancarville, Luc-sur-Mer, Roumare and Asnelle in Normandy (Puisségur in Lautridou 1985; Rousseau unpublished), at Sangatte near Calais (Rousseau unpublished) and in both the larger Channel Islands (Keen 1982, 1986). In all these localities the faunas are found in calcareous loess or in slope deposits derived from it or in dune sands. Typically the glacial faunas consist of a small number of molluscan species tolerant of low temperatures and extreme conditions of humidity. Taxa present at all localities are *Pupilla muscorum* (Linné), *Trichia hispida* (Linné) and Succinidae. Because of the problems of identification in Pleistocene Succinidae, the exact number of species of this family that occur is uncertain. *Succinea oblonga* Draparnaud is recorded from most of the sites. *Oxyloma pfeifferi* Rossmässler is noted from St. Martins Point, Guernsey by Keen (1982), and it is possible that *Catinella arenaria* (Bouchard-Chantereau) may also be present although it has not actually been recorded from any of the sites noted above. Plates of the slug genus *Deroceras* may also occur, and the calcareous granules attributed to the genus *Arion* are also recorded (Keen 1982, 1986). The arctic–alpine species *Columella columella* (von Martens) has been noted only from Bréhat and the two larger Channel Islands.

The Portelet site

In the island of Jersey, Mourant (1935) described four sites which have yielded non-marine Mollusca. These were reinvestigated by Keen (1982), but during this study only two Mourant sites could be found. At one of the 'lost' sites, Portelet, during examination of the sections prior to the visit of the INQUA Loess Commission and the Periglacial Commission of the IGU in August 1986, mollusc-rich layers were found in the loess (Fig. 1). Collection of 7.5 kg of sediment provided the following Mollusca:

Succinea oblonga Draparnaud	322
Columella columella (von Martens)	2
Pupilla muscorum (Linné)	451
Deroceras sp.	2
Arion sp.	granules
Trichia hispida (Linné)	46

