

# Bioarchaeological evidence for the health status of an early Icelandic population

P.L. Walker<sup>1</sup>, J. Byock<sup>2</sup>, J.T. Eng<sup>1</sup>, J.M Erlandson<sup>3</sup>, P. Holck<sup>4</sup>, K. Prizer<sup>1</sup>, M.A. Tveskov<sup>5</sup>.

<sup>1</sup>Dept. of Anthropology, University of California, Santa Barbara; <sup>2</sup>Old Norse/Icelandic Studies & Institute of Archaeology, University of California, Los Angeles; <sup>3</sup>Department of Anthropology, University of Oregon, Eugene; <sup>4</sup>Anatomical Institute, Department of Anthropology, University of Oslo; <sup>5</sup>Sociology/Anthropology Department, Southern Oregon University, Ashland

*Paper presented at the 73<sup>rd</sup> meeting of the American Association of Physical Anthropologists, Tampa, Florida*

## Abstract

Recent excavations at Hrísbú in the Mosfell Valley of Iceland have revealed a church and cemetery as well as domestic and ceremonial structures spanning the pagan and early conversion periods in the 10th and 11th Centuries. The skeletal remains of thirteen people buried at Hrísbú provide new evidence of the health status and living conditions of Iceland's early inhabitants. The economic life of these people centered on sailing, fishing, and stock-raising in a challenging marginal environment. Traumatic injuries appear to have been common. One person buried in the cemetery is an apparent homicide victim with massive head injuries. Another has a healed leg fracture. In addition to traumatic injuries, skeletal lesions associated with heavy labor and infectious diseases are also common in this conversion period population. Several individuals, including an adolescent, show evidence of strenuous physical activity involving the hands and arms and osteoarthritis is prevalent. One young man from this cemetery is of special interest owing to the presence of lesions associated with a chronic ear infection that resulted in a brain abscess. Another adolescent male has lesions on the pleural surfaces of his ribs. Although other diagnoses are possible, the lesions in both of these cases suggest that tuberculosis was present in the Hrísbú population. Stature comparisons with the early conversion period burials at Hrísbú and contemporaneous skeletal remains from Norway provide additional data on the living conditions of these people. These data suggest that stressful living conditions and heavy labor were common among early Icelanders (Walker et al., 2004).

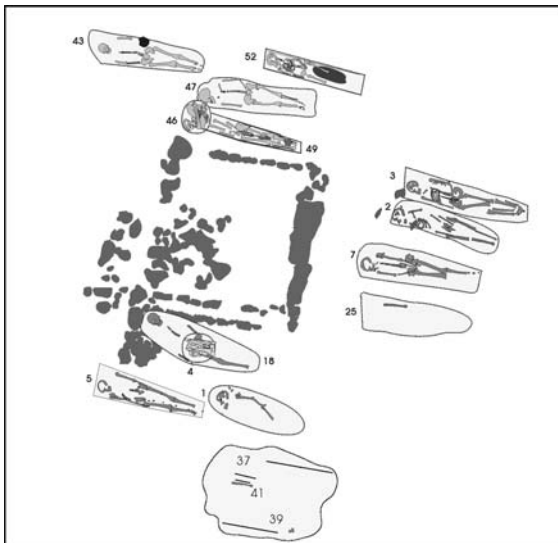


Figure 1: Map showing the Hrísbú church chancel (dark gray) and burial features.

## The Mosfell Archaeological Project

The Mosfell Archaeological Project is an interdisciplinary research effort to construct a picture of human habitation and environmental change in the region of Mosfell in southwestern Iceland. The Mosfell Valley (Mosfellsdalur), the surrounding highlands, and the lowland coastal areas are a "valley system," that is, an interlocking series of natural and man-made landscapes that, beginning in the ninth-century settlement or Landnám period, developed into a functioning Viking Age, Icelandic community. During the past three field seasons we have focused our work on the excavation of an early (10-11th century) church and cemetery at Hrísbú as well as an adjacent burial mound containing cremated human remains (Byock et al., 2003).

