CHAPTER EIGHT

IDENTIFYING ANCIENT MIGRATION
CASE STUDIES II: IRON AGE AND NORSE BURIALS ON THE ISLE OF LEWIS

> *"Lewis…(is) but thinly peopled, because it is mountainous and rocky, and almost unfit for cultivation…Olaf took possession …and dwelt there; living, however, very scantily"*
>
> *Chronicles of Man, 13th century* (Graham-Campbell & Batey 1998, 4).

8.1 Introduction

Lewis is the largest and most northerly of the chain of islands west of the Minch, that comprise the Outer Hebrides (or Western Isles) and includes Harris, North and South Uist, Barra and St. Kilda. The Inner Hebrides refers to the islands between the Minch and the Scottish mainland such as Skye, Eigg, Rhum, Canna, Mull, Tiree and Coll. The Outer Hebrides remained largely untouched by the Roman occupation of southern Scotland and thus, their first millennium AD remains, to all intents and purposes, a prehistoric period (Armit 1996, 161). Accordingly, in this region, the Iron Age denotes the period from ~500 BC to 500 AD and the Viking Age ~780-1100 AD. The intervening period is sometimes termed Late Iron Age or the historical period of the Picts and Scots. The terminology referring to the Viking period will follow that of Ritchie (1993, 9) wherein Vikings are Scandinavian warriors, raiders and settlers from Norway, Sweden or Denmark. In Scotland the culture is termed Norse as all the evidence points to the settlers being predominantly of Norwegian origin (Ritchie 1993, 15). A domesticated Viking on Lewis was, therefore, a Norseman.

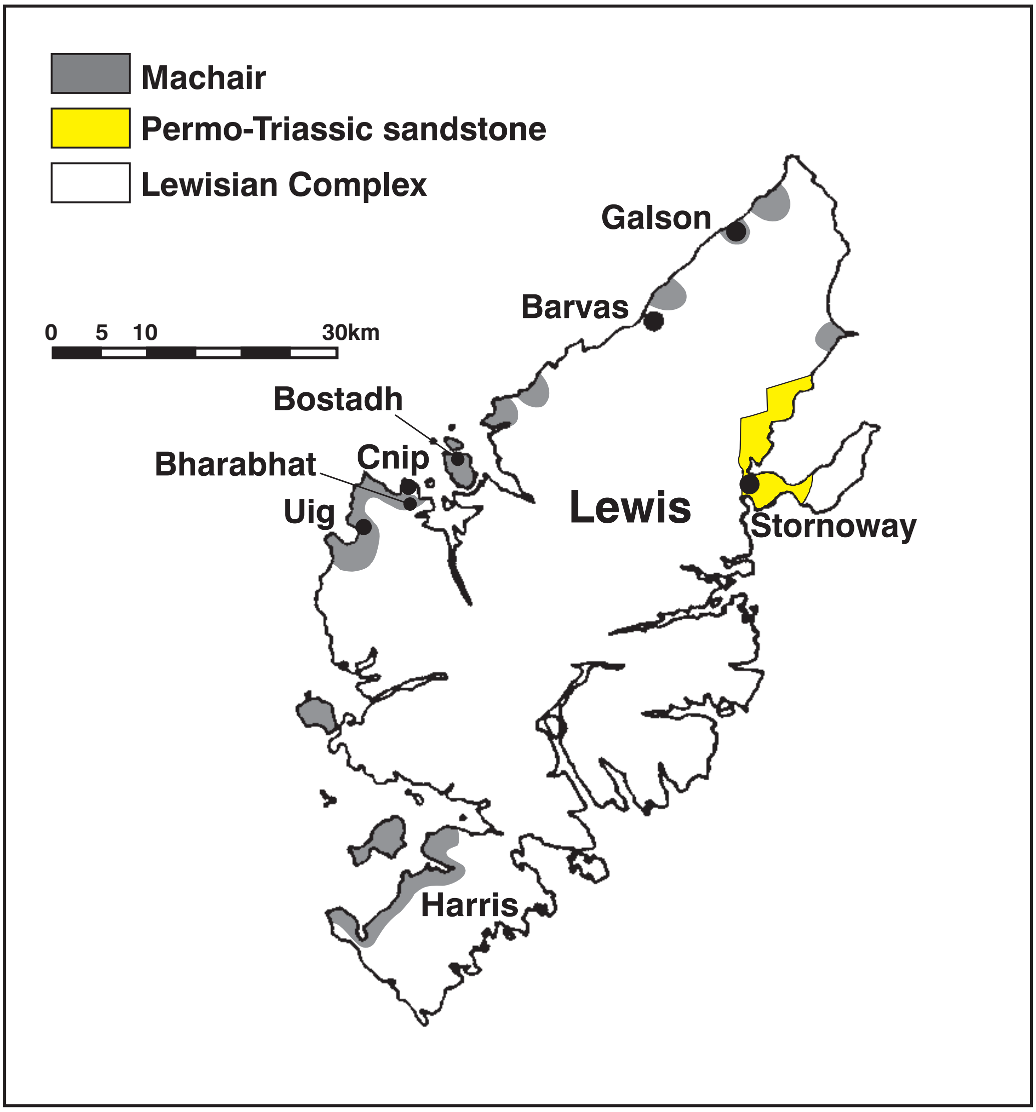

Figure 8.1 Map of Lewis and Harris showing simplified geology and machair distribution.
Adapted from British Geological Survey 1979 and Love (undated).

8.1.1 *Aims of the study*

The two-site Lewis study was proposed by Tim Neighbour, CFA Archaeology Ltd who directed the excavations at Galson, and together with Andrew Dunwell and Alastair Rees carried out the last excavations on the Norse cemetery at Cnip. Burials from two coastal machair, cemetery sites on the West Coast of Lewis (Figure 8.1) were investigated:

1. The only known Iron Age long cist cemetery in the Hebrides at Galson, North Lewis which may have hitherto, unrecognised importance in pushing back the arrival of Christianity in the Western Isles.

2. The only known family cemetery from the Viking Age, on the Cnip headland of the Bhaltos peninsular, Uig.

The Atlantic coast of Lewis is gradually being lost through erosion and, rather than being planned, large-scale excavations, both sites were excavated as they eroded from the sand over a period of years and monitoring and recording is ongoing. Machair deflation following high winds and storms is an acknowledged threat here as at other important archaeological coastal sites in the Hebrides. Excavation was frequently on a rescue basis and often in the difficult and extreme weather conditions that initiate sand erosion and the subsequent exposure of remains. The full extent and size of either cemetery is not currently known and burials are still being exposed in the region following episodes of high winds (MacIver 2000).

The homogeneity and notable antiquity of the Lewisian gneiss that forms virtually the whole of the Isle of Lewis (Figure 8.1 and discussed in greater detail in section 8.2.3), suggested the signature for prehistoric inhabitants of the island should be relatively straightforward to establish. Moreover, there are very few places in the North Atlantic where rocks of this age outcrop, thus making it very likely immigrants would have origins on younger lithologies. Today, Lewis is virtually treeless and bare rock and vast blankets of peat, of little use other than for fuel, cover the majority of the interior. Settlement and agriculture are, therefore, concentrated in coastal regions and particularly on the machair plain. The Hebrides are justly famous for these deep, Quaternary deposits of highly-alkaline, carbonate shell sand, which fringe the coast up to a 2km inland (Figure 8.1) and produce the renowned beaches that were a focus for prehistoric and historic settlement and agriculture (Gilbertson *et al.* 1999, 443). However, the machair is of considerably more recent origin than the Lewisian gneiss, making the environment rather more complex than its homogeneous bedrock would suggest. Moreover, the relative proportions of prehistoric dietary inputs sourced from the gneiss bedrock and the machair were unknown.

The aims of this case study were:

1. To identify an indigenous Sr and Pb isotope ratio signature range for prehistoric inhabitants using human and animal teeth and burial and cultivation soil leaches.

2. To ascertain whether individuals buried in the Iron Age long cist cemetery at Galson were indigenous or immigrants.
3. To look for evidence of first generation migrants amongst the Norse burials and suggest possible origins.

Figure 8.2 Map of the early historic Kingdoms of Scotland.
Adapted from Graham-Campbell & Batey 1998.

8.1.2 Cnip and Galson in the wider archaeological context

Although viewed today as on the periphery of western society, in the Bronze Age the Hebrides were clearly in contact with European culture and beaker pottery styles, single graves and elaborate bronze weaponry were adopted by the islanders (Armit 1996, 108). The presence of ard marks beneath a Bronze Age cairn on Cnip headland demonstrates that agriculture was being practised prior to the building of the cairn (Armit 1996, 107; Close-Brooks 1995). Migration has previously been invoked to explain visible changes in the Hebridean archaeological record such as agriculture, beaker burials, Atlantic roundhouses and the unique long cist burials found at Galson (Armit 1996, 231). Nevertheless, there is little evidence for any substantial population movement to the islands between the initial colonisation during the Mesolithic and the Viking Age (Armit 1996, 231). Moreover, the presence of a seemingly unbroken indigenous pottery tradition from the Early Neolithic through to the 19th century, even during periods when parts of mainland Scotland, and indeed other Viking settlements, were virtually aceramic, would strongly suggest population continuity (Armit 1996, 233; Sharples & Parker-Pearson 1999, 58).

The cultural affiliation of the inhabitants of Skye and the Western Isles prior to the onset of Viking raiding is, nonetheless, unclear. That they were Scots recently arrived from Dalriada (Co. Antrim) in the 5th century (Figure 8.2) (Graham-Campbell & Batey 1998, 14) or indigenous Picts, appears the most likely because both cultures had considerable maritime expertise (Ritchie 1993, 24). However, the inhabitants of Lewis show no strong cultural affiliations to either group and there is little archaeological and no documentary evidence to support or refute either suggestion (Armit 1996, 231). As Armit (1996, 232) explains *"Even in the Viking Age…the scale of immigration is unclear, as is the question of how far down the social hierarchy significant change occurred."* Nonetheless, there is virtually no evidence that any pre-Norse place-names survived on Lewis (Graham-Campbell & Batey 1998, 74) implying Norse settlement was pervasive, and cultural if not physical replacement of the indigenous population occurred. Indeed, the Hebrides were apparently so completely overwhelmed by the Norse that they were known as Innse Gall or *"Islands of the Foreigners"* (Ritchie 1993, 94).

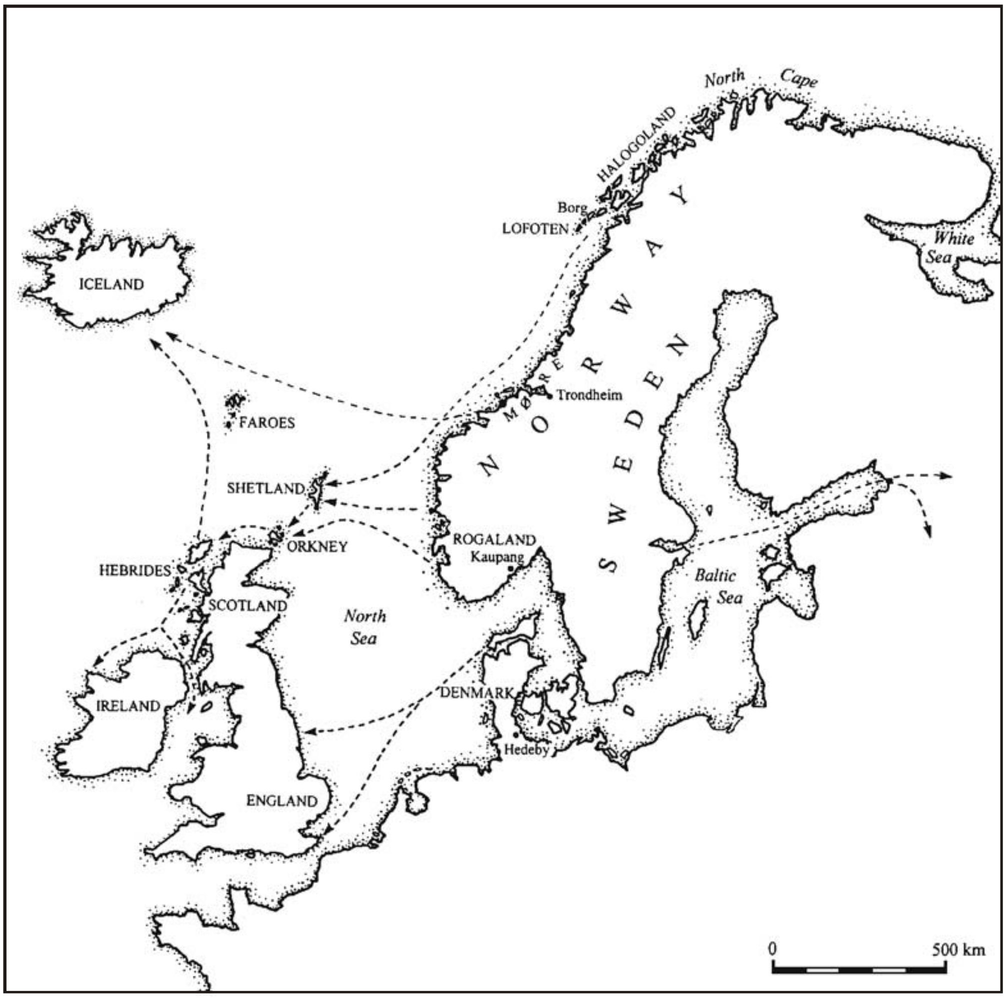

Figure 8.3 Map of northern Europe showing sailing routes during the Viking period.
Adapted from Graham-Campbell & Batey 1998.

The Vikings were pagan whilst their contemporaries, the Picts and Scots, were already Christian (Ritchie 1993, 25) and the burial evidence should demonstrate change from pagan to Christian to pagan beliefs during the first millennium AD. The Hebrides probably suffered from Viking raids for the first few decades of the 9th century (Figure 8.3) after which raiding is likely to have given way to a period of settlement until ~870 AD (Figure 8.4) when attention was turned to Iceland and other Atlantic islands (Armit 1996, 186). Graham-Campbell and Batey (1998, 45) reproduce the following quotation relating to the Western Isles from the Frankish *Annal of St. Bertin* for 847 AD: *"The Scotti, after being attacked by the Northmen for very many years, were rendered tributary and (the Northmen) took possession, without resistance, of the islands that lie all around and dwelt there"*. Following the Viking age, the Hebrides were officially ruled by Norway from 1098 to 1266, when they were ceded back to Scotland; this period during the central Middle Ages is termed the "Kingdom of the Isles" (McDonald 1997, 3).

Figure 8.4 Map of the British Isles showing the areas settled by Scandinavians. Adapted from Ritchie 1993.

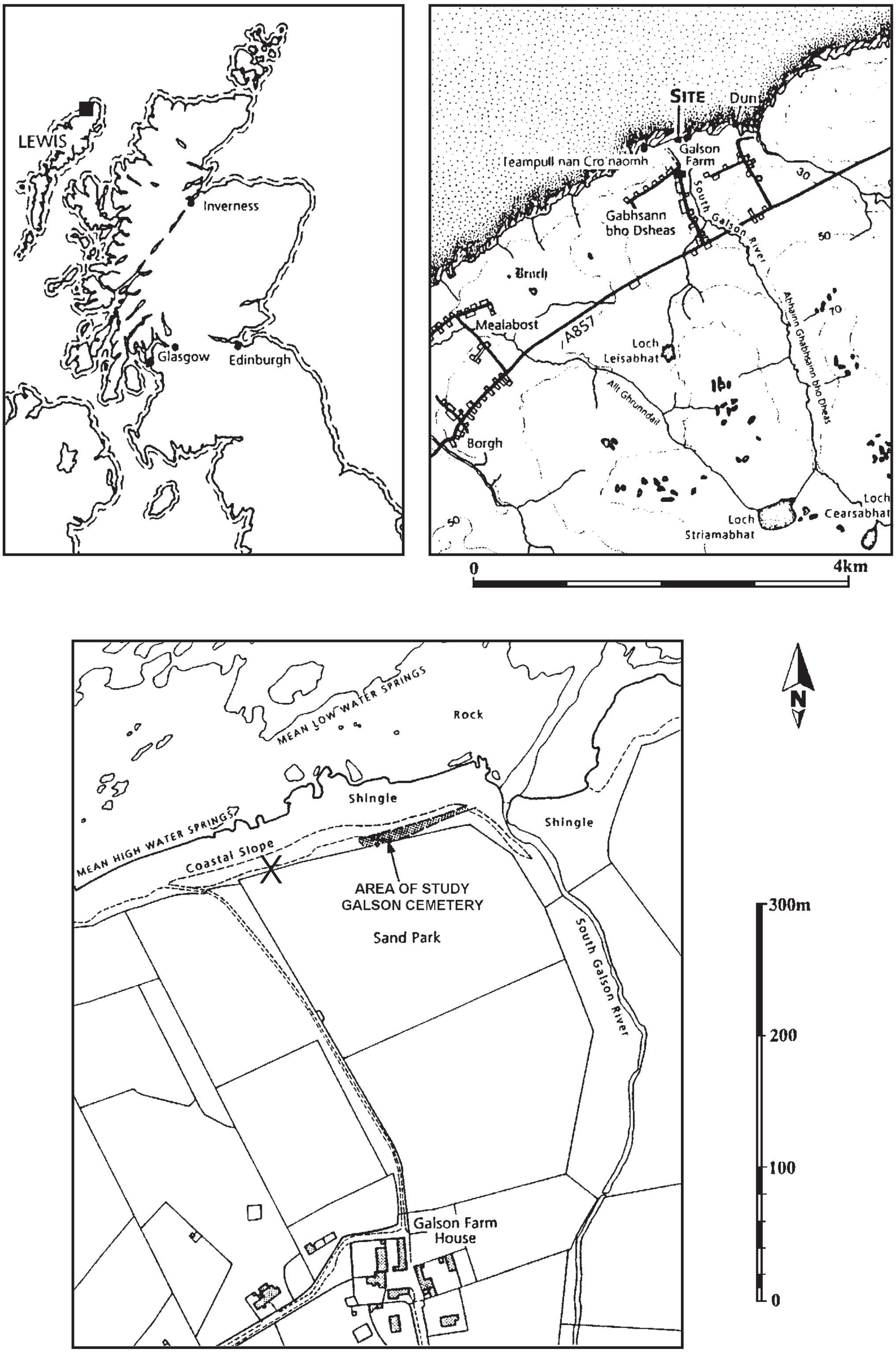

Figure 8.5 Site location map of the Iron Age cemetery at Galson. Location of the soil samples analysed in this study is marked with an X
Adapted from Neighbour *et al*. 2002.