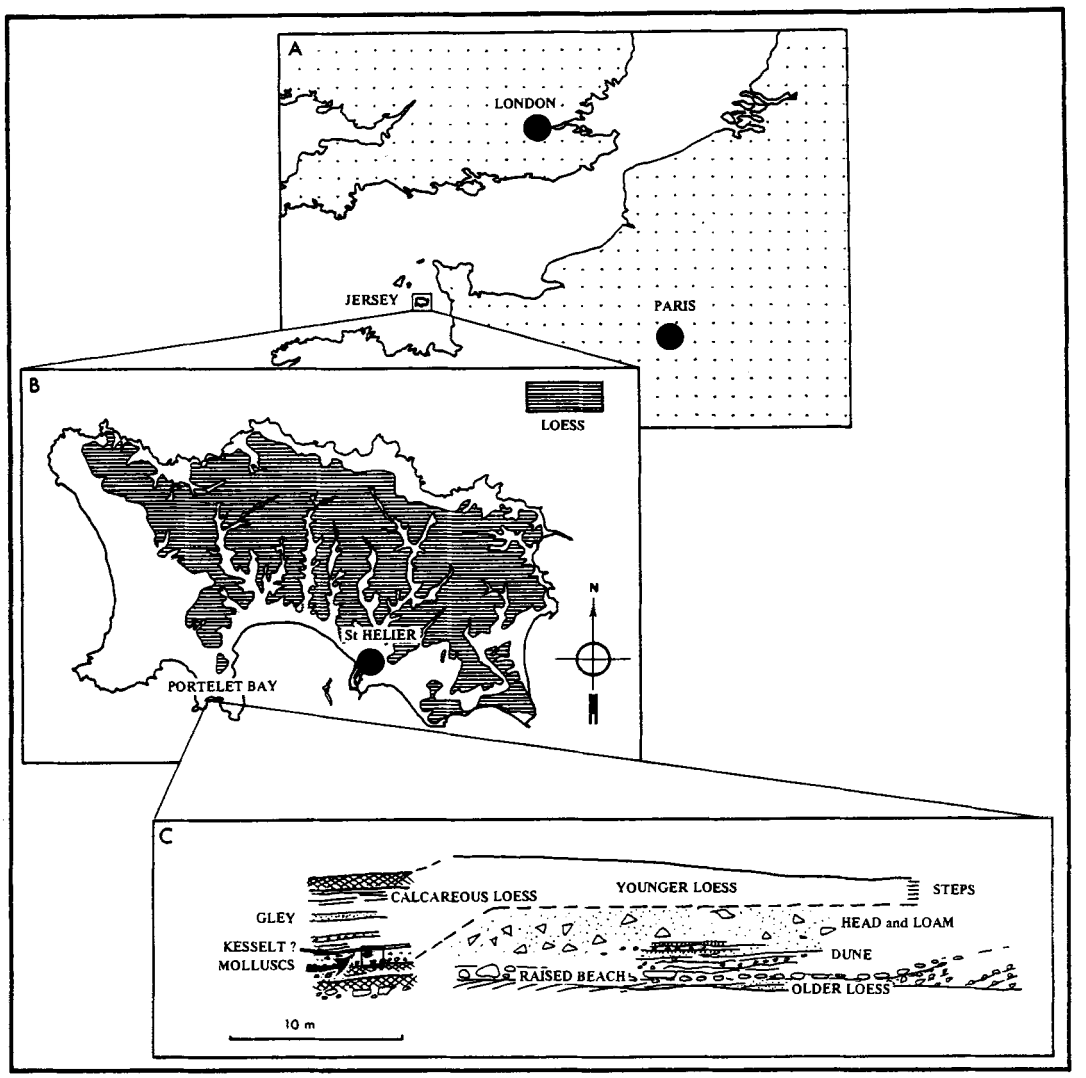

Fig. 1. Geographical and geological context of the study: A. Location of Jersey, Channel Islands. B. Distribution of the loess deposits on Jersey and location of Portelet Bay. C. Portelet section with location of the sampling column (modified after Lautridou *et al.* 1986).

Further collecting by D-D. Rousseau during the visit to the locality (Fig. 1) by the two Commissions on the 23rd August, 1986 gave a series of stratified samples and the Mollusca listed in Table 1.

The stratigraphy of the Portelet site is a complicated one and has been described by Lautridou *et al.* (1986) (Fig. 1). At the base of the section is a wave-smoothed surface cut in coarse-grained Corbiere Granite. On top of this is up to 2 m of head which is a rubble of granite fragments, weathered quartz and feldspar sand, and loess. Above this is 0.50 m of loess or very loessic head, which is truncated by an erosion surface. Above this erosion level is a beach deposit composed of boulders of granite up to 0.30 m long axis, which with its pebble and sand matrix is up to 0.70 m thick. Capping the beach is 1.30 m of horizontally bedded red-brown blown sand. The upper layers of the unit are humified and have the early stages of pedogenesis visible in them. The blown sand passes up

Table 1. Mollusca at the Portelet site, from bottom (1) to top (5).

Species	1	2	3	4	5
Succinea oblonga Draparnaud	69	97	117	76	35
Columella columella (von Martens)	22	32	9	10	23
Pupilla muscorum (Linné)	202	232	222	243	159
Deroceras sp.	4	3	1	8	3
Trichia hispida (Linné)	106	93	54	42	18
Total	403	457	403	379	238

into granitic head at the sides of the bay, but in the centre the head is replaced by up to 8.0 m of loess infilling a channel in the head. The top of the succession is also in loess in total up to 4.90 m thick. The lower part of this loess is calcareous and yielded the Mollusca, but the higher parts are decalcified and have a *'limons à doublets'* texture.

Malacological analysis

The Mollusca noted above were collected from five samples each representing *c.* 15 cm slices of sediment. Although the 1986 samples yielded the same five taxa as recorded by Keen (1986), the stratified sampling now allows some comment on the changes in abundance of Mollusca through the sequence and thus changes in the environment of deposition of the Portelet deposits. The Mollusca represented in the sample occur at different values through the sequence.

Pupilla muscorum is present at 50.12% at the base of the series of samples, but increases in representation to 66.81% at the top.

A similar pattern of changes occurs for *Columella columella* and *Succinea oblonga* with an increase for the former from 5.46 to 9.66%, and for the latter from 17.12 to 20.05% up the section. For *S. oblonga* the uppermost value is 14.71% which shows a fall in percentage for the topmost sample, and the most numerous representation, 29.03% in the middle of the sediment.

Deroceras sp. also increase their values upward from 0.99% in the lowest sample to 0.25% in the middle of the succession, to values of 2.11 and 1.26% in the topmost sample.

Only *Trichia hispida* shows a decrease in numbers up the sequence with a fall from 26.30% at the base to 7.56% at the top.