## Historical Records

*"When Christianity was adopted by law in Iceland (ca. 1000 A.D.), Grím of Mosfell was baptized and built a church there. People say that Thordis had Egil's bones moved to the church, and this is the evidence. When a church was built at Mosfell, the one that Grím had built at Hrísbú was demolished and a new graveyard was laid out. Under the altar some human bones were found, much bigger than ordinary human bones, and people are confident that these were Egil's because of stories told by old men."*

*Egil's Saga, chapter 86*

Because of the wealth of medieval and later documentation, Mosfell is an unusually important Viking Age site. Historical sources provide a rich source of information about the history of the Mosfell valley. One goal of our research is to obtain archaeological data that can be used to evaluate the historical accuracy of literary sources such as *Egil's Saga*. For example, scholars have been in some disagreement as to precisely what this saga passage tells us about the placement of the early church at Mosfell and the relationship to the neighboring church and farm at Hrísbú. One of these farms, or perhaps both at different times, appears to have been the home of chieftains.

## Nineteenth Century Health

*"The diet of the Icelanders consists almost solely of animal food; of which, fish, either fresh or dried, forms by far the largest proportion. During the summer they have milk and butter in considerable abundance; but of bread, and every other vegetable food, there is the utmost scarcity, and, among the lower classes, an almost entire privation."*

*George Mackenzie, 1812*

Nineteenth century reports suggest poor living conditions in Iceland with large families crowded into the small rooms of turf dwellings. Infectious diseases were common, as were nutritional

deficiencies. Travelers described the health of the Icelandic population during the early 19th Century in dismal terms. According to George Mackenzie, personal hygiene was poor and scabies (mange) was ubiquitous. Nutritional diseases such as scurvy were common. Tuberculosis, leprosy, and tetanus were also common, but syphilis was rare. Epidemics of measles, smallpox, and plague caused marked fluctuations in the population, which averaged around 35,000-50,000 individuals (Figure 2).

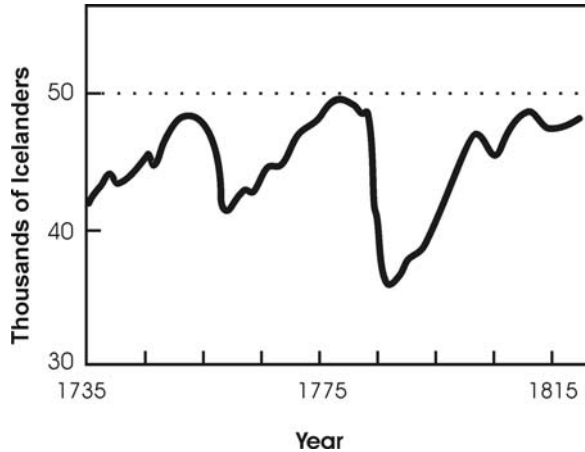


Figure 2: The population of Iceland during 18<sup>th</sup> and early 19<sup>th</sup> centuries. After Vassey (1996).

**Body Size**

Height decreases with nutritional deprivation, and among genetically similar populations, differences in body size provide an index of how favorable a person’s childhood environment was for growth and development.

Comparisons of long bone lengths indicate the individuals buried at Hrísrú are significantly shorter than all other samples, including our Viking Age Icelandic museum sample. During the medieval period in Iceland, femoral length increases for both males and females, with proportionally larger increases seen in males. This suggests that living conditions improved somewhat at that time (Figure 3).

The body proportions of the Hrísrú males also suggest stunting. Modern clinical studies have shown that unfavorable conditions tend to result in adults with relatively short legs. The Hrísrú sample has a mean tibiofemoral index of 81, which suggests that they had proportionately much shorter tibias than Icelanders (83) and Norwegians (87) living during the early 20th century.

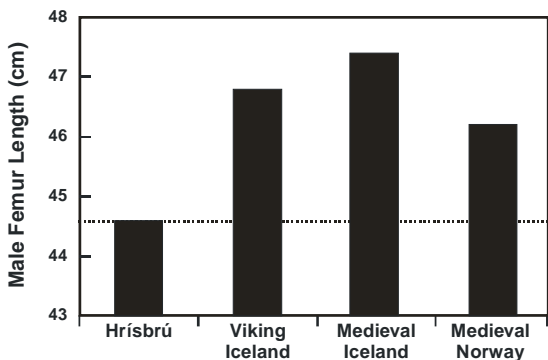


Figure 3: Comparison of Hrísrú femur lengths with those of other Viking Age, Medieval Age, and medieval Icelandic and Norwegian samples.

Several of the Hrísrú burials exhibit defects in the enamel of their teeth (linear enamel hypoplasias). The locations of these defects suggest that these individuals experienced one or more stressful episodes during the first few years of life during which their development was disrupted.

