Animal Bones from Vígishellir Cave, W Iceland

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Abstract

In 2001 excavations by the Icelandic National Museum in the lava cave Vígishellir (also called Beinahellir, Surtshellir) documented the presence of defensive walls, a rock outline of a dwelling, and a bone rich midden deposit exposed on the cave floor. Traditional stories associated these features with a band of outlaws reputed to have raided the surrounding countryside during the 10th century from their fortified refuge within the cave (until they were eventually betrayed and killed). The excavated animal bones collected during the 2001 investigations were kindly sent to the Hunter NORSEC laboratory for analysis by Guðmundur Olafsson (National Museum of Iceland) and Kevin Smith (Haffenreffer Museum of Anthropology) in spring 2003. The bones are very fragmented, both by very complete butchery and probably also by freeze thaw cycling but 372 domestic mammal fragments could be identified taxonomically from a total collection of 7,424 bone fragments. All identified fragments derived from domestic mammals regularly found in 9th-10th century Icelandic archaeofauna: cattle, pig, horse, and both sheep and goat. While shellfish, fish, bird, and sea mammal bones are regularly recovered from 10th century sites in Iceland, these remains were not present in either the identified or unidentified fragments. The domestic mammal bones appear to come from multiple individuals of each species and represent bones from the whole skeleton. While both adults and older juveniles are represented, neonatal cattle bones normally common in Icelandic farm collections are not present in the collection. If these remains are in fact associated with outlaws, they suggest that the band's impact on local farms must have been substantial.

Excavation Background

The archaeofauna reported here was collected by on 26-27 September 2001 during a mapping and reconnaissance visit to the Vígishellir cave (part of the Surtshellir/Stefánshellir cave complex, Hvítársíða, western Iceland), by, Guðmundur Ólafsson, Agnes Stefánsdóttir (both Þjóðminjasafn Íslands), and Kevin P. Smith (Háls Archaeology Project, Haffenreffer Museum of Anthropology, Brown University), . The material comes from a 1.25 x 0.5 m (c 0.625 sq m) test excavation located in an exposed midden that extends 3.7 meters north-northeast from the northern long wall of a Viking Age dry-stone structure built within the cave and is at least 1.7 meters wide in its remaining extent. The test unit was located near the center of the midden (measured along its N-S axis) and extended from its current western edge to within one meter of the cave wall forming its eastern border. This test unit represents an approximate 10% sample of the estimated 6.1 sq meter, bone-rich deposit remaining in the cave at the time of excavation. The bone bearing layers were 3 – 7 cm thick at the deepest, and may represent the base of an exposed bone bed that was once much thicker but has been reduced by souvenir collectors over the past two centuries, with accelerated reduction in the past five years due to recently enhanced access to the cave by casual tourists and organized tour groups.[1] According to the landowner the bone bed was once 30-50cm thick (which matches stained deposits on the cave wall incorporating bits of bone and ash). Three layers were identified in the field. A light dry upper layer (contexts S 4B and S 3), a somewhat darker but still dry middle layer (context S 4) and a darker brown ash enriched water soaked deposit of fine bone fragments lying directly upon the basalt floor of the cave (S 5). The bulk matrix samples recovered a 100% sample of all bones,

[1] The September 2001 visit to Vígishellir was intended to establish the age and integrity of the deposits present in the cave, following a visit to the site in summer 2000 by members of the Háls Archaeology Project, that identified recent tourist garbage around the site, and reports to the Reykholt Archaeology Project's staff that tourists were removing bones from the cave as souvenirs (Guðrún Sveinbjarnardóttir, personal communication to K. Smith, 2000).

artifacts, and associated sediments present in the three layers. The bulk samples from the test excavation were dry sieved in the laboratory by Kevin Smith and sub-divided by mesh size (1/4" / 4 mm and 1/16" / c 1mm mesh sieves) and some mammal teeth were picked out during this sorting. All sediment passing through the 1/16'' screen was saved for microartifact analysis; all bones and bone fragments retained on the ¼" and 1/16" mesh sieves were submitted to the NORSEC laboratories for analysis; all artifacts and geofacts from the bulk samples were retained for further analysis. A large percentage of the collection is less than 1 cm in maximum dimension, and the standard of recovery seems to have been very high.

The deposit is dated by the formation of the lava flow (after the fall of the Landnám tephra of AD 871 +/- 2) and the upper limit (AD 970) of the calibrated two sigma range of two bone collagen AMS dates from two large and medium terrestrial mammal long bone shaft fragments. It appears that this bone deposit accumulated over a fairly short period of time and that the stratigraphic divisions probably do not represent different phases of occupation. It is likely that water percolation and freeze thaw cycling in the exposed bone bed have produced some of the size sorting evident in the collection- the wet basal layer is almost entirely composed of tiny bone flakes and chips. While the current archaeofauna derives from a small excavation unit, it easily exceeds the NABO minimum sample size limits (300 mammal bones or 1000 fish bones) for basic comparability. Note that any small excavation unit is necessarily subject to skewing by the chance deposition of unrecognized articulation and the deposit of multiple elements from a single individual in a small area.

La**boratory Methods**: Analysis was carried out March-April 2003 at Hunter College Bioarchaeology Laboratory by Thomas McGovern. All fragments were identified as fully as possible with current methods (no sub-sampling or restricted-element-range approaches were employed) making use of NORSEC Laboratory comparative specimens and identification manuals. Quantification in this report follows NABO Zooarchaeology Working Group recommendations by making NISP (number of identified specimens) the basic quantitative measure, as this simple counting technique has proven robust in numerous sampling experiments and is easily replicable across investigators (Gilbert 1982). Basic data was recorded through the NABO Zooarchaeology working group NABONE system (7th edition, see NABO website www.geo.ed.ac.uk/nabo for updates and sample data sets) which combines Access database with specialized Excel Spreadsheets. A full data archive with coding manual is in the CD R attached to this report, and will also be available via nabo@voicenet.com.

Taphonomic Observations

The bone collection from Vígishellir is very fragmented, and shows signs of rather specialized weathering resulting from its exposure on the floor of the lava cave. However, most bone fragments were quite robust and not excessively damaged by the sort of exfoliation and "mushiness" evident in bone exposed to weathering in open air or attrition from acid soil matrix. The highly fragmented nature of the collection seems to mainly reflect extremely complete butchery and

bone marrow and collagen extraction prior to deposition, with some flaking and spalling taking place after deposition.

Table 1 below presents the fragment size distribution for the Vígishellir collection and provides a comparison with the approximately contemporary farm site of Hrísheimar in N Iceland near Lake Mývatn (McGovern & Perdikaris 2001).

Table 1	*Vigishellir 01*		*Hrísheimar 01, context 003*	
size range	count	%	count	%
up to 1 cm max.	4683	63.08	233	5.25
1-2 cm	2143	28.87	1881	42.40
2-5 cm	589	7.93	1501	33.84
5-10 cm	6	0.08	388	8.75
>10 cm	3	0.04	433	9.76

The Hrísheimar context 003 collection comes from a small excavation unit (2 x 2 m) that sampled midden filling a sunken feature structure, The deposit was completely sieved through 4 mm mesh during excavation. The context 003 is AMS radiocarbon dated on cattle bone collagen to the late 9th to 10th century (ref: calibrated 1 sigma range GU 9729 AD 860-980, GU 9730 AD 880-990, GU 9731 AD 880-990). The site is still under investigation but Hrísheimar appears to represent a middle-to-upper status farm's settlement period archaeofauna broadly similar in terms of species diversity, element representation, and taphonomy to other settlement period archaeofauna from early farm excavations in Iceland (McGovern et al. 2001). Since this collection is similar in terms of source (small excavation unit), recovery, and approximate date it may provide a comparative baseline for the Vígishellir material.

As table 1 illustrates, Vígishellir not only has a great many more very small fragments smaller than 1 cm in maximum length than does Hrísheimar, but has proportionally far fewer middle sized fragments in the 2-5 cm range and almost no larger fragments. The Vígishellir collection in fact contains almost no whole bones, and the only complete elements are carples, tarsals, teeth, and caprine [2] toes. This fragmentation seems to be the result of extremely thorough and complete processing of the bones for the extraction of even the smallest bits of edible marrow. Figure 1 illustrates the butchery marks present on many of the bone fragments in the collection. These include bone

[2] *Caprine* is a term including both sheep and goats. As these closely related species cannot be reliably differentiated on much of their skeletons most zooarchaeologists lump these two species into this higher taxonomic category for comparison to other species (equals "Ovicaprid", "Ovis/Capra" O/C of other authors)