It is clear from the small number of species represented at Portelet that the deposits were laid down under conditions of some climatic severity. The high values throughout for marsh taxa such as *S. oblonga* show that the site of deposition was generally under wetland conditions. None of the other taxa represented would be out of place in such an environment. The increase upwards of the most damp-tolerant species at the expense of the most hygrophobe, *T. hispida*, perhaps points to an increase in wetness up the sequence. It is difficult to see any real evidence of regional climatic changes in the Portelet deposits, but the increase of the hardier elements of the fauna at the expense of *T. hispida* perhaps points to increasing cold upwards as well as increasing wetness. At present *T. hispida* is found north of the Arctic Circle only at the Norwegian coast (Kerney & Cameron 1979), unlike the rest of the fauna which is northerly and/or continentally distributed. A further indicator of a severe climate is the form of *P. muscorum* present at Portelet. The shells range up to 4 mm in height compared to just 3 mm for recent local specimens. This size increase agrees with the observed size increase for Pleistocene populations elsewhere in north-west Europe which has been correlated with the increased cold of periglacial conditions (Kerney 1963; Rousseau 1985).

In summary then, the Portelet fauna is the product of a cold and wet environment, with some evidence of both an increase in wetness and a decrease in temperature up the section.

The age of the Portelet fauna

The restricted diversity of the Portelet assemblage does not allow any suggestion of age to be made on palaeontological grounds, and the only evidence for dating must come from the stratigraphy of the deposits enclosing the fauna. The key horizons here are the major raised beach near the base of the section and the geliflucted layer above the mollusc-

bearing level which can be equated with the widely recognized Kesselt level of Normandy (Lautridou *et al.* 1986). The raised beach horizon is generally correlated with the '8' m beach of the Channel Islands of Keen (1978) which in turn has been dated to an age of 121 ka by the stalagmitic cement of the beach outcrop at the Belle Hougue cave in the north of the island (Keen *et al.* 1981). Thus the Portelet fauna cannot exceed 121 ka in age. The Kesselt level, present in loess across much of northern France, marks the boundary between the Middle and Upper Weichselian wherever it occurs. The mollusc-rich deposits at Portelet underlie this horizon and therefore must be older than this datum (Fig. 1). The exact age of the Mollusca cannot be more precisely stated than this, but as the shelly horizons are only a little below the Kesselt level and not separated from it by any erosion, it seems most probable that they are close to the Middle Weichselian/Upper Weichselian boundary in age.

Comparison with other areas in north-west Europe

The loess of the Channel Islands represents one of the westernmost parts of the European loess belt. Further east the loess is thicker and other fossiliferous sites occur. Comparison with these faunas shows a broadly similar environment occurring over long distances, with the Portelet assemblage being only a small part of the whole faunal province. Correlation between these widely separated sections has been obtained by the recognition of similar cycles of loess deposition linked by significant horizons such as mark lines.

The faunas of these loess sequences whether they occur in northern France, as described by Puisségur (1976) or in central Europe as described by Lozek (1964), are characterized by two malacological associations poor in numbers of species but rich in numbers of individuals.

These faunas can be divided up on the basis of their major members into a *Pupilla* fauna and a *Columella* fauna. The former is dominated by species of the genus *Pupilla* such as *P. muscorum, P. alpicola* (Charpentier), *P. sterri* (Voith) and *P. loessica* Lozek with the latter two taxa being especially prominent. Accompanying the *Pupilla* sp. are *T. hispida* and *S. oblonga* although these are often minority members of the fauna. The environment thought to be indicated by the *Pupilla* fauna is steppe.

The *Columella* fauna is richer in numbers of species than the former one. For example at Achenheim (Alsace, France) the major species are *C. columella, Vertigo parcedentata* Braun, *V. genesii* (Gredler), *V. alpestris* Alder, *Vallonia tenuilabris* (Braun), *P. alpicola, P. muscorum, T. hispida, S. oblonga, Eucobresia nivalis* (Dumont et Mortillet) (Rousseau 1987). The environment occupied by these species is tundra-like.

The first of these two associations can no longer be found anywhere in Europe, the second is still partly represented in modern tundra areas. At individual localities in western Europe not all of the species noted in the two assemblages above may be present, but major elements of the two faunas allow in almost all cases the two environmental types to be recognized by way of these molluscan faunas.

At most localities so far discovered in the west, the cold climate faunas are typified by the steppe *Pupilla* fauna. In Normandy virtually all the sites on the calcareous loess are of this type with numerous *P. muscorum*, and *T. hispida* and *S. oblonga* also being present (Puisségur in Lautridou