**Neural Tube Defects**

Failure of the posterior arch of the atlas to fuse in two individuals (Figure 4) suggests the possibility that these are relatives sharing a hereditary disorder. Although the extent to which genetic factors mediate in the expression of arch defects is unknown, the presence of posterior atlas arch defects in the members of a family (a mother and son) has been reported (Currarino et al. 1994). Defects such as these are fairly common. In one study of 1613 dissections 4%, of the atlases had posterior arch defects (Schulze and Buurman, 1980). Even considering the small size of the Hrísrú sample, the frequency of cervical arch defects (2 out of 7 observable atlases) is significantly higher than would be expected by chance (Fischer’s exact test  $p < 0.03$ ).

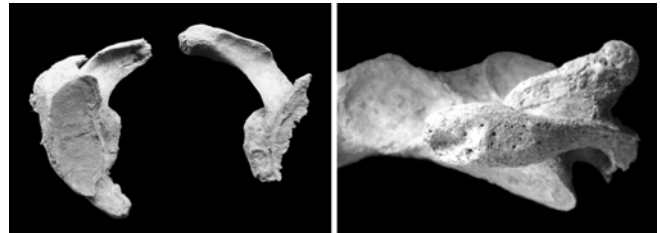


Figure 4: Failure of the neural arches to fuse in the atlases of two Hrísrú burials

A third Hrísrú burial shows a failure of the neural arch to fuse at the level of the upper half of the second sacral vertebra. Although damaged, it appears that the neural arch at the level of the first sacral vertebra was complete. The hiatus is also open from the level of S3-S5. This may be a case of spina bifida occulta, or simply a case of delayed closure of the sacral canal.

Nutritional factors may also have played a role in the development of these neural tube defects. Maternal diets deficient in essential nutrients such as methionine and folate have been shown to result in an increased risk of neural tube defects in babies. Historical sources indicate that green vegetables and other folate-rich plant foods were rare in the early Icelandic diet (Mackenzie 1812). Thus it is possible that both genetic and environmental factors contributed to the neural arch defects seen in these people.

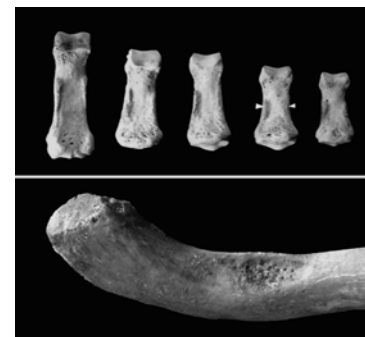


Figure 5: Evidence of strenuous physical activity at Hrísrú (top) flexor ridge development in the phalanges. (bottom) An enthesopathy in the area of the clavicle of a child where the deltoid muscle attaches

### Activity Patterns

Our bioarchaeological studies indicate that the people of Hrísbú led active lives of strenuous physical activity. Osteoarthritis is common, especially in the elbows and wrists of males. This probably reflects heavy lifting during agricultural and maritime activities. Accentuated insertion sites for ligaments and tendons are common, even in young children. This suggests that heavy work began early in life (Figure 5). The combined features of vertebral osteophytosis and osteoarthritis, new bone formation at muscle tendon and ligament insertions, and osteoarthritis at the major joints suggest that the males in this population lived lives of heavy physical labor (Figure 6). Although our female sample is small (3 individuals), they lack the signs of strenuous arm use seen in the males. This suggests significant sex differences in occupational activities.

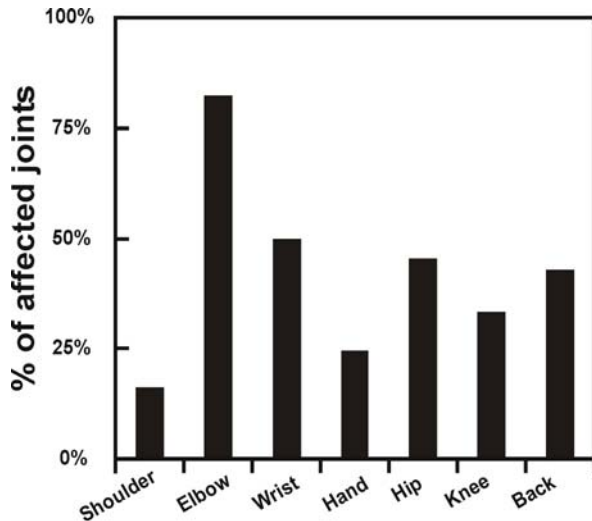


Figure 6: Osteoarthritis in Hrísbú males. The “back” includes only osteoarthritis of the articular facets

### Evidence of Tuberculosis

Two burials have skeletal lesions suggestive of tuberculosis. An adolescent male (Feature 46) shows areas of subperiosteal new bone formation on one left and six right ribs, indicating that this individual had persistent pulmonary infection on the right side (Figure 7). These lesions are consistent with a diagnosis of tuberculosis. On the lateral anterior side of the left scapula, near the joint, there is an area of periosteal reaction with dimensions of about 1x2 cm.



Figure 7: Subperiosteal new bone formation on the visceral surfaces of the ribs of the feature 46 burial.

An adolescent male (Feature 46) shows areas of subperiosteal new bone formation on one left and six right ribs, indicating that this individual had persistent pulmonary infection on the right side (Figure 7). These lesions are consistent with a diagnosis of tuberculosis. On the lateral anterior side of the left scapula, near the joint, there is an area of periosteal reaction with dimensions of about 1x2 cm.

A male in his early 20's shows evidence of a brain abscess that is consistent with a diagnosis of tuberculosis (see photo below). The infection has produced a smooth walled cloaca with the appearance of an accessory foramen that passes through the masto-occipital suture



Figure 8: Evidence of a brain abscess in a young male from Hrísbú.

Autopsy studies indicate that about 26% of individuals with fatal cases of hematogenous tuberculosis have skeletal lesions. This is close to the 25% prevalence of skeletal signs of tuberculosis in the Hrísbú burials that are well enough preserved to examine for this condition. This suggests that tuberculosis was epidemic among the people of Hrísbú and a very significant health problem. This is consistent with statistical registers from the early nineteenth century, which indicate phthisis (tuberculosis) was common and that Icelanders at that time had a “strong tendency to pulmonary complaints; and out of the annual number of deaths in the island, a very large proportion are referable to this cause” (Mackenzie, 1812:403).

### Evidence of Violence

Violence in Viking Age Iceland is indicated by the skeleton of an apparent homicide victim found in the Hrísbú cemetery. This skull of a man in his forties, who was interred immediately outside the church foundation, shows massive cranial trauma with a gaping wound in the left parietal and a slice of bone removed from the occipital bone. These wounds would have caused rapid death. As the cuts in the skull show, the edged weapon(s) used on this victim were of excellent quality. Probably the wound on the top of the head was caused by an axe, as evidenced by the size and the isolated region of the cut, while the wound to the rear may have been the result of either an axe or a sword. Possibly the killing was carried out by two assailants. Given the nature of the blows that came directly down on top of the skull, the victim may have been executed.

This evidence of interpersonal violence at the Hrísbú site is consistent with descriptions of feuds found in the Icelandic sagas. One saga in particular offers an account that specifically describes the Hrísbú/Mosfell site and corresponds, at least in a general way, to the archaeological evidence for violent death that we have found:

*“In the autumn [around the year 1020, the chieftain] Illugi rode from his home at Gilsbakki with thirty men and arrived at Mosfell early in the morning. Onund [the chieftain there] and his sons escaped into the church, but Illugi caught two of Onund’s kinsmen, one named Bjorn and the other Thorgrim. Illugi had Bjorn killed and Thorgrim’s foot chopped off. Then he rode home.”*

*Gunnlaug’s Saga Serpent Tongue*

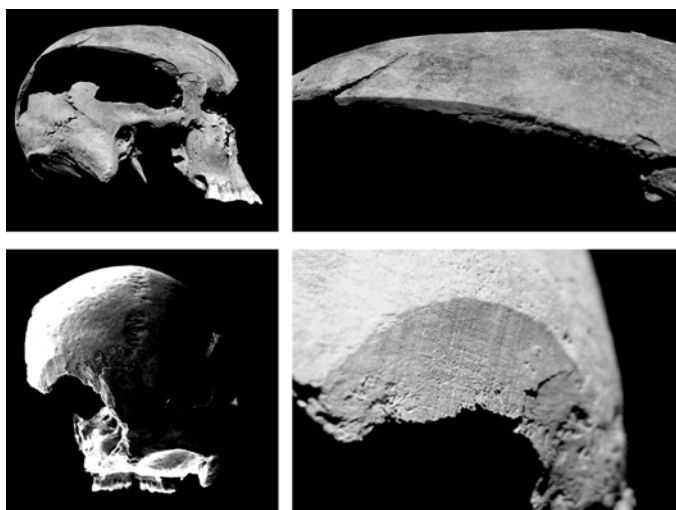


Figure 9: Cranium of the feature 2 burial showing parietal (top) and occipital (bottom) injuries made by a bladed weapon such as an axe.

### Conclusions

The skeletal remains we have excavated at Hrísbú are providing important new evidence concerning the health status and living conditions of Iceland’s earliest inhabitants. Skeletal lesions associated with infectious disease, heavy labor, and traumatic injuries are common in this conversion-period sample. Unfavorable conditions for growth and development are suggested by the comparatively short stature of these people and the presence of hypoplastic lesions in the teeth of several individuals. Adults surviving these early periods of stress led lives of heavy physical activity that that resulted in arthritic changes and accentuation of areas for the insertion of ligaments and tendons. The pathological lesions found in these early Icelandic skeletons imply that living conditions in Iceland were very difficult soon after the island was colonized.

### Acknowledgments

The Mosfell Archaeological Project is an international cooperative effort done in collaboration and with support from the town of Mosfellsbær and the National Museum of Iceland (Þjóðminjasafn). Along with the crucial financial support from the town of Mosfellsbær, major funding for the 2003 field season came from the National Geographic Society. We also have received valuable logistic and financial support from the

Icelandic Ministry of Education, Science, and Culture, the U.S. Embassy in Iceland, the John Simon Guggenheim Foundation, the Fulbright Foundation, the U.S. National Science Foundation, The National Endowment of the Humanities, and The Academic Senates of the University of California at Los Angeles and Santa Barbara, and the University of Oregon.

Many organizations and individuals made this excavation possible. We very much appreciate the archaeological expertise and support given us by Margrét Hallgrímsdóttir, Guðmundr Ólafsson, Lilja Árnadóttir, and Halldóra Ásgeirsdóttir of Þjóðminjasafn. Bjarki Bjarnson, Magnús Guðmundsson, and Helgi Þorláksson shared with us their great knowledge and worked with us on the project as consultants on historical issues. We remain especially indebted for the help we have received from the people of Mosfellsbær. Together with Mosfellingar, the members of the Mosfell Archaeological Project are engaged in a multi-disciplinary and international scientific effort to unearth the past of the Mosfell region. We especially thank the Mayor Ragnheiður Ríkarðsdóttir, of Mosfell. Over the years Björn Þráinn Þórðarson at the town office has consistently worked with us and been of enormous help. In Mosfellsdalur we have been welcomed by the inhabitants. Davíð Sigurðsson is always ready to help, and Valur Þorvaldsson has given freely of his time.

Finally, we wish to especially thank Ólafur Ingimundarson, the bóndi at Hrísbú, on whose farm we excavate. The kindness, steady friendship, and interest shown by Ólafur, his wife Ásgerður, and their sons and daughter Andrés, Ingimundur, and Ingibjörg are greatly appreciated.

### References

- Currarino G, Rollins N, and Diehl JT (1994) Congenital defects of the posterior arch of the atlas: a report of seven cases including an affected mother and son. *AJNR Am J Neuroradiol* 15:249-54.
- Byock J, Walker P, Erlandson J, Holck P, Eng J, Tveskov M, Sigurgeirsson M, Lambert P, Moss M, Prizer K, Reid M, Zori D, Byock A, and Fyllingen H (2003) A Viking Age farm, church, and cemetery at Kirkjuhóll, Mosfell Valley, Iceland. *Antiquity* 77: <http://antiquity.ac.uk/ProjGall/erlandson/erlandson.html>
- Mackenzie GS (1812) *Travels in the island of Iceland during the summer of the year MDCCCX*. Edinburgh, Printed by T. Allan and company, for A. Constable and company.
- Schulze PJ, and Burman R (1980) Absence of the posterior arch of the atlas. *AJR Am J Roentgenol* 134:178-80.
- Vasey DE (1996) Population regulation, ecology, and political economy in preindustrial Iceland. *American Ethnologist* 23:366-392.
- Walker PL, Byock J, Eng JT, Erlandson JM, Holck P, Prizer K, and Tveskov MA (2004) Bioarchaeological evidence for the health status of an early Icelandic population. *American Journal of Physical Anthropology. Supplement* 38:204.