8.2 Archaeological background, context and samples

All details on the human remains, burial practices and grave goods at the cemeteries at Galson and Cnip reproduced below are taken from the following sources (Dunwell *et al.* 1996a, 739; Dunwell *et al.* 1996b; Hill 1952; Neighbour *et al.* 2002; Ponting & Bruce 1989; Stevenson 1953; Welander *et al.* 1987; Wells 1953).

8.2.1 Iron Age long cist cemetery at Galson

The Iron Age long cist cemetery at Galson was discovered in the 1940s (Stevenson 1953) when the first recorded burials were removed from the eroding, exposed face of Galson raised beach (Figure 8.5). Further burials (Table 8.1) have been excavated piecemeal when necessary. Currently, fourteen burials (including one juvenile) are known, with a possible further adult male being excavated, but not recorded, in 1974 (T. Neighbour pers. comm.). Where bone was recovered, radiocarbon dating (Table 8.3) indicates the cemetery was in use during the first half of the first millennium AD, which is consistent with long cist cemeteries elsewhere in Scotland (Proudfoot 1997, 443; Rees forthcoming), and may have origins in the 1st century AD (Neighbour *et al.* 2002). The absence of grave goods and E-W orientation in organised rows is often taken to indicate that long cists are the earliest form of Christian burial in Scotland. Pre-Christian burial in long cists is not unknown, however, and some Scottish and Irish long cists date from the Bronze Age (Proudfoot 1997, 443). It is the size and organisation of the large long cist cemeteries that sets them apart from long cists of earlier date (Proudfoot 1997, 444). If this is so, the dating at Galson makes the arrival of Christianity (and by implication missionaries) to the Hebrides, very early indeed and is discussed further in section 8.2.6.1.

8.2.2 Norse cemetery at Cnip, Uig

Recent erosion is revealing from within the deep sands the remains of two overlying ancient ground surfaces dating from the Bronze Age and the Norse period (Armit 1994, 72/96). The first recorded Norse burial on the Cnip headland was an adult female (A) discovered in 1979 protruding from an eroding sandbank on Cnip headland overlooking Traigh na Berie, one of the largest and most scenic beach, dune and machair systems in

Lewis (Figure 8.6). Although much of the information surrounding the burial context had already been lost, a rich assemblage of pagan Norse grave goods indicated burial in the late 10th to early 11th century (Welander *et al.* 1987). Six further burials of adults (males C and D, female E) and juveniles (infants F and G, child B) were recovered from the site during rescue excavations in 1991, 1992 and 1994 (Figure 8.6). Radiocarbon dating of burials A to E indicates that the cemetery was in use in the 8th to 10th centuries AD and that all the burials are broadly contemporary (Table 8.3), although D is the earliest in the series. Stray finds of bones and teeth and several pins of Norse date and possible Norse pottery have also been reported from the vicinity and exposure of further burials as a consequence of continuing erosion is expected (Dunwell *et al.* 1996a, 743). This site is, therefore, currently the largest of the two Viking Age cemeteries identified in the Hebrides (Dunwell *et al.* 1996a); the other being a small group of three pagan male burials excavated on Eigg in the 19th century (Armit 1996, 202). The Norse burials at Cnip lie close to a multi-phase Bronze Age funerary site consisting of a D-shaped cairn raised over a short cist adult inhumation with a short cist urn cremation subsequently inserted into the earlier burial (Close-Brooks 1995). A second Bronze Age short cist burial with pottery vessel was discovered in 1992 adjacent to the cairn (Dunwell *et al.* 1996b; MacLeod & Cowie 1996). This cist contained an adult male inhumation (Figure 8.7), which together with all seven Norse burials constituted the sample analysed from the Cnip headland.

8.2.3 The geology of Lewis

The Outer Hebrides are a remarkably homogenous landform being composed almost entirely of rocks from the Lewisian complex, formed around 2700 Ma and one of the oldest rock groups in Europe (British Geological Survey 1979a; Derry 1980). These intensely metamorphosed basement rocks are grey quartz-feldspar gneisses (Hall 1996, 5). The chain of islands, and particularly the plateau of northern Lewis, represents the weathered surface remnants of a long ridge of gneiss eroded to form a series of low, fragmented islands with few remaining hills of any great height (Armit 1996, 22).

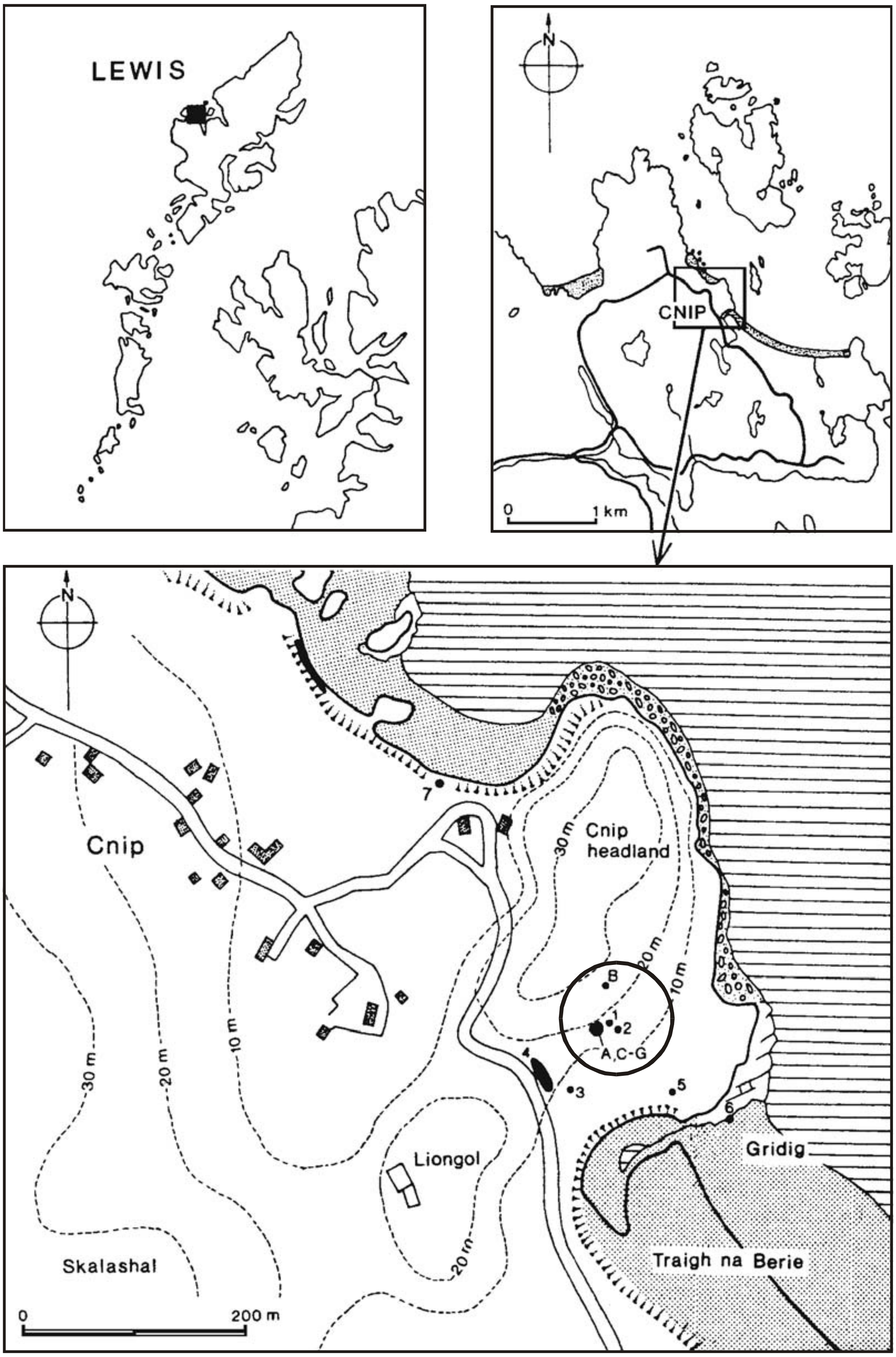

Figure 8.6 Map showing the location of Viking burials A-G on the Cnip headland. Soil samples analysed in this study were taken from within the circled area. Also shown are: 1: Cist burial; 2: Bronze Age cairn; 3: Hut circle; 4:Undated settlement mound; 5: Exposed walling; 6: Boat noose; 7: Cnip wheelhouse.
Adapted from Dunwell et al. 1996.

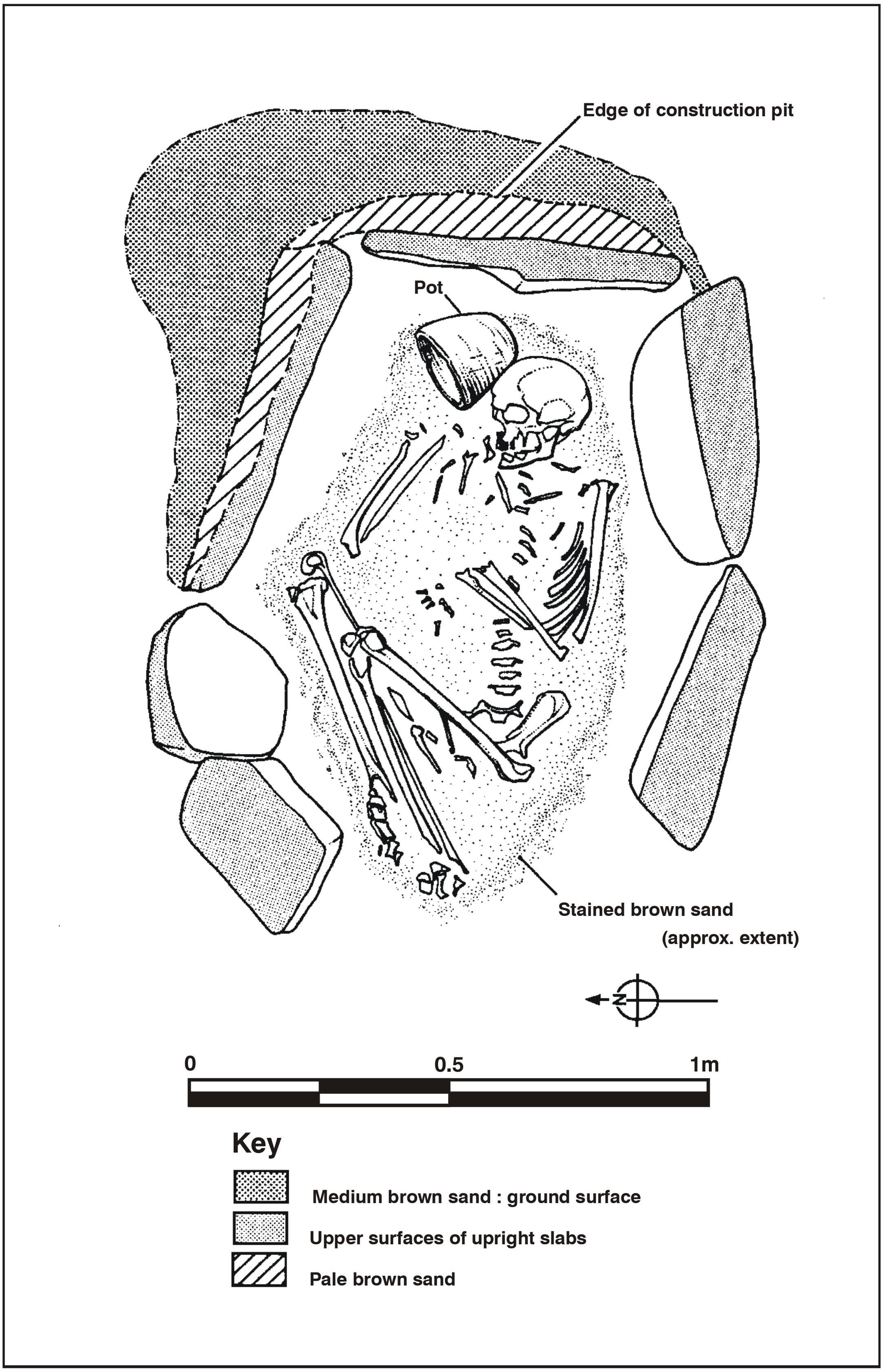

Figure 8.7 Plan of Bronze Age cist burial at Cnip.
Adapted from Dunwell et al. 1996.

On land, there are no younger rocks, apart from the Permo-Triassic sandstones and conglomerates which are restricted to the Stornoway basin on the east coast and a few basic igneous dykes of Permo-Carboniferous and early Tertiary age (Figure 8.1) (British Geological Survey 1979a; Hall 1996, 5). The direction of deglaciation during the last ice age, appears to be towards the Scottish mainland (Hall 1996, 6). The most widespread landforms of glacial deposition are mounds composed of blocky till derived from erosion of local bedrock (Hall 1996, 8) and it is, therefore, unlikely that glacial drift deposits composed of younger lithologies from the mainland and islands in between, cover the Lewisian gneiss.

The west coast of Lewis is vulnerable to both sea level rise and coastal erosion and it has been estimated that as much as 1.25km of the shallow west coast has been lost to the sea since the Neolithic (Armit 1996, 28). Much of the prehistoric coast is believed to now lie beneath the Atlantic Ocean. Coastal erosion, instability and inundation by both sand and sea remain often catastrophic problems both for the current inhabitants and the survival of archaeology (Armit 1994, 71/2; Armit 1996, 227). The Lewisian gneiss contains few mineral resources of any value and there is no Pb mineralisation in the Outer Hebrides (Tom Shepherd pers. comm.).

The terrestrial rocks of Lewis produce a barren landscape with thin, acid soils of limited agricultural value and the vast majority of the island interior is covered with extensive Quaternary drift deposits of peat. In addition to the blanket peat many areas of the West Coast are covered with windblown, calcareous shell sand, known as machair (Figure 8.1). Although more extensive on the southerly islands of Harris and the Uists, there are notable areas of machair formation on Lewis at Cnip. The machair plain consists of a shell-rich (40-80%), blown sand base with a lime-rich soil (pH >7.0) and the system includes strandline, dunes, flat grasslands and the transitional "blackland" area between the machair and the moorland (Love undated; Owen *et al.* 1996, 125). The machair system developed from a combination of oceanic climate and erosional and depositional processes that produced an excess of sand after the last deglaciation of Scotland (Owen *et al.* 1996, 126). Deposition began *c.*9000 BP and is characterised by long periods of stability interspersed with spasmodic episodes of erosion and deposition (Gilbertson *et al.* 1999, 465). Recent evidence presented by these researchers suggests that the stratigraphic layers of thick organic materials within the calcareous sand are anthropogenic in origin and result from attempts to improve the machair by the addition of organic waste and fertilisers. The periods of stability are associated with these organic layers and suggest that survival of the machair system is partly dependent upon human agricultural activity not periods of relatively calm weather (Gilbertson *et al.* 1999, 465). The machair environment is, nevertheless, a dynamic system where erosion and deposition occur naturally. Consequently, episodic wind-storms and the unremitting, high, average wind speeds so characteristic of the Hebridean climate, both contribute to the formation of the machair habitat and threaten its stability (Owen *et al.* 1996, 130).

Considerable aeolian deposits of Late Devensian periglacial quartzose sands beneath and in horizons between, the machair, have only recently been identified in the Outer Hebrides (Gilbertson *et al.* 1999, 440). These post-glaciation sands are of unknown provenance(s) but are of the same age and type as those already known from the Scottish mainland and the Northern Isles. They are *"dominated by quartz and heavy minerals with subsidiary amounts of feldspars and fine-grained rock fragments such as chert"* (Gilbertson *et al.* 1999, 451) and are thus, mineralogically very different from the overlying machair.

8.2.4 Settlement and subsistence evidence

There is evidence for human settlement in the Hebrides since 9,000 BP although the peat covered interior remains virtually unexplored by archaeologists (Armit 1996, 235). On Lewis, the area of the Stornoway basin which is underlain by sandstone and supports the best soils on the island was the first area to be settled (Armit 1996, 22). In the Bhaltos region the earliest settlement sites date from the mid-1st millennium BC (Armit 1994, 74). Since the Neolithic the environment has changed considerably: peat has spread over most of the interior; machair has been deposited and removed; and the sea has encroached (Armit 1996, 227). Settlement and agriculture appear to have concentrated progressively on the machair throughout prehistory and by the Iron Age, was largely restricted to machair coastal regions with the interior exploited only for fuel and rough pasture (Armit 1996, 228; Graham-Campbell & Batey 1998, 22; Owen *et al.* 1996, 129). The Outer Hebrides is and was, therefore, a marginal area for agriculture (Armit 1998). On Harris less than 1% of the land area is suitable for cultivation the rest being rock and blanket peat (Graham-Campbell & Batey 1998, 4). Machair is free draining and thus susceptible to leaching and nutrient deficiencies, and in dry periods to drought (Owen *et al.* 1996, 218). Consequently, machair soils are particularly poor in organic matter, phosphates, nitrates and minerals such as K, Cu and Mn but they are relatively productive compared to the alternative option of the peaty, wet, acid soils of the inland and upland areas (Graham-Campbell & Batey 1998, 71; Owen *et al.* 1996, 128). Seaweed and bone were both used as fertiliser to improve machair soils (Graham-Campbell & Batey 1998, 219). Gneiss quernstones are frequent finds at Iron Age wheelhouse sites indicating arable agriculture was taking place, but direct archaeological evidence for it is scarce (Armit 1996, 149).

Subsistence evidence from the Iron Age Cnip wheelhouse (Figure 8.6) and from the nearby mid-late 1st millennium AD Loch na Berie broch tower, unexpectedly indicates that red deer were the main source of meat with cattle and sheep making up most of the remainder (Armit 1996, 31/148). Deer were also the prime source of meat at the Atlantic roundhouse at Bharabhat, West Lewis (Gilmour & Cook 1998, 335). It is thought they were introduced during the Mesolithic and their number and semi-maturity at Iron Age sites suggests they were being consciously and carefully managed and culled during the period (Gilmour & Cook 1998, 334). Moreover, it has been suggested that smaller islands such as Iona, were actively importing deer, and possibly cattle, from Mull during the Iron Age (Gilmour & Cook 1998, 334). Both cattle and deer were of unusually short stature, indicating perhaps, a marginal climate or scarcity of good grazing; it is thought the machair was used principally for tillage during this period with stock restricted to low quality, peatland grazing further inland (Armit 1996, 149). It is, perhaps, surprising that the Iron Age inhabitants did not rely more on sheep, which are far more suitable to the environment. However, as red deer are the only animal motif depicted on both Hebridean pottery and late Iron Age painted pottery on the Continent, this may be part of a widespread cultural phenomenon (Armit 1996, 150).

Dairying does not appear to have played a significant role in Hebridean economies in the Iron Age; cattle were kept more for meat than milk products (Armit 1996, 149). It is likely that stock, particularly sheep, goats and deer, were over-wintered outside in the milder coastal regions. If cattle were kept indoors, hay and fodder would have to be produced or foraged. Heather and seaweed could have been exploited for animal feed and for fertilising machair pastures (Graham-Campbell & Batey 1998, 20/25). Seal and whalebone are commonly found in most machair, wheelhouse sites (Armit 1996, 149). Sea birds predominate amongst the bird bones, with a few migratory geese present and grouse being the only land-based bird exploited. Fish bone assemblages consisted of saithe, cod and ballan wrasse but were dominated by hake, a deep-sea fish (Armit 1996, 150).

Despite the almost total absence of pre-Norse place-names on Lewis, irrefutable evidence for Norse settlement is scarce (Sharples & Parker-Pearson 1999, 42) and entirely absent in the Bhaltos region despite extensive archaeological survey and activity (Armit 1996, 188). This could result from the sites either still being occupied today or lying unrecognised amongst the many abandoned, post-mediaeval settlements. There are, for example, two undated settlement mounds on the machair very close to the Cnip cemetery (Figure 8.6) (Armit 1994, 83). Until recently, evidence of occupation continuity spanning the Iron Age and the early Norse period was absent, despite the extremely restricted area, i.e. the machair plain, suitable for settlement. The numerous Iron Age sites seem to have been permanently abandoned around the time of the Viking incursions. Whether this is due to land reorganisation or population replacement is unclear (Armit 1994, 91). Settlement discontinuity in the absence of population replacement is historically recorded and illustrated by the widespread post-mediaeval abandonment of the machair plain for the “blacklands” further inshore. This settlement shift is attributed to the increasing instability of the machair and rise of the winter water table during the Little Ice Age (Armit 1996, 233). Moreover, there are numerous historical accounts of agricultural land as well as whole settlements being lost through incursions of sea and sand (Armit 1996, 30). However, recent fieldwork on the machair of South Uist (Sharples & Parker-Pearson 1999) has suggested that the Norse settlement pattern is very similar to that of the preceding Late Iron Age with localised movement around a settlement core (Sharples & Parker-Pearson 1999, 50). Moreover the recognition of a distinctive regional type of Norse pottery, such as the platter which is restricted to the 9th to 11th centuries AD, has led to the reanalysis of many old excavations and the subsequent identification of Norse occupation on a number of earlier settlements (Lane 1990).

Direct subsistence evidence for the Norse community buried at Cnip is, unfortunately, absent. Work at the 10th – 11th century Norse settlement slightly inland at Barvas (Figure 8.1) in the northwest of Lewis, suggests both barley and oats were staple crops in line with the rest of northern Scotland (Armit 1996, 192; Barrett *et al.* 2000, 20). Cattle and sheep were the dominant domesticates and pig, red deer, horse and otter were present in small quantities. Milk production from cattle and sheep appears to have been central to the Norse economy, a marked increase from the preceding Iron Age (Barrett *et al.* 2000, 25; Graham-Campbell & Batey 1998, 174). There is little evidence for hunting of wild animals (Ritchie 1993, 36) which is, perhaps, unsurprising given the restricted range of native Hebridean fauna; rabbits, for example, were only introduced in the mediaeval period (Armit 1996, 31). Fish remains are plentiful with the predominant species being cod, ling and saithe, suggestive of offshore fishing from boats. Shallow water fish such as plaice, flounder and turbot are also present along with some whalebone but, overall, marine mammals are surprisingly scarce (Armit 1996, 192/3). The proportion of fish remains in middens increases during the Norse period at Bostadh and Galson (R. Ceron-Carrasco pers. comm.). This increase in fish consumption at the Iron Age/Norse transition in the early 9th century is confirmed by carbon isotope analysis of skeletal remains both on Lewis (T. Neighbour pers. comm.) and elsewhere in Viking Scotland (Barrett *et al.* 2000, 18/19).

Seasonal transhumance (the movement of cattle and people to higher more remote inland pastures during the summer months) was practised on Lewis well into the 20th century but has gradually died out with an increasing reliance on sheep since the 19th century (Fenton 1995, 39). There is little positive evidence that it was carried out in prehistory but nothing to disprove it. Radiocarbon dates from a shieling on Skye indicate use during the 12th –15th centuries and also during the 1st millennium BC but it is not known whether this is re-use of an old site or continuity throughout (Armit 1996, 216). Evidence from Viking Age Orkney indicates that long distance trade in staple foods (cereals, fish and dairy products) cannot be detected until at least the 11th century (Barrett *et al.* 2000, 24).

8.2.5 The skeletal remains

Machair sites are highly alkaline, free draining and calcareous and macro-morphological preservation of archaeological skeletal remains is generally very good (Neighbour *et al.* 2002; Ponting & Bruce 1989, 95/97). Where skeletal recovery is incomplete it is usually due to truncation and loss through erosion prior to excavation rather than *in situ* decay. This was the case with all the adult remains analysed in this study and preservation and recovery was frequently described as *"excellent", "well mineralised"* and *"remarkably well preserved"* (Dunwell *et al.* 1996a; Neighbour *et al.* 2002; Ponting & Bruce 1989). All of the males, and some females, were robust with well-marked muscle attachments, although the infant and juvenile remains from Cnip were rather more fragile. Nine (possibly ten, see Table 8.1 and note*) adult burials and one juvenile have been recorded at Galson, along with four graves where no remains were recovered. Of these, five adults (3 males, 2 females) were analysed for this study. Four Norse adults, one Bronze Age adult and three Norse juvenile burials have been recovered from the Cnip headland and all were analysed (Tables 8.2 and 8.3).

8.2.5.1 Stature

Osteological evidence indicates that the majority of adults from Cnip and Galson were robust and of short stature (Table 8.3). Although only a small sample, the Norse individuals from Cnip demonstrate little sexual dimorphism in stature and males, (but not females) were below the average stature recorded in broadly contemporary populations from Denmark, Greenland, Aberdeen and Linlithgow (Dunwell *et al.* 1996a, 740; Graham-Campbell & Batey 1998, 50). Gals 93 and Gals 96 were both of a similar height (169 ± 4cm), as was the unanalysed Gals 89/2 (Ponting & Bruce 1989). The Bronze Age male from Cnip (Cnip BA) was also of noticeably short stature (Table 8.3). Short male stature has also been noted in other Viking burials from the Hebrides (Ritchie 1993, 80). Although height potential has a hereditary component, its phenotypic expression can be greatly affected by intrinsic and extrinsic factors during childhood, such as poor nutrition or health. Short stature, therefore, may equally result from genetic or non-genetic causes, although the stunted growth observed amongst contemporary deer and cattle on Lewis (section 8.2.4), may suggest that adverse environmental conditions played a large part.

Table 8.1 List of known burials from Galson Iron Age cemetery

Skeleton No.	Year of excavation	Sex	Age	Analysed?
Gals I	1946	F	M Adult	No – severe attrition on only surviving tooth
Gals II	1948	F	Adult	Yes
Gals III	1946	?M	Adult	No - no teeth
Gals IV	1946	F	Y Adult	Yes
Gals V*	1949	F	M Adult	No – not found
Gals VI	1952	n/k	n/k	No – no remains recovered
Gals VII	1952	n/k	n/k	No - no teeth
Gals 69	1969	n/k	Juvenile	No – not available
Gals 74*	1974?	M	M-A Adult	Yes
Gals 89/1	1984	F	Y Adult	No - re-interred?
Gals 89/2	1985	M	M Adult	No - re-interred?
Gals 89/3	unexcavated	n/k	n/k	No – not excavated
Gals 89/4	unexcavated	n/k	n/k	No – not excavated
Gals 93	1993	M	M Adult	Yes
Gals 96	1996	M	M Adult	Yes

Adapted from Neighbour *et al*. 2002.

* There is some confusion over these two individuals. The tooth analysed was C^1L from a skeleton in a box marked Galson V (1974) which was noted by the author to be a robust male with enthesopathies at many muscle and ligament attachments sites as described by Margaret Bruce (pers. comm.). She estimated his stature at 169 ±4cm (~5'7") and commented on the "*very characteristically male*" pelvis and "*distinctive facial appearance*" with heavy brow ridges, depressed nasal bridge and asymmetrical nose and orbits. However, when Gals V was excavated in 1949 (i.e. not 1974) it was recorded as female, ~150cm (~5') with no extant maxillary (upper) teeth and an ununited fracture of long-standing of the right femoral neck (Wells 1953, 113). However, Bruce makes no mention of this potentially serious and unusual fracture in her skeletal report of Gals V (1974) and lists only four teeth as being present, three of which were from the maxilla. As it seems unlikely that these two skeletons could have been easily confused, the adult male analysed was renamed as Gals 74. Due to the rescue status of the archaeology at the site, it is possible that a skeleton could have been excavated in 1974 and either unrecorded or the records lost (T. Neighbour pers. comm.). If this is so, the location of the original Gals V is unclear.

8.2.5.2 Pathology

The three Galson males were considered to have *"shared a complex of trauma and/or degenerative pathology indicating a physically arduous life-style"* (Neighbour *et al.* 2002) as was also the case with the Bronze Age and Norse males. All achieved at least middle age, i.e. 35-49 years. There is however, no clear-cut relationship between long-term strenuous activity and osteoarthritis; in fact, there are indications that increased robusticity as a result of strenuous labour at an early age may confer some protection against the development of osteoarthritis (Knüsel 2000, 394). Other factors such as heredity, congenital abnormalities, trauma, increased body weight and old age may all contribute to its onset (Knüsel 2000, 393). Although both samples from Cnip and Galson are small, the prevalence of trauma, degenerative joint disease and congenital anomalies affecting the spine (Table 8.2) was unusually high (Dunwell *et al.* 1996a; Neighbour *et al.* 2002). However, cause of death could not be ascertained in any case and evidence for chronic infection affecting the skeleton was virtually absent, perhaps suggesting that death occurred as a result of acute disease, infection or soft tissue trauma.

Although the Outer Hebrides were a marginal environment (Armit 1998) and male stature was short, few of the Lewis skeletons display signs of metabolic stress or dietary deficiencies such as enamel hypoplasia, scurvy or cribra orbitalia (Dunwell *et al.* 1996a, 740). This may be an indication that they had a diet containing ample fish and meat rather than one based predominantly on a limited range of cereal crops (Cunha 1995, 191). Conversely, lack of evidence on the skeleton indicates that the person may have succumbed to an acute condition before any bone changes could take place. However, the absence of enamel hypoplasia suggests no disruption of the enamel formation process occurred as a result of health or nutritional stress during early childhood (Hillson 1996, 166). The dentition of the Galson and Cnip adults exhibited severe occlusal and interproximal attrition probably as a result of a coarse diet and caries rates were low (Dunwell *et al.* 1996a, 741). As the majority of individuals had lost teeth ante-mortem, had extensive calculus on those remaining and suffered dental abscesses, the rarity of caries was probably a function of tooth wear rather than good dental hygiene (Dunwell *et al.* 1996a, 741; Neighbour *et al.* 2002).

8.2.5.3 Familial traits and grouping

The three Galson males were observed to be of *"broadly similar head and limb shape"* (Neighbour *et al.* 2002), although Gals 93 was dolichocranic (Figure 1.2) and Gals 96 mesocranic (average). The Norse adults were variable, the females (A and E)

Table 8.2 Summary of selected developmental and environmental traits observed amongst Lewisian adults

Skeleton code	Wormian bones	Six segment sacrum	Spondylo-lysis	Lateral flange on proximal femur	Healed fractures	Unfused acromial processes
Cnip BA	Probably	No	No	Yes	Zygomatic, tempo-mandibular joint, mandible	No
Gals I skull only	Yes	X	X	X	X	X
Gals II	X	X	No	Yes	None reported	No
Gals IV	cranium incomplete	No	No	Yes	left clavicle	No
Gals 74	Yes	No	No	Yes	None reported	No
Gals 89/1	No	No	No	Yes	None reported	No
Gals 89/2	Yes	No	Yes	Yes	iliac spine (pelvis)	Yes
Gals 93	Yes	X	X[a]	**No**	None reported	**Yes**
Gals 96	Yes	Yes	No	Yes	?vertebral spine, rib, depression fracture of skull,	No
A	No	Yes	No	No	None reported	No
C	Yes	Yes	No	No	humerus	No
D	No	No	Yes	No	pelvis	**Yes**
E	Yes	No	No	No	None reported	No

X: Element not present
a: The 4th and 5th lumbar vertebrae, the elements usually involved, were not present
Data sources: Cnip Bronze Age: (Dunwell *et al.* 1996b, fiche 2 G1-10)
Galson burials: (M. Bruce pers. comm., Hill 1952; Neighbour *et al.* 2002; Wells 1953)
Cnip A-G: (Dunwell *et al.* 1996a, fiche 4 B9-G14; Welander *et al.* 1987)

were mesocranic, whilst the males C (brachycranic) and D (dolichocranic) were at opposite ends of the scale (Dunwell *et al.* 1996a, 741). Amongst the Norse individuals there was considered to be *"no significant dental or skeletal feature"* by which Burial A, (the female buried with numerous Norse grave goods) could be distinguished from

Burials C-E (the group of three Norse adults lacking a distinctively Norse grave assemblage) (Dunwell *et al.* 1996a, 741). However, cranial index and cranial capacity are significantly correlated between father and son pairs where no correlations exist between mothers and daughters or between parents (Sjøvold 1995, 277). This suggests there is unlikely to be a close family relationship between C and D, or that cranial plasticity in response to environmental changes produced a significant change in cranial morphology between the initial and subsequent generations (see section 1.4.2.1).

Many individuals had wormian bones (ossicles) in cranial sutures (Figure 1.2). As discussed in Chapter One, cranial ossicles have no known functional or environmental expression and are, therefore, considered to be one of the few developmental non-metric traits which have a high genetic component (Tyrrell 2000, 294) and have significant heritability through the male line (Sjøvold 1995, 250). They have a high frequency amongst the adults at Galson: they were observed in all four adult males and one of the females. Of the remaining three females, only one had a complete cranium (Table 8.2). At Cnip, their presence was considered probable in the Bronze Age male and they were observed in both C and E. They were, however, absent in Cnip A, and Cnip D, the only male analysed who lacked them.

It is also of interest that *"none of the four (Norse adults) shows the lateral flange of bone which is so prominent in femora of Scottish short cist skeletons including that excavated at Cnip"* (Dunwell *et al.* 1996a, 740). This trait involves lateral buttressing of the femur just below the level of the lesser trochanter, thereby increasing the transverse diameter of the shaft and giving it a distinctly flattened appearance (MacLaughlin & Bruce 1983, 435). It has also been reported as present on femora from two females buried in a rural, late Norse (14th – 15th century), cemetery at Scalloway, Shetland (Lorimer 1998, 192). The trait was present on all the male and female Iron Age femora from Galson, with the single exception of Gals 93 but absent on all those from the Norse burials at Cnip (Table 8.2). The cause is currently unknown but it appears to clearly separate the Norse from the Iron Age population on Lewis. If it occurs in response to biomechanical stress as has been suggested (Lorimer 1998, 192), its presence on Bronze Age and Iron Age femora and absence from those of the early Norse implies a significant change occurred in traditional activity patterns on the island during the early Norse period.

8.2.6 Burial practices

8.2.6.1 The Iron Age cemetery at Galson

All recorded Galson individuals were buried in long cists with the exception of Gals 93 which was contained in a simple, shallow, unlined grave pit dug into the soil, and the possible exception of Gals 74 whose burial context is unclear (Table 8.1). They all appear to be aligned roughly E-W with the head at the west end (Figure 8.8) and with the possible exception of Gals IV whose position was not accurately recorded in 1946, were all at the same original ground level (Figure 8.9).

Long cists are body-length chambers originally constructed above ground using low stone walls and flat capstones (Figure 8.10). They are known from the Bronze Age in Scotland but the sudden appearance of large, organised, E-W, long cist cemeteries in the early centuries AD, marks a sudden and complete break with preceding burial rites (Proudfoot 1997, 445). Long cist cemeteries appear to overlay older pre-Christian or late prehistoric burial grounds and have, therefore, been proposed as an early Christian burial form associated with Ninian's (*c.* 360-432AD) conversion of the southern Picts (Proudfoot 1997, 447) where suitable stones were available for their construction (Graham-Campbell & Batey 1998, 144). In date, they overlap with the earlier, and conventionally indigenous, Pictish square barrow tradition and small clusters of long cists have been found beneath square and round barrows. No barrows were evident at Galson but due to lower population density, the cemetery is unlikely to be as large as those known from the mainland at Fife and Angus (Neighbour *et al.* 2002). No dress accessories or other grave goods were found at Galson, with the exception of a flattened stone with rubbed faces in Gals 89/2 (not analysed) which may not have been included intentionally.

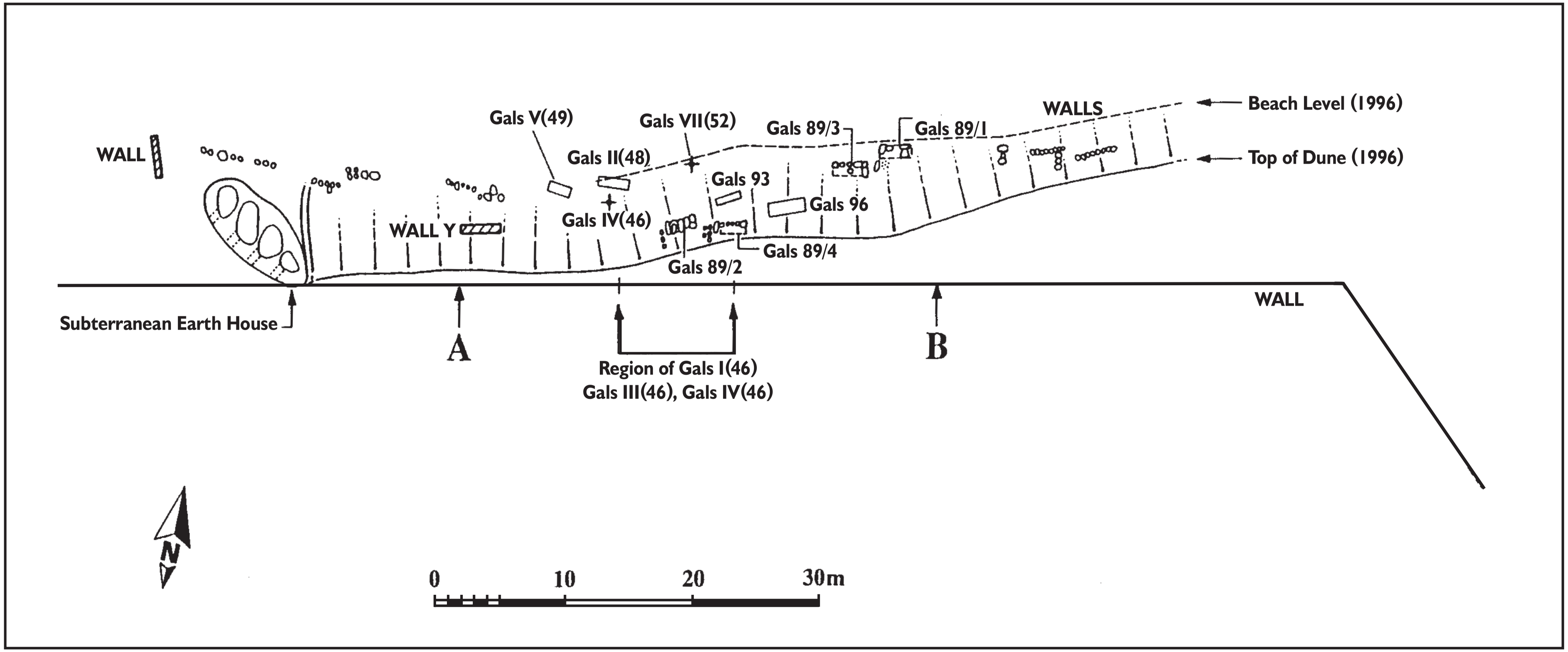

Figure 8.8 Combined plan of all reported burials at Galson.
Adapted from Neighbour *et al.* 2002; Ponting & Bruce 1989.

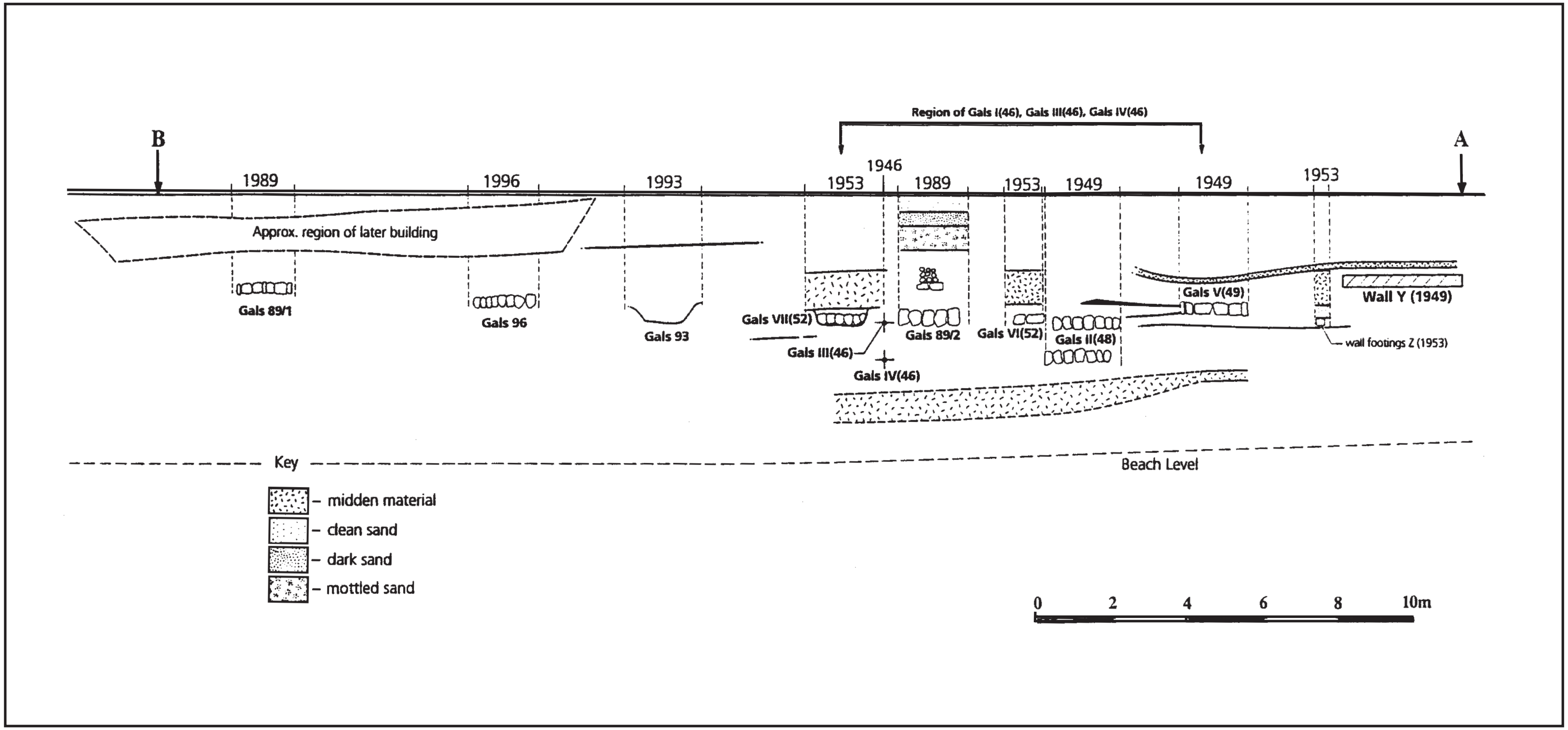

Figure 8.9 Schematic section through the Galson cemetery showing location and depth of all reported burials. Adapted from Neighbour *et al*. 2002.

Cists are laid out in regular rows, aligned E-W, with no accompanying goods or dress accessories that would suggest the use of shrouds. Family plots have been proposed but burials also appear to cluster around the earlier pagan graves (Graham-Campbell & Batey 1998, 144; Proudfoot 1997, 441). The vast majority of Scottish long cist cemeteries are concentrated in Angus, east Fife and Lothian with isolated examples at coastal locations elsewhere in Scotland and the Isles, and are abandoned in the late first millennium AD in favour of graveyards focussed on churches (Proudfoot 1997, 444). All are located near either a sea route or track way and the latter has led to the suggestion that they were influenced by the Roman custom of burial outside the city or fort walls (Proudfoot 1997, 441).

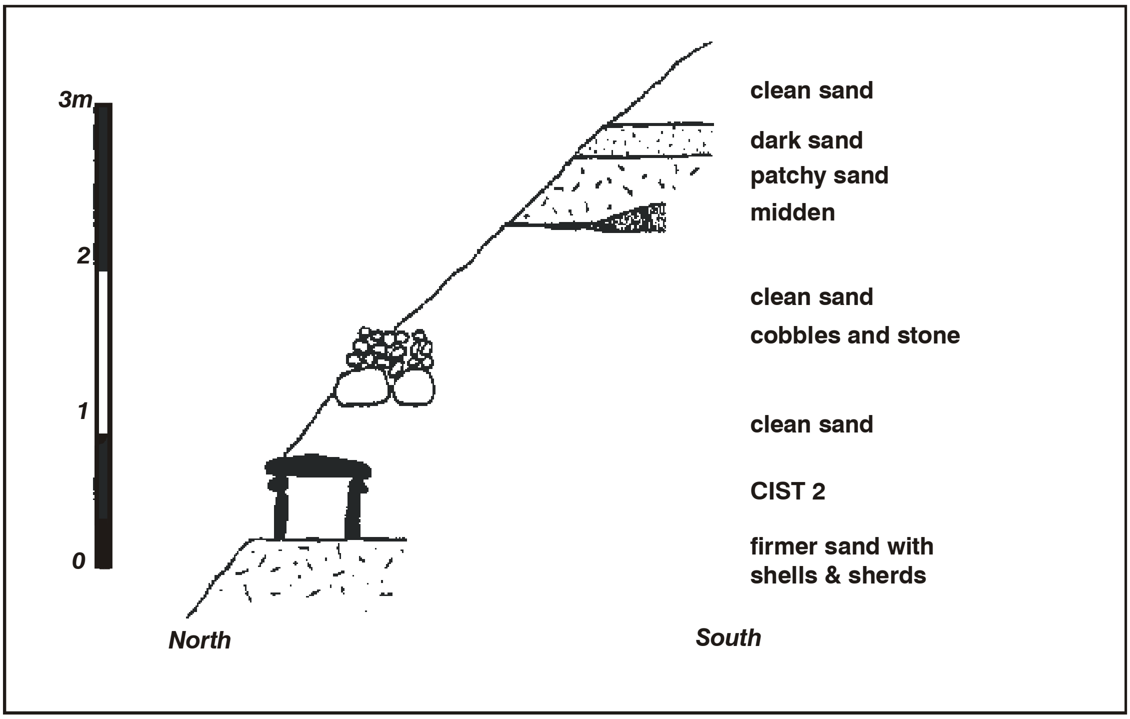

Figure 8.10 Schematic section showing the stratigraphic location of a stone cist burial in the Galson raised beach.
Adapted from Ponting & Bruce 1989.

However, the earliest date for Scottish long cist cemeteries has now been pushed back to the 3rd century AD (Rees forthcoming) whilst the radiocarbon dates from Gals 96 and Gals II (Table 8.3) span the 1st to 4th century AD. This could make their association with Christianity extremely early, although this *"does not preclude the floruit of long cist cemeteries being Christian"* (Neighbour *et al.* 2002).

Table 8.3 Grave and burial attributes of Lewisian individuals

Skeleton code	Sex	Age	Stature estimate	Grave type, alignment and body position	Grave goods	cal. ^{14}C dates (2σ)
Cnip BA	M	M Ad	163 ± 4cm	short cist E-W crouched	plain pottery vessel	1856-1520BC
Gals II	F	Y Ad	165 ± 4cm	long cist W-E extended	None	30-230AD
Gals IV	F	Y Ad	149 ± 4cm	long cist alignment n/k ?extended	None	70-250AD
Gals 74	M	A	169 ± 4cm	not known	None	-
Gals 93	M	A	169 ± 4cm	dug grave W-E extended	penannular iron brooch, decorated pot, bone pin, textile	110-410AD
Gals 96	M	A	169 ± 4cm	long cist W-E extended	None	60-316AD
Cnip A	F	M Ad	155.5 ± 3.5cm	not recorded - probably simple dug grave	Rich assemblage including pagan Norse jewellery [a]	720-970AD
Cnip B	n/k	~6yrs	-	dug grave S-N flexed	amber bead, stone pendant	778-1006AD
Cnip C	M	M Ad	167 ± 4cm	kerbed E-W extended	None	778-1006AD
Cnip D	M	M Ad	162 ± 4cm	kerbed N-S extended	None	687-974AD
Cnip E	F	M Ad	159.5 ± 3.5cm	kerbed E-W flexed	bone pin, perforated iron plate	717-985AD
Cnip F	n/k	6-9m	-	dug grave NW-SE ?extended	amber beads, decorated bone pin	-
Cnip G	n/k	neonate	-	dug grave E-W crouched	iron rivet, textile	-

[a] Assemblage included items considered to be of foreign and indigenous origin: Norse oval gilt bronze brooches, 44 glass bead necklace, antler comb, bone needle case and 2 iron needles, 10th century ringed pin (but see discussion in text), bronze belt-buckle and strap end, sickle, knife, whetstone, fine linen.

Data sources:	Cnip Bronze Age: (Dunwell *et al.* 1996b, fiche 2 G1-G10)
	Galson burials: (Hill 1952; Neighbour *et al.* 2002, and M. Bruce pers. comm.; Wells 1953)
	Cnip A-G: (Dunwell *et al.* 1996a, fiche 4 B9-G14; Welander *et al.* 1987)

It does, nevertheless, raise the possibility that other factors may have originally precipitated this widespread change in burial custom (Neighbour *et al.* 2002). Whatever the underlying impetus, the adoption or invention of this new form of burial by the Galson community suggests the transmission of ideas and information by human agency. Migration between Lewis and the mainland can, therefore, be proposed, although the initial direction at this time is by no means certain.

The layout of the cemetery is difficult to reconstruct given the piecemeal nature of its excavation, the early methods of recording used for Gals I to VII and the very real possibility that many burials, e.g. Gals 89/3 and 89/4 noticed but unexcavated in 1989 (Ponting & Bruce 1989), may have eroded unrecorded from the exposed face of Galson beach. A plan and section of the burials has, however, been produced (Neighbour *et al.* 2002) and shows no identifiable grouping of burials or order to the layout apart from a consistent depth (Figures 8.8 and 8.9). Given the dynamic nature of the machair environment this indicates that the grave pits were contemporary and quite shallow and that *"the layer of sand over the cists formed after the cemetery was abandoned, rather than being the layer through which the graves were dug"* (Neighbour *et al.* 2002). Remains of what is believed to be the cemetery wall have recently been recorded prior to being lost to erosion and its presence perhaps strengthens the identification of the cemetery as an early Christian site (T. Neighbour pers. comm.). The grave goods, alignment, position and dug grave found with Gals 93 set it apart from the rest of the Galson burials and it has been proposed that Gals 93 may be pre-Christian and the long cist burials early Christian. However, this interpretation is not supported by the radiocarbon dates, which indicate that Gals 96 is an earlier burial than Gals 93 which is contemporary with the long cist burial Gals 89/2.

8.2.6.2 The Norse cemetery at Cnip

The Norse inhumation cemetery at Cnip consists of a central cluster of three adults (C, D & E) and two infants (F & G). Cnip A is located a couple of metres to the south and Cnip B, the ~6 year old child, approximately 45m northeast and uphill (Figure 8.6). Both inhumation and cremation were practised in Scandinavia during the Viking period (Graham-Campbell & Batey 1998, 30) but inhumation was the normal pagan burial rite in Scandinavian Scotland. Similarly, there are no known Norse period cremations on Iceland where lack of wood, also a problem on Lewis, may have dictated the choice of rite (Graham-Campbell & Batey 1998, 144).

There is no evidence for burials between B and the cluster C-G, raising the possibility that the cemetery was organised in family plots. The three adults (C, D and E) are interred in kerbed graves constructed of undressed stones in close proximity to each other but with no intercutting and are evidently closely contemporary (Figure 8.11). C and D were adult males and both were extended, supine burials but of different alignment. E was an adult female flexed burial. Cnip E and C were aligned E-W and D N-S. No kerbstones were found around the three juvenile graves. Grave alignment is clearly variable, suggesting they were not interred according to the Christian burial rite. Although Cnip A was not recorded in detail, it was considered to be in a simple dug grave pit with no apparent grave markers (Welander *et al.* 1987, 153). There is clearly dissimilarity between the rich burial assemblage and simple grave of Cnip A and the unaccompanied, kerbed graves of C, D and E. The Bronze Age inhumation at Cnip (BA) was contained within a short cist (Figure 8.7), and prior to the erosion event that led to its exposure, was stratigraphically overlain by the layers beneath the Norse cemetery. The adult male skeleton was tightly flexed and orientated E-W with the head towards the east (Dunwell *et al.* 1996b).

8.2.7 Grave goods

The Bronze Age short cist burial at Cnip contained a coarse, undecorated pottery vessel placed near the head (Figure 8.7), which appears to have been carelessly or inexpertly made and is not of Beaker type (Dunwell *et al.* 1996b, 284). A pottery vessel was also found with the Iron Age burial, Gals 93 and is the only vessel currently known from an Iron Age burial context within the Hebrides (but see Armit 1996, 153). It was very finely made and apparently unused but displays no differences in either form or decoration to other vessels of this period found on Atlantic Roundhouse sites (Neighbour *et al.* 2002). Gals 93 also contained an iron penannular brooch, a bone or antler pin and textile remnants. The iron penannular brooch is a rare find. Only two other penannular brooches are known from Scotland and these date from the 1st century BC to 3rd century AD, thus being entirely consistent with a date prior to 300AD for the pottery vessel (Neighbour *et al.* 2002) and the radiocarbon dates for the burial (Table 8.3).

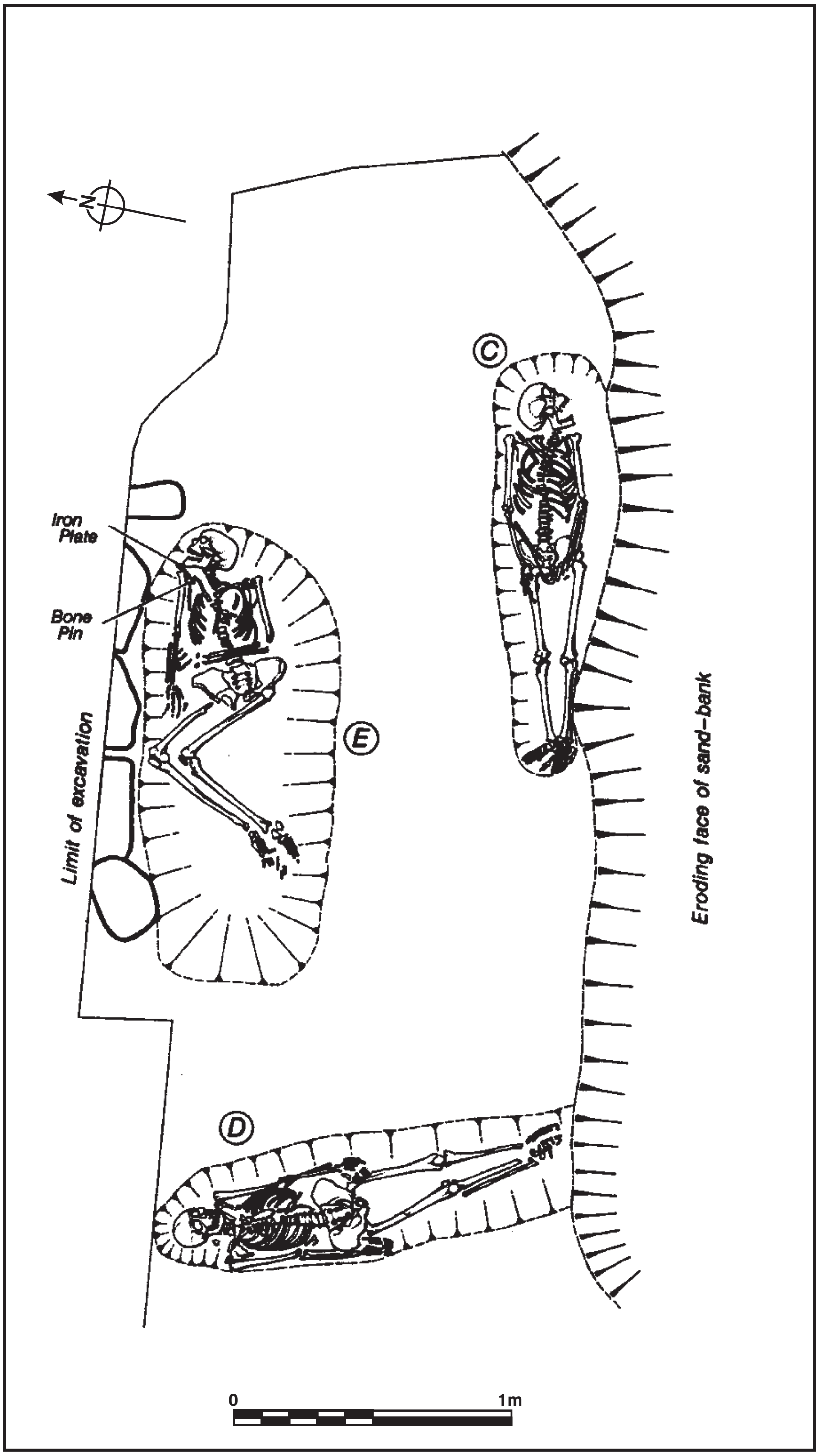

Figure 8.11 Plan of Norse kerbed burials at Cnip. C and D are adult males, E is an adult female
Adapted from Dunwell *et al*. 1996.

No other grave goods were found with the other four individuals analysed from Galson. Unaccompanied burial appears to predominate throughout the Hebridean Iron Age

(Armit 1996, 153) and in long cist cemeteries in general, thus supporting the idea that long cist cemeteries reflect the change to Christianity. Nonetheless, some pre-Christian Picts were also buried without grave goods and this fact, together with what would be implausibly early 1st and 2nd century radiocarbon dates for Christian burials in the British Isles, argue against the Galson long cists resulting from the adoption of Christianity (Neighbour *et al.* 2002).

The vast majority of known pagan Norse graves in Scotland appear to date to the hundred years from the mid-9th to the mid-10th century (Graham-Campbell & Batey 1998, 154). At Cnip, A is the only burial that contains this characteristic assemblage of grave goods, although another such pagan female burial was found in the vicinity, near Bhaltos school, in 1915 (Armit 1996, 201). The high quality craftsmanship of the decorative metalwork and the glass beads found with Cnip A indicates the artefacts were imported from specialist craft centres such as those known at Birka in Sweden or Dublin in Ireland (Welander *et al.* 1987, 165). Although superficially similar, the oval brooches (*c.* late 9th to early 10th century) were not a matching pair and one had been damaged in antiquity. This, together with the original later 10th century date proposed for the ringed pin, led to the suggestion that they were heirlooms (Welander *et al.* 1987, 169). However, a subsequent reassessment of the ringed pin suggests it should be dated to the late 9th – early 10th centuries, thus bringing it into line with the presumed date of manufacture of the oval brooches and the radiocarbon dates of the bone (J. Graham-Campbell pers. comm.). Whilst this would signify that Cnip A is contemporary with the other Norse burials, artefacts can be deposited at any time after manufacture and the observation that the brooches were clearly not new when buried still demands a burial date some time after their manufacture.

None of the other burials at Cnip contain such clear evidence for Norse affiliation, although they are believed to be of pagan Norse character. Amber beads were only recovered from juvenile burials at Cnip but are common finds in Viking Age funerary contexts. Parallels for the perforated iron plate from Cnip E and bone pins from E and F, which may have secured clothing, have been found in other Norse contexts in Scotland and the Hebrides (Dunwell *et al.* 1996a, 737). The sandstone pendant from B, whilst not definitively of Norse type, can be paralleled by a pendant of similar form found at Birka in Sweden and the perforated whetstones which are a common find in Norse graves (Dunwell *et al.* 1996a, 726).

8.2.8 Samples

Human, animal and soil samples are listed in Tables A6, A7 and A9 respectively. Alison Sheridan, Assistant Keeper of Archaeology, National Museums of Scotland and Richard Langhorne, Museum nan Eilean, Stornoway kindly selected and made available teeth from the Cnip and Galson individuals. The author selected tooth samples from the Galson individuals. Due primarily to the severity of tooth attrition or the complete absence of teeth, it was not possible to obtain a suitable sample from Gals I, III, VI or VII (Table 8.1). All the Cnip Norse burials were analysed together with the Bronze Age inhumation (Cnip BA) excavated in 1992. Two permanent teeth were analysed from Cnip D and primary crown dentine samples were prepared and analysed for Sr isotope ratios to further characterise the time-averaged mobile soil Sr isotope ratio of the burial soils. In addition, animal tooth enamel from cattle, sheep and red deer (Table A7) were analysed from stratified Norse and Iron Age contexts identified by Jennifer Thoms, Edinburgh University, at Bostadh (Figure 8.1), to assess the Sr and Pb isotope ratios available from a range of local herbivorous grazers and hence, plants, meat and milk products. Soil samples were kindly obtained by Mike Church and Mary McLeod, the Western Isles Archaeologist, Museum nan Eilean, Stornoway from both the Iron Age burial contexts at Galson and the Bronze Age and Norse burial contexts at Cnip together with samples from the contexts considered to be Iron Age cultivation soils at Galson and Norse cultivation soils at Cnip (Table A9, Figures 8.5 and 8.6). Acetic acid leaches were analysed from a crushed sample of outcropping Lewisian gneiss from Cnip.

Although the skeletons were generally very well preserved morphologically, preservation of enamel and dentine samples was quite variable. Teeth with enamel graded as poor (Cnip C: preservation score = 5) or satisfactory (Cnip BA and Gals 74: preservation score = 4), were the teeth with the greatest attrition (moderate/severe or severe) and hence, greatest exposure of the dentine (Table 5.3). The three juvenile teeth all appeared to be unerupted. The infant deciduous teeth from Cnip F and G were incompletely mineralised and the enamel sample obtained remained brown. The I^1L from Cnip B was white and initially appeared fully mineralised but the surface was matte and softer than would be expected and had to be removed to a greater depth than is usual before a sample of hard, white translucent enamel could be produced. The animal teeth were all very well preserved (preservation scores: enamel = 2). The samples from Cnip and Galson are too small to be statistically valid independently but cannot be treated as a single population because the sites are from different periods. They are, nonetheless, both coastal, geographically close (Figure 8.1) and the underlying geology is the same. Accordingly, they provide an interesting comparison of changes through time on the island.

8.3 Results

The results for Galson and Cnip are presented in graphical form in Figures 8.12 – 8.18 at the end of the chapter and in Tables A1, A2 and A4 in Appendix I.

8.3.1 Sr results

Most tooth samples (whether enamel or dentine) fall between the machair end-members of the sandy soils (cultivation and burial) at Cnip and Galson and rain/seawater. All three juveniles fall within this machair range. The cultivation soil leaches from Galson are slightly more radiogenic than those from Cnip and this may reflect a greater contribution from marine sources in the deeper and more extensive machair deposition on the Cnip headland. The local Sr signature ranges from the marine value of ~0.7092 through to ~0.7105 and is indicative of a contribution from the older Lewisian gneiss to an environment dominated by marine inputs. Animal ratios fall within this machair range and have concentrations ranging from 355 - 656ppm. Human enamel-Sr concentrations range from 58 - 417ppm which is a larger range and greater concentration than found at other sites in this study where enamel rarely exceeds 100ppm. The two teeth analysed from Cnip D have replicated well.

Four adults fall outside the locally defined machair range: two Norse (D and E) and two Iron Age (Gals 93 and Gals IV). Both Norse individuals (two different teeth analysed from D) have considerably less radiogenic Sr ratios than the machair range and these ratios cannot be explained by any of the environmental parameters so far analysed (or expected) from Lewis. The two Iron Age individuals have Sr isotope ratios that are more radiogenic than the local range, although still not as radiogenic as the gneiss leach and what would be expected from such an old bedrock geology (Åberg *et al.* 1998). However, such a dietary signature cannot be sourced entirely from marine and machair inputs and it is clearly of very different origin to that obtained by Cnip D and E. Cnip A has the most radiogenic Sr of any of the Norse analysed. Although this is only just outside the Cnip soil range, Figure 8.13 shows the enamel/dentine diagenetic vector is towards *less* radiogenic Sr (i.e. as are the Galson individuals), rather than from less to *more* radiogenic Sr as is the case with the other Norse adults.

8.3.2 Pb results

Pb data from the soils at Galson and Cnip are extremely variable compared to the results from the Lewis burials and data from all other case studies in this thesis. Pb plots are, therefore, presented both with soil data (Figure 8.14) and on an expanded scale without (Figure 8.15). The Cnip soils, which appear to be almost entirely composed of calcareous sand, have produced a cluster of Pb isotope ratios which is very different to the linear array of the Galson soil leaches. This difference was not apparent in the Sr soil data. On the uranium derived plot (Figure 8.14b), nearly all the Cnip soils plot below and to the right of the growth curve, indicating they are depleted in ^{207}Pb relative to ^{206}Pb. The aberrant Cnip soil (Cnip-S3) was a water leach that produced too little Sr to analyse and it is possible this Pb result is inaccurate. Alternatively, its presence on the growth curve may indicate the incorporation of older rock within the carbonate sand. The sandy soils from Galson are clearly enriched in thorium relative to uranium (Figure 8.14a) which is the case with granites and gneisses (Faure 1986, 283) and may result from the presence of thorium-bearing accessory minerals. The unusual slope and the fact that it arises from the analysis of a sandy soil, strongly suggests the cause is mixing between two end-members rather than *in situ* radioactive decay. These end-members are not readily apparent when both plots are considered together. Figure 8.14b suggests the array may arise from a mixing of material of recent marine origin (i.e. machair) with the Lewisian gneiss. However, when the data from Figure 8.14a are also taken into account it appears that ore Pb, rather than machair, and the gneiss may provide the most appropriate end-members for the cluster of Norse enamel ratios in both cases.

Norse enamel-Pb isotope ratios from humans and cattle are very similar to, and within error of, each other and cluster tightly within the ore Pb source field. They show similarity to ore Pb from England and, interestingly, the cluster from eastern Ireland (specifically ores from Kildare, Wicklow, Dublin and Meath) but not ore from mainland Scotland (Figure 8.15) (Rohl 1996). There is no ore mineralisation on Lewis itself (T. Shepherd pers. comm.). Iron Age and Bronze Age ratios are considerably more variable than the Norse ratios. Gals IV and Gals 93 are indistinguishable from the Norse, whereas Gals 74 and Gals II are very similar to each other and intermediate between the Norse cluster and the looser grouping of the Bronze Age individual from Cnip and the Iron Age sheep and cattle. Gals 96 and the Iron Age deer are clearly separated from each other and all other data points. The two teeth analysed from Cnip D replicated within analytical error.

Human enamel-Pb concentrations (Figure 8.16) follow the grouping suggested by the isotope ratios. Gals IV and Gals 93 have ore Pb isotope ratios and the greatest Pb concentration (>1ppm). Gals 74 (0.10ppm) and Gals II (0.23ppm) have the lowest concentrations which are most similar to those found in the Iron Age stock and the Bronze Age adult from Cnip (≤0.06ppm). Gals 96 is intermediate at 0.61ppm. At 0.16ppm, the Norse cow has the highest Pb concentration amongst the animals. Unfortunately, concentration data failed for most of the Norse individuals from Cnip and that from the juvenile Cnip B (44ppm) is very high and requires repeating before any conclusions are drawn. Nevertheless, the data obtained (Figure 8.16) indicates no noticeable difference in the range of human Pb concentrations between the Iron Age and the Norse periods but, as found at West Heslerton, individuals with higher Pb concentrations have ore Pb ^{207}Pb/^{206}Pb ratios ~0.846.

8.3.3 Pb and Sr combined

Prehistoric Pb isotope ratios are more variable than prehistoric Sr isotope ratios (Figure 8.17). If the Galson and Cnip samples are combined, the trend that clearly emerges is that individuals with variable non-ore Pb signatures have machair Sr signatures but individuals with variable (i.e. non-machair) Sr isotope ratios have an ore Pb signature. The pairing of Gals IV with Gals 93 is strengthened when both Pb and Sr are considered together (Figure 8.18). They have similar Pb isotope ratios, Sr and Pb concentrations, and the most radiogenic Sr. Likewise Gals II and Gals 74 have similar Pb isotope ratios, Sr and Pb concentrations and a machair Sr signature. Gals 96 has a machair Sr signature but is marked out by a greater Sr concentration.

8.3.4 Diagenesis

At first inspection Figure 8.12 appears to show a trend for diagenetic accumulation of Sr from the burial environment in the samples with the greatest Sr concentrations. Moreover, amongst the human samples, the individuals that have Sr isotope ratios *most* different from the burial soils have well-preserved enamel, i.e. Cnip A, D x 2, E, Gals 93 and Gals IV have preservation scores = 2/3 (Table A5). It is not the case, however, that teeth with Sr isotope ratios most similar to the burial soil are all poorly preserved. Gals 74 and Cnip C (preservation scores = 4/5) are (Figure 8.13), as are the two incompletely mineralised infant teeth but demonstrably well-preserved teeth such as Gals 96, Gals II and all the animal teeth also have a machair ratio. High Sr concentrations (~800ppm) are expected in modern herbivore teeth as plants are a richer source of Sr than meat or milk (section 2.3.3). High Sr concentrations in humans may result from a plant based diet, although the level of bioavailable marine Sr in machair-grown crops is not known and Sr ingestion would also increase if bones (e.g. small fish bones) were consumed. It is, therefore, very likely that a marine skeletal Sr isotope ratio would result *in vivo* from a local origin. Nevertheless, the lack of correlation of gross macromorphological preservation with non-soil Sr isotope ratios makes it impossible to disprove post-mortem contamination for even apparently well-preserved dentine samples. Gals 96 and Gals II may either preserve the integrity of the *in vivo* Sr isotope ratio or equally, be entirely swamped by diagenetic Sr. It is worrying that there are no obvious osteological parameters (e.g. preservation, tooth type, attrition, root formation, maturation, age at death) that would discriminate these two teeth from those of Gals 93 and Gals IV. However, the three Galson teeth that have burial soil Sr isotope ratios are the three teeth with non-ore Pb isotope ratios and no enamel-Pb diagenesis is suspected. As no evidence from this thesis suggests Pb and Sr behave the same in skeletal tissue, however, the Pb results cannot prove Sr diagenesis has not taken place particularly as it is in precisely these alkaline conditions where Sr is considered mobile and Pb is not.

Figure 8.13 shows paired enamel and dentine results for each individual together with the water and acetic acid leaches from the associated burial soil. As was demonstrated in Chapter Six, the diagenetically susceptible dentine is usually intermediate between the enamel ratio and that of the burial soil leaches. Evidently, at Galson and Cnip, acetic acid leaches do not characterise the mobile Sr as well as water leaches, which produce a better estimate in this highly alkaline burial environment. This is illustrated by the Bronze Age individual from Cnip and by the Galson ratios. The best estimate of the mobile Sr for the Norse burials at Cnip would appear to be obtained from an average of the Norse and Bronze Age soil leaches (i.e. ~ 0.7100) and is, perhaps, understandable given the dynamic nature of the machair dune system and the stratigraphic relationship between the Norse and Bronze Age inhumations.

Due to the considerable variability of the soil Pb isotope ratios, it is difficult to constrain without further analysis, what a diagenetic Pb signature would be at Cnip or Galson but clearly, no enamel samples have equilibrated with the leaches obtained to date from the burial soils.

8.4 Discussion of results

The burial and cultivation soil leaches have delineated a local Sr isotope ratio range consistent with what would be predicted for sandy soils with a high marine component on geologically ancient bedrock. There is little observable difference between the Sr in soils from Galson and Cnip. The difference in soil Pb leaches at the two sites (Figure 8.14) supports the assertion of Gilbertson *et al.* (1999) that two types of sand, quartzose and carbonate, are present on the west coast of the Hebrides. The extensive machair deposition at Cnip appears to be predominantly of marine origin whilst the sandy soils at Galson have a very different provenance which may well be quartzose sands of terrestrial origin which were deposited after the last Ice Age. Young Pb from Atlantic Ocean volcanic islands (such as Ascension Island and Tenerife) plots in the same region as the Cnip soils (Faure 1986, 328) and such ratios may arise in the machair from the incorporation of sand grains of recent volcanic, marine origin. The Cnip ratios also plot in broadly the same region on both Pb plots as ratios obtained from chalk leaches at other sites in this study. Like machair, chalk is predominantly composed of calcareous marine shells. It seems, therefore, that there is a much greater non-machair component in the Galson soils than soils from Cnip, which appear to be almost entirely of marine origin.

Taken as a whole, the Pb isotope and concentration data from Lewis confirms the conclusions from West Heslerton that there is both an increase in Pb concentration and a focussing of the isotope ratio towards ore Pb isotope ratios over time (Figure 9.2 and 9.3). It is of note that this ore Pb, as at other sites in this study, is more similar to English ores, and perhaps crucially, ores from eastern Ireland, specifically Wicklow, Dublin, Kildare, and Meath, rather than those from Scotland. However, mediaeval tooth data published by Åberg *et al.* (1998, 116) present very similar ratios for Norwegian teeth but no explanation of the source is given other than that it *"may have been local"*. The widespread occurrence of these Pb isotope ratios in a variety of localities from the Roman period onward suggests that these people all inhabited the same cultural sphere of trade and artefact exchange.

The Norse ratios (including the cattle) are tightly clustered on both Pb plots (Figures 8.14 and 8.15) whilst there is much more variability in the Bronze Age and Iron Age (including the cattle, sheep and deer). The only Iron Age individual buried with an iron artefact (Gals 93) has the same anthropogenic Pb signature as the Norse. The thorium derived plot (Figure 8.14a) suggests that Norse Pb isotope ratios could result from mixing between a Galson soil end-member and a component of the gneiss but this is not the case with the uranium derived plot (Figure 8.14b). Furthermore, the relatively high Pb concentrations (>1ppm) found in Gals 93 and Gals IV would argue against their enamel Pb being purely of country rock origin. It is possible that the end-member of the Galson soil leaches is anthropogenic Pb; the addition of manure, bone ash and waste has been occurring since the Bronze Age in this region to improve and fertilise soils (Gilbertson *et al.* 1999, 465). Gals 96 has the earliest radiocarbon dates at the cemetery (Table 8.3) and poses a somewhat different problem. This individual has Pb isotope ratios on the thorium derived plot (Figure 8.14a) that could be obtained from a mixture of Galson and Cnip (i.e. machair) type soils but this becomes unlikely when the uranium derived ratios alone are considered (Figure 8.14b).

8.4.1 Identifying the local signature

The group loosely formed by the Iron Age cattle and sheep, Gals 74 and Gals II and the Bronze Age individual from Cnip probably represents the best estimate of an indigenous, pre-anthropogenic Pb signature from the northwest coast of Lewis (i.e. thorium-rich) based on the current data. All have a machair Sr signature. However, analysis of more animal and plant samples from Iron Age sites would help to clarify this. It is of note that Gals 93 is one of the later burials in the cemetery and has, along with Gals IV, an anthropogenic ore Pb ratio. If this was obtained locally, it may date the increased exposure to Pb on Lewis, an island relatively unaffected by the Romans in southern Scotland, to the 1st to 3rd centuries AD.

The Pb and Sr isotope ratios obtained from the Iron Age deer are somewhat unexpected. Deer are difficult to pen and liable to have ranged far more freely than cattle even if semi-domesticated, especially as the machair appears to have been reserved for arable crops (section 8.2.4). Grazing on the inland peat would be expected to produce a Pb and Sr isotope signature dominated by the outcropping gneiss bedrock. However, the Sr isotope ratio appears heavily influenced by the machair environment whilst that of the Pb plots near the Pb ore growth curve, and apart from the single sample from Cnip, is not explicable by any of the soil or bedrock samples analysed thus far from Lewis. Moreover, if indigenous, it suggests that the Pb soil leaches do not characterise the Pb entering the food chain. It is, however, only a single animal and demonstrates both the complexity encountered with this sort of ancient bedrock and the need to do further flora and faunal samples to more closely characterise the food chain on the island. The possibility of deer being exported throughout the Hebrides from specialist islands such as Mull during the Iron Age, must also be considered (Gilmour & Cook 1998, 334).

The observation that variable Pb isotope ratios are combined with machair Sr isotope ratios whilst variable Sr isotope ratios are combined with ore Pb signatures is explicable when the different concentrations of Sr and Pb in the marine and terrestrial environments are recalled. Sr is a major trace element in seawater whereas Pb is present at the ultra-trace level (section 2.2.2). Although the machair environment may constitute only a small proportion of the diet (as predicted for deer), it may be so Sr-rich that it will swamp any contribution from the gneiss (section 2.2.1). Moreover, although Sr is bio-purified in the marine food chain as in the terrestrial food chain, plants are a rich source. With Pb, the reverse is likely to be the case. Machair-Pb (as represented by the Cnip soils) may have been the signature of a large proportion of the diet but at very low concentration. Consequently, machair-Pb would in turn be swamped by Pb from other terrestrial sources, anthropogenic or natural such as soft, acidic freshwater (known to assist Pb absorption) and grit incorporated into the food from quernstones, which are of local gneiss (T. Neighbour pers. comm.). Furthermore, the high Ca content of the machair would suppress the absorption of machair-Pb in the gut and further enhance this imbalance. This effect may also explain the very different Pb isotope ratios but very similar Sr isotope ratios of the Galson and Cnip soils. Clearly, the marine Sr isotope ratio swamps the terrestrial signature at Galson but marine Pb does not. The Cnip soils, which are virtually pure calcareous sand, retain the marine Pb signature in the absence of any terrestrial contribution.

8.4.2 Galson 93

The simple dug grave and grave assemblage of Gals 93 is currently exceptional amongst the contemporaneous long cist burials at Galson, suggesting his lifestyle or beliefs necessitated a different ritual to be enacted. Moreover, the absence of the lateral flange of bone which is present on all the other Iron Age femora suggest his lifestyle was different in some way to the other individuals buried in the cemetery. He has the most radiogenic Sr (0.7130), although it does not approach the ratios that could be expected from the Lewisian gneiss. For example, Sr isotope ratios ranging from 0.7197-0.7323 were obtained from mediaeval Norwegian teeth from inland sites (Åberg *et al.* 1998, 113). Nevertheless, based on the preceding discussion, it would appear that Gals 93 (and to a lesser degree Gals IV) had a childhood diet that relied very little on Sr-rich marine or machair sources. Stable isotope analysis confirms that he consumed a high animal protein diet but with virtually none coming from marine sources (T. Neighbour pers. comm.).

As the Iron Age sheep, cow and deer all produced a machair Sr isotope ratio it is somewhat of a puzzle, with only the current data set to go on, as to what food he was eating. It is possible such a Sr signature could be obtained from an inland or east coast origin (the sandstone near Stornoway was not analysed), but survival on Lewis would seem highly unlikely if no seafood, machair-grown crops or domestic livestock were consumed, especially given the limited indigenous wildlife. Equally, however, such a Sr signature could be obtained from mainland Scotland and much of Ireland with the exception of Co. Antrim in the northeast. The Pb isotope ratios clearly show Gals 93 and Gals IV have a different and greater childhood Pb exposure than the other Iron Age individuals from Galson and the iron brooch worn by Gals 93 is a very rare find indeed. Support for the mobility of certain classes of people in the Iron Age is given by Armit (1996, 232): *"It is likely therefore that there would always have been some inflow and outflow of people from the Hebrides, particularly ... amongst those whose primary activities were other than subsistence agriculture. The proportion of the population able to achieve such mobility may be expected to increase in broad terms as society became more hierarchical, as apparently happened ... from the Later Iron Age onwards".* Thus, the data raise the possibility of the presence of mainland Picts or Scots who adhered to a different burial rite and had greater access to metallurgy, in the cemetery at Galson. It is of note that itinerant metalworkers were believed to have been operating in this region (T. Neighbour pers. comm.).

The isotope and concentration pairing of Gals IV with Gals 93 and Gals 74 with Gals II produces two male/female pairs (Figure 8.16). As enamel is formed in early childhood this indicates that they had very similar exposure whilst the teeth were mineralising. Gals IV and Gals 93 having a greater exposure to anthropogenic Pb and more radiogenic (e.g. inland) Sr, whilst Gals 74 and Gals II had a more natural and lower Pb exposure and a diet sourced predominantly from the machair and/or the sea. Obviously, this is not necessarily as local co-habiting couples – a sibling or offspring relationship is also possible. It does, however, demonstrate that the observed differences are not sex-specific and may arise from living in the same or similar households during childhood.

8.4.3 Cnip D and E

The two Norse individuals D and E provide the earliest dates in the radiocarbon series from Cnip (Table 8.3) and the most clear evidence for immigration to Lewis. There is a limited range of lithologies that can provide Sr isotope ratios of <0.7080 in the North Atlantic region and none occur on Lewis or Norway. These are predominantly young rocks of the Cretaceous or later and include the igneous Tertiary rocks that comprise Skye, Iceland, the Faeroe Islands and Co. Antrim in Northern Ireland. In this study, such unradiogenic Sr isotope ratios ≤0.7079 have been obtained from Cretaceous chalk and its associated soils but not from any other enamel samples. The Sr isotope ratios from Cnip D (0.7078) and E (0.7086) are, therefore, notably unradiogenic ratios but they may have been obtained from a restricted diet sourced entirely from chalk. At Monkton, ratios similar to Cnip D were obtained from the *dentine* of individuals buried in the chalk, i.e. diagenetically incorporated from the chalk but no burials on chalk at Monkton, Winchester or West Heslerton had wholly chalk *enamel* ratios, although all may of course be migrants to the area. Enamel Sr isotope ratios tend to be more radiogenic and shifted towards rainwater values, i.e. local inhabitants appear to have enamel Sr isotope ratios that fall between the local geology and rainwater/seawater even at inland sites.

There is no Cretaceous chalk in Scotland, the Hebrides, the Northern Isles or Western Scandinavia. Cretaceous deposits occur in northern Denmark, the southern tip of Sweden, northeast Ireland, Yorkshire, Humberside and the south and east of England (Figure 1.1 and 1.4). Clearly, these areas are all some considerable distance from the Hebrides and, with the exception of Ireland, they are not traditionally areas from where migration would be occurring to the Hebrides at this time. Of the Scandinavian Vikings, it is believed the Swedes went east towards Russia whilst the Danish may possibly have raided the East Coast of Scotland and used Scottish waters to reach the Irish Sea (Figure 8.3). All the available archaeological evidence points to the Vikings in the North Atlantic being of western Norwegian origin (Graham-Campbell & Batey 1998, 25; Ritchie 1993, 15). Neither the archaeological nor the currently available geological isotope evidence would, therefore, support an origin on chalk and origins should perhaps be sought on less radiogenic lithology.

Young rocks of tertiary volcanic origin are found on Skye, Mull, Canna, Muck and Eigg. Archaeologically, movement between these islands would be understandable as evidence suggests a considerable degree of contact between them. Skye and the Western Isles share a similar range and type of monuments throughout prehistory from Neolithic chambered tombs to Iron Age broch towers, which are markedly different from those of mainland Scotland and the Northern Isles (Armit 1996, 4). Moreover Viking trading routes between Ireland and the Faeroes and Iceland (Graham-Campbell & Batey 1998, 110) would have facilitated regular passage and contact between all these islands (Figure 8.3). However, the young, igneous Tertiary rocks of Skye and Mull were extruded through the ancient crust and mixing of the magma with the partially melted Lewisian gneiss has contaminated and altered their Pb and Sr signatures so they do not appear as young, or as homogeneous as would be expected (Faure 1986, 331/4, J. Evans pers.comm.). This, coupled with the proposed shift towards rainwater ratios, makes it unlikely that the Sr isotope ratios of D and E could be obtained from these islands.

The oceanic, volcanic islands of Iceland and the Faeroe Isles are locations where Sr isotope ratios <0.708 can be obtained in the North Atlantic region (Faure 1986, 166). Although people had clearly reached the Shetland Isles during the Neolithic, the initial settlement of the more northerly Faeroes cannot be proved, or disproved, archaeologically prior to 900AD (Arge 1993, 471; Debes 1993, 460). However, the Vikings were believed to have first settled the Faeroes from the south, rather than direct from Norway, sometime around 800AD (Debes 1993, 461) and Iceland slightly later in 870-930AD (Ritchie 1993, 9). Both Iceland and the Faeroes were described by the Irish monk, Dicuil, in ~825AD. He noted that Irish hermits had initially found them uninhabited when they arrived a century earlier but *"Northern pirates"* had since caused them to be abandoned by all but the sheep (Debes 1993, 455).

Hermit monks do not readily spring to mind as a breeding population, however, and the question, therefore, is one of dating and time. Do the radiocarbon dates (D = 687-974AD; E = 717-985AD, 2σ) provide sufficient time for the initial settlement of either the Faeroe Isles or Iceland with a breeding population, the birth of D and E and the journey to Lewis? The form and size of the graves of Cnip D and E have many parallels with both the typical Icelandic Viking burial and a Viking Age female grave in the Faeroes (Dunwell *et al.* 1996a, 745). Historical records indicate that inhabitants of the Hebrides were amongst the first settlers in Iceland (Andersen 1991, 137; Sharples & Parker-Pearson 1999, 43). Migration theory allows for flow in both directions once a migration stream between two places has been established (Anthony 1997, 25). Moreover, migrants have an increased tendency to return to their place of origin or to target places where they have family or where familiar social systems prevail (Anthony 1997, 25). Nevertheless, the dating constraints provide a window of ~100 years and do not, therefore, rule out such an origin.

The final point of origin to consider is on the tertiary basalts of Co. Antrim in northeast Ireland. Viking trading routes between Ireland and Norway, the Faeroes and Iceland passed by Lewis, although most probably down the more sheltered east coast (Sharples & Parker-Pearson 1999, 43). The Vikings settled in Ireland during the mid 9th century AD but were driven out by the Irish temporarily in 902 AD (Graham-Campbell & Batey 1998, 110). Antrim was one of the areas of Viking settlement in Ireland (Figure 8.4). These seaways, however, were well travelled before the Vikings reached them and there are many earlier cultural links and influences between the Hebrides and Co. Antrim, such as similarities in housing form (Armit 1996, 186; Ritchie 1993, 21). Co. Antrim is the ancestral home of the Dalriadic Scots who extended their kingdom to the west coast of Scotland in the late 5th century (Figure 8.2) (Graham-Campbell & Batey 1998, 14) and perhaps, were present in the Hebrides, prior to the Norse settlement. However, by the 6th century, Dalriada was a centre of the Celtic Church and the Scots of Co. Antrim would be expected to be Christian (Ritchie 1993, 86). There is little about the burial rite of D and E that would suggest Christian burial, although neither is there anything definitively Norse.

The presence of a male/female pair of immigrants casts a different light on the nature of the cemetery at Cnip, particularly as Ireland, Iceland and the Faeroes were all settled by Vikings subsequent to the Hebrides. All other Viking period burials in the Western Isles are either isolated graves or, as at Eigg, three adult male burials (Armit 1996, 202). Previously it was difficult to ascertain whether such burials resulted from colonisation or casualties of raids (Ritchie 1993, 79). Moreover, the first generation settlers buried with Norse grave goods on the Isle of Man *c.*900AD appear to be all male, the females having no grave goods (Graham-Campbell & Batey 1998, 111; Ritchie 1993, 89). The cemetery has been interpreted as resulting from Viking males marrying indigenous females and not bringing their womenfolk with them. Clearly, the presence of an immigrant male *and* a female at Cnip may attest to the peaceful settlement and established migration stream between Lewis and their point of origin. It is, however, not necessarily the case that they were migrants of either long-standing or any permanence on Lewis. It is of particular interest that an origin in Norway can be ruled out for Cnip D and E.

8.4.4 Cnip A

The rich female burial (Cnip A) poses a different set of questions. It is interesting because it is the only Norse burial with enamel *more* radiogenic than the Cnip soils and the only Norse adult where the vector of movement between enamel and dentine is from more to less radiogenic Sr (Figure 8.13). It is, therefore, different from the others. However, despite the re-dating of the grave goods with Cnip A (section 8.2.7), it is still feasible that Cnip A could be a later burial than C-D, and a change in subsistence practices once the community became established is possible. That Cnip A should have a more marine-derived Sr isotope ratio than Gals IV and Gals 93 would be expected as fish consumption increased during the Norse period (Barrett *et al.* 2000, 24) and this difference is borne out by stable isotope analysis which indicated ~40% marine protein in the diet of Cnip A, 10-20% for Cnip C, whereas Gals 93 had virtually none (T. Neighbour pers. comm.). Nonetheless, a Norwegian coastal origin cannot be ruled out for Cnip A ($^{87}Sr/^{86}Sr = 0.7105$) as this too may produce Sr isotope ratios that are only slightly more radiogenic than the marine ratio. Åberg *et al.* (1998) report a Late Mediaeval tooth from coastal Bergen with very similar Sr *and* Pb isotope ratios to Cnip A.

8.5 Conclusions

The Pb and Sr environment at Galson and Cnip is complex. Clearly, many more environmental (water, plants and soils) and food (cattle, sheep, deer, carbonised grains) samples need to be analysed in order to characterise the Sr and Pb available to the food chain, in a manner comparable to Sillen *et al.* (1998). Only then will it be possible to fulfil the first stated aim of this study: to identify an indigenous Pb and Sr signature for prehistoric inhabitants of northwest Lewis, with assurance. From the limited range of environmental samples analysed it is not possible to conclude whether the machair environment completely dominates the Sr signature on Lewis or if it is possible to obtain an indigenous radiogenic Sr signature such as that obtained from Gals 93. Archaeological evidence seems to suggest that subsistence independent of the machair plain was not viable during the Iron Age or the Norse period. Additionally, it needs to be ascertained whether all flora and fauna on the island (including the peat, heather and wild animals) are in fact entirely dominated by the marine climate with virtually no contribution from the gneiss geology at all. If this is the case, it is quite possible that the Gals 93, Gals IV and Cnip A are migrants to the island from somewhere such as the Scottish or Irish mainland or, in the case of A, coastal Norway.

The suggestion that a large proportion of the adults analysed from Galson and Cnip are immigrants to the islands may appear excessive. However, the rarity of both types of cemetery in the Hebrides means neither can be considered typical. Moreover, whilst no wholesale population settlement can be proved after the Mesolithic, small scale movement to and from the islands has been a significant agency of information exchange and cultural change on the Hebrides for thousands of years (Armit 1996, 232). Indeed, it is impossible to imagine that innovations such as beakers, metallurgy, Norse jewellery or long cists - with or without Christianity - arrived here if people did not get in a boat and sail to the islands, whether they stayed or merely visited.

Notwithstanding the previous caveats the following conclusions can be drawn from this case study:

1. The Iron Age individuals, Gals 93 and Gals IV, have radiogenic Sr isotope ratios, which do not indicate subsistence on the machair or marine resources and this is

consistent with stable isotope analysis, which indicates no marine protein was being consumed. They also have a greater Pb concentration and an anthropogenic ore Pb isotope ratio, which is not the case with the other Iron Age (or Bronze Age) burials. However, radiocarbon dates indicate they are not amongst the earliest burials in the cemetery. There is currently insufficient environmental and geological data to confirm whether such Sr isotope ratios can be obtained inland or on the east coast of Lewis, or whether a mainland origin (e.g. Scotland, Ireland) must be sought. Such a question would be interesting to pursue in the light of conclusion 6 below, because if these two individuals are natives, they provide evidence for the onset of anthropogenic Pb exposure on the island.

2. Amongst the Norse individuals, Cnip E (female) and Cnip D (male) are immigrants to the Hebrides. Their unradiogenic Sr isotope ratios cannot be obtained from sources on Lewis, Norway nor in much of the North Atlantic region. Origins would most profitably be sought on rocks of Tertiary volcanic provenance. It is suggested that Iceland, the Faeroe Isles or Co. Antrim are the most plausible places where Cnip D and E spent their childhood.
3. Cnip A has a different (more radiogenic) Sr isotope ratio from the other Norse adults which demonstrates a significant input from non-machair and marine resources. However, it is not as radiogenic as Gals 93 and Gals IV and could quite possibly have been obtained locally. However, a coastal Norwegian origin cannot be ruled out, as similar Pb and Sr isotope ratios have been obtained for mediaeval teeth in Bergen (Åberg *et al.* 1998).
4. Water leaches appear to characterise the mobile Sr from the alkaline coastal soils of Lewis better than acetic acid leaches.
5. In machair and coastal environments, marine Sr (0.7092) swamps the Sr from terrestrial sources. Sr is thus, an inappropriate element when attempting to differentiate between different geological areas in these habitats. It is currently unclear how far inland this marine effect on the soils will extend but clearly this may be a problem for small, maritime island studies. Sr concentration may help to differentiate between marine fish and mammal meat (low-Sr ppm) and crops grown on the machair (high-Sr ppm), although stable isotope analysis would be useful in such cases. In such maritime habitats during prehistoric periods before access to metal artefacts becomes widespread, Pb may prove a better discriminant. Pb is only present at very low concentrations in seawater and terrestrial Pb will, therefore,

predominate over marine Pb. This conclusion confirms that of Outridge and Stewart (1999) in their study of marine mammals (see section 4.3).

In addition, the Lewis case study confirms the following preliminary conclusions made in the pilot studies and the West Heslerton case study:

6. It confirms the trend of enamel-Pb isotope ratios in geologically related communities to move away from the natural country rock signature and converge on anthropogenic ore Pb with a concomitant rise (i.e. >1ppm) in enamel-Pb concentration. Clearly, individuals buried on Lewis (Gals 93 and Gals IV), which was little affected by the Roman occupation of southern Scotland, were exposed to anthropogenic Pb during the Iron Age in the 1st – 3rd centuries AD, although it is possible that these two individuals may be migrants to the island.
7. Juvenile and animal teeth provide a useful method of assessing the local indigenous dietary signature.
8. Co-genetic teeth from the same individual replicate both Pb and Sr isotope ratios well and usually within analytical error (Table A1, Appendix I).
9. Rain/seawater Sr has an ameliorating effect on the local geological Sr biasing the bioavailable Sr isotope ratio towards the marine ratio of ~0.7092. For example, a country rock ratio of 0.708 produces biogenic ratios that are more radiogenic whilst a ratio of 0.712 produces less radiogenic skeletal signatures.
10. Enamel is highly resistant to diagenetic alteration by either Pb or Sr and an effective indicator of mobility although evidence indicates that incompletely mineralised teeth are susceptible to incipient fossilisation and should be rejected as samples. Differences seen are minimum differences as diagenetic accumulation or exchange would have an homogenising effect and make them more like the local soil.
11. Dentine is considerably less resistant than enamel to diagenetic Sr incorporation and can be used as a proxy for mobile soil Sr over the period of time the remains have been buried. This would apply to bone also by implication but, because bone is continually remodelling *in vivo*, there is no guarantee that bone and enamel ratios would have been the same at the time of burial. Primary crown dentine and enamel incorporate the same dietary Sr at the time of mineralisation because they are co-genetic and neither remodel nor reform subsequently.

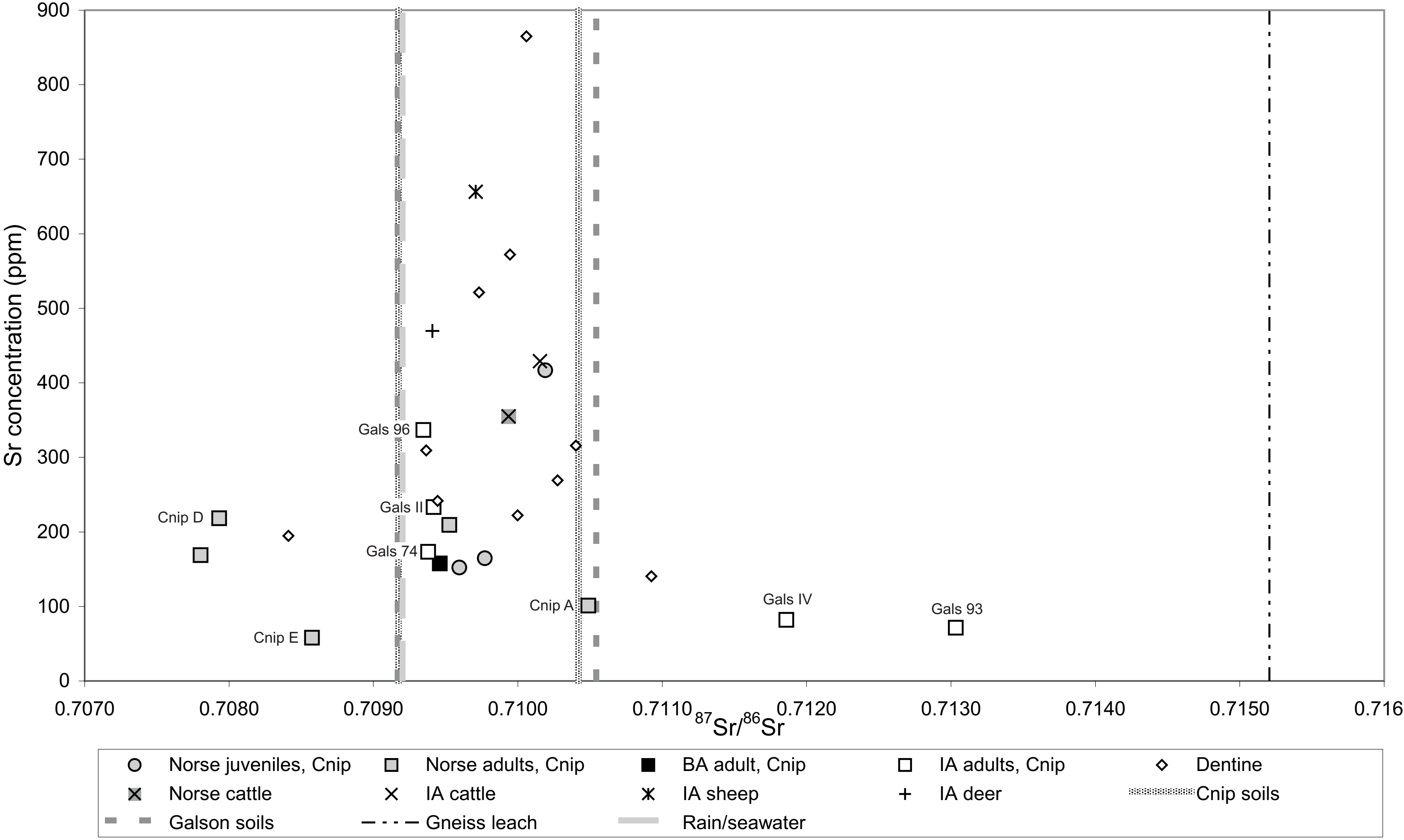

Figure 8.12 Plot of $^{87}Sr/^{86}Sr$ ratio v Sr concentration for Galson and Cnip samples. Note the greater Sr concentration in the animal and dentine samples and the lower concentration and greater ratio variation exhibited in the human enamel samples. Note also the unradiogenic Sr signature of Cnip D and E, which are outside all the environmental parameters obtained from Lewis.

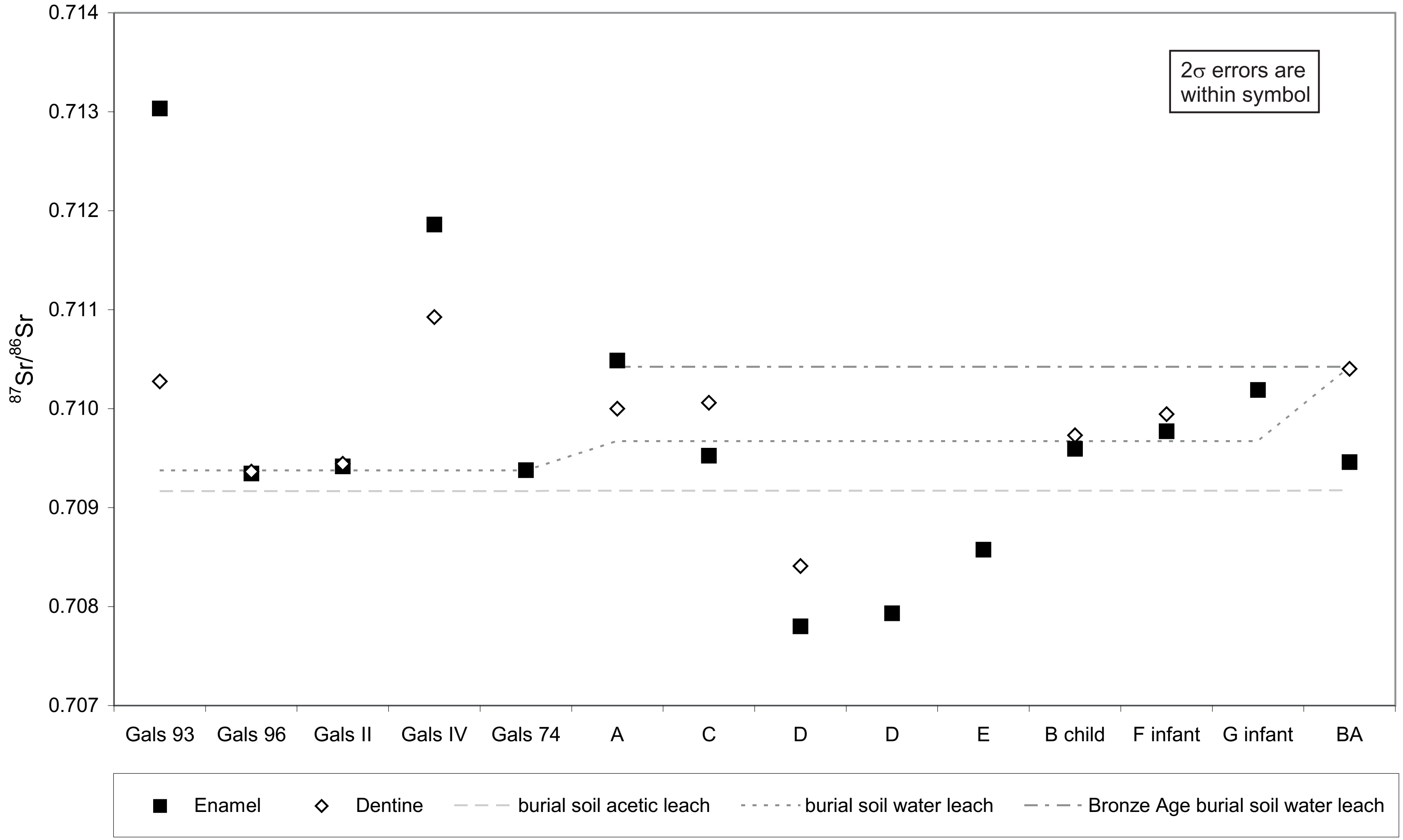

Figure 8.13 Plot of ^{87}Sr/^{86}Sr ratios of intra-tooth tissues for Galson and Cnip samples. Note that where dentine samples are not the same as the co-genetic enamel they are intermediate between the enamel and the soil leach. The vector for movement of Cnip A appears to be from more to less radiogenic Sr as is the case with the Galson samples, whereas C, D and E is from less to more radiogenic Sr. These differences imply a change in diet or subsistence practices, which may possibly be due to place of origin.

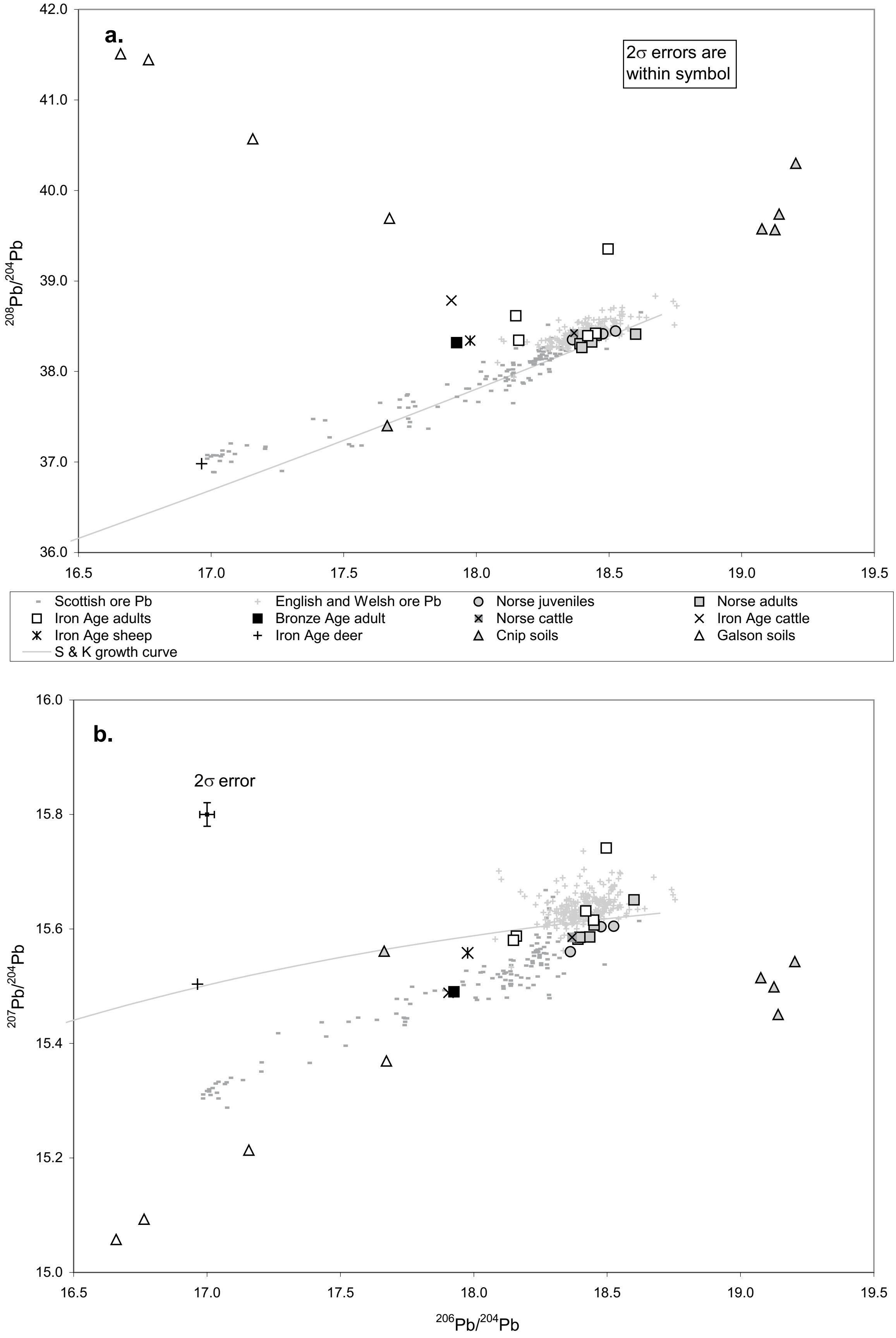

Figure 8.14 Plots of $^{206}Pb/^{204}Pb$ v $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios for Galson and Cnip enamel and soil samples. The central portion is presented with an expanded scale in the following Figure 8.15.

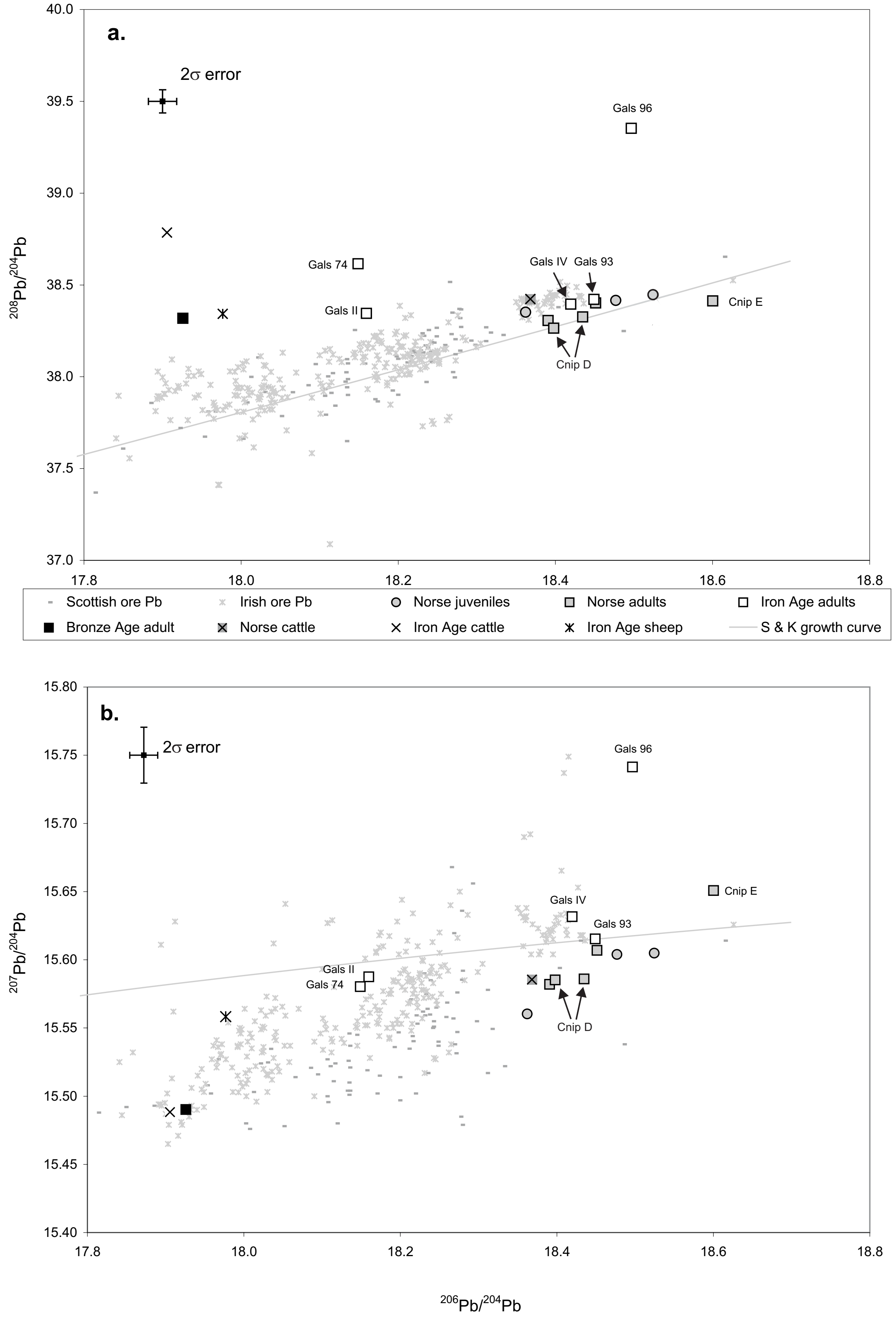

Figure 8.15 Plots of ^{206}Pb/^{204}Pb v ^{207}Pb/^{204}Pb and ^{208}Pb/^{204}Pb ratios for Galson and Cnip enamel samples using an expanded ^{206}Pb/^{204}Pb scale. Irish ores are plotted on these graphs and demonstrate the close agreement between the Norse and the Iron Age (Gals 93 and Gals IV) enamel-Pb with that of ores from Dublin, Kildare, Meath and Wicklow in eastern Ireland (Group A: ^{206}Pb/^{204}Pb ~18.36-18.44) rather than Scottish ore sources (see Figure 2.1). These individuals also have the highest enamel-Pb concentrations.

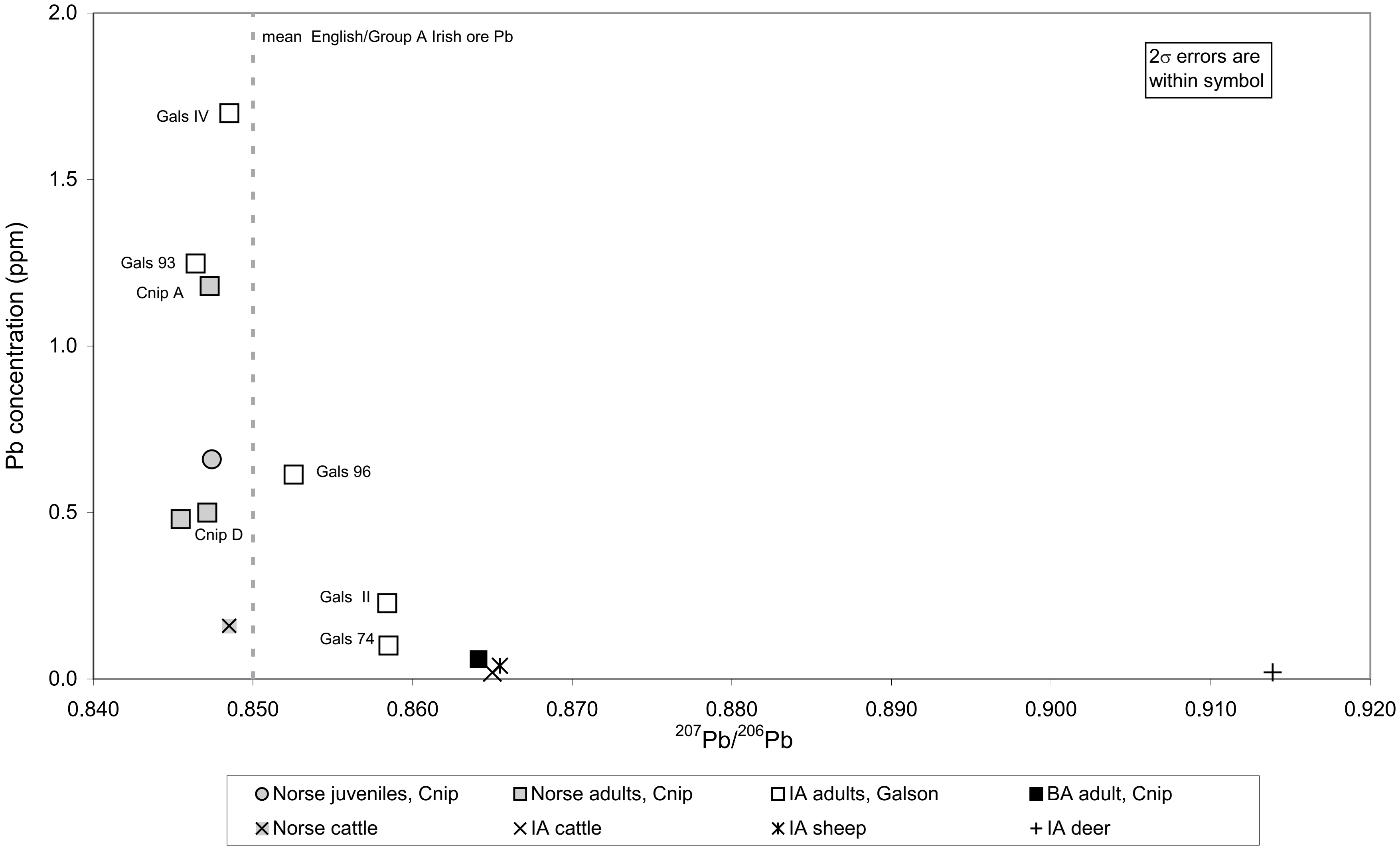

Figure 8.16 ^{207}Pb/^{206}Pb ratio versus Pb concentration for Galson and Cnip enamel samples. Note the focussing of the isotope ratio on values of ~0.846 with increasing Pb concentration. Cnip B (0.842, 44ppm) is not plotted on this graph. The mean English ore Pb also coincides with the mean ^{207}Pb/^{206}Pb ratio for Irish ores in Group A (see Figure 8.15).

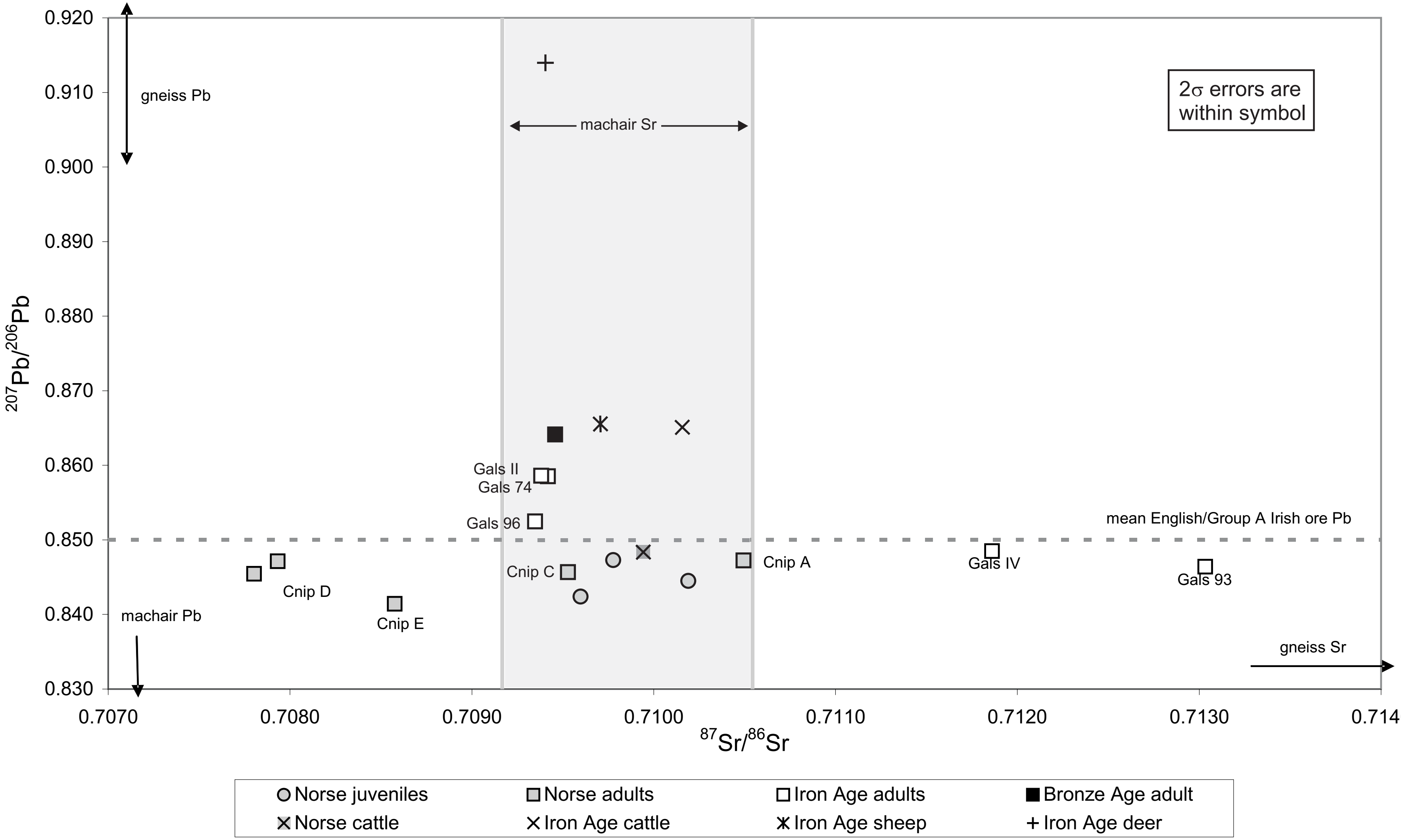

Figure 8.17 ^{87}Sr/^{86}Sr v ^{207}Pb/^{206}Pb for Galson and Cnip enamel samples. Note the greater variability in the ^{207}Pb/^{206}Pb ratios for prehistoric individuals but consistent "machair" ^{87}Sr/^{86}Sr ratios compared to the variable ^{87}Sr/^{86}Sr but invariant ^{207}Pb/^{206}Pb for the Norse and the high-Pb Iron Age individuals. The mean English ore Pb also coincides with the mean ^{207}Pb/^{206}Pb ratio for Irish ores in Group A (see Figure 8.15).

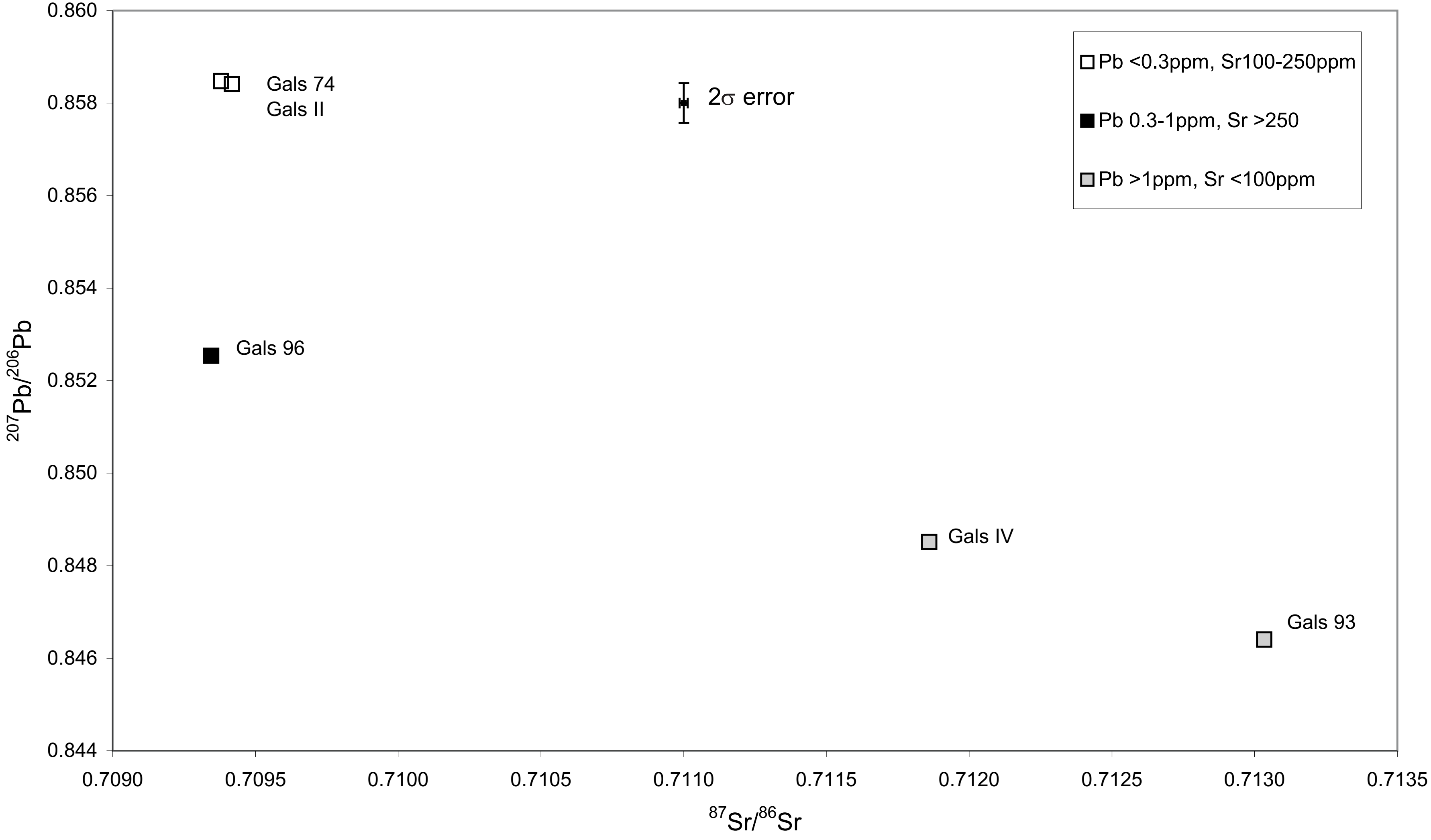

Figure 8.18 Plot showing grouping of Galson Iron Age samples by ^{87}Sr/^{86}Sr v ^{207}Pb/^{206}Pb and Sr and Pb concentrations