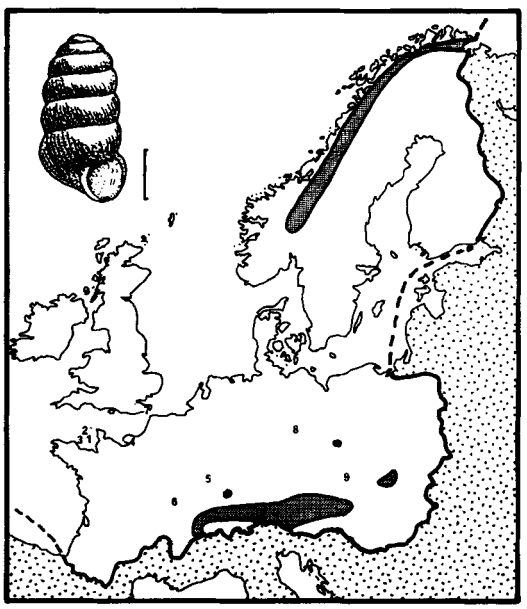

Fig. 2. Present distribution of *Columella columella*, shading, in North and Middle Europe (modified after Kerney *et al.* 1983). The scale bar is 1 mm long. 1 Jersey, 2 Guernsey, 3 Bréhat, 4 Le Havre, 5 Achenheim (Alsace), 6 Burgundy, 7 Kent, 8 East Germany, 9 Czechoslovakia.

1985). Only at Le Havre (Fig. 2) has a *Columella* fauna been recorded (Lautridou 1985).

In Brittany the position is similar. At several sites in the Baie de St. Brieuc the typical faunas are dominated by *P. muscorum* with subsidiary *Vallonia costata* (Müller), *V. pulchella* (Müller) and *T. hispida* (Puisségur in Monnier 1980; Rousseau in Monnier & Bigot 1987). At only one site, Bréhat (Fig. 2), has a typical *Columella* fauna been described. Here J. J. Puisségur (in Monnier 1980) has recorded the following species: *P. muscorum* 230, *C. columella* 30, *S. oblonga* 50 and *Limax* sp. 1. This association is closely similar to the Portelet fauna, but marks the only other occurrence of such a tundra assemblage in the Normandy–Brittany area during the Weichselian stage.

Further to the north and the east the *Columella* fauna is absent from the Paris Basin and in the Pas de Calais, the site of Sangatte, Calais, recorded by Rousseau has yielded *P. muscorum, T. hispida* and *S. oblonga* but no *Columella* (Rousseau unpublished). The *Columella* fauna is again present at Achenheim (Fig. 2) in Alsace (Rousseau 1987) and in central Europe (Fig. 2) it occurs up to the Weichselian Tardiglacial (Lozek 1964; Fuhrmann 1973). This fauna is also found in Burgundy (Fig. 2) in Weichselian colluvial sands (Puisségur 1976), and in the Late-glacial deposits of Kent (Fig. 2) in south-east England (Kerney 1963).

This review of the localities where cold climate molluscan faunas in western France and Britain are recorded shows that the tundra assemblage typified by *C. columella* spread to the extreme western parts of the continent during the Weichselian/Devensian stage (see Rousseau 1986). By comparison with central European faunas of the same type, however, those of western Europe are impoverished in terms of species numbers.

Two explanations can be proposed for such impoverishment:

(1) The very small number of species in these faunas is similar to those faunas of the high arctic at present (Kerney & Cameron 1979). It is possible that such climatic conditions also affected western Europe during Weichselian times, but the relative richness of the central European faunas of the same age suggests that another influence on the western faunas has occurred. This may be the 'peninsula' effect noted by Blondel (1979) where the faunas of peninsulas have reduced numbers of species compared to the adjacent areas. This phenomenon operates at present in France where molluscan species numbers are reduced from the Paris Basin to the peninsula of Brittany (Kerney & Cameron 1979). In the Weichselian the peninsula effect would have been accentuated by the position of Normandy, Brittany and south-east Britain at the far western end of a long corridor of loess–tundra delimited in the north by the main Weichselian/Devensian ice sheet and in the south by the smaller Alpine ice cap. The core area of the *Columella* fauna was in central Europe. Western France and south-east Britain were at the outer limit of this zone with corresponding reduction in the numbers of the species in the fauna.

(2) Very similar poor assemblages occur also in marginal parts of the central European loess belt (Lozek 1965). The loess occurrences of Brittany and the Channel Islands are situated in such a marginal zone and this represents the so-called 'damp loess landscape' which is usually characterized by a fauna poor in species.

Acknowledgements. – The sections at Portelet were sampled during the visit of the INQUA Loess Commission and the Periglacial Commission of the IGU. We thank our fellow members of the party for helpful discussions in the field. The section at Portelet was prepared for examination by members of the La Société Jersiaise to whom especial thanks are due. D-D. Rousseau was financially supported by CNRS during the completion of this work. Special thanks to Dr J. Chaline (Dijon) for reading the manuscript and Dr V. Lozek (Prague) for comments and suggestions.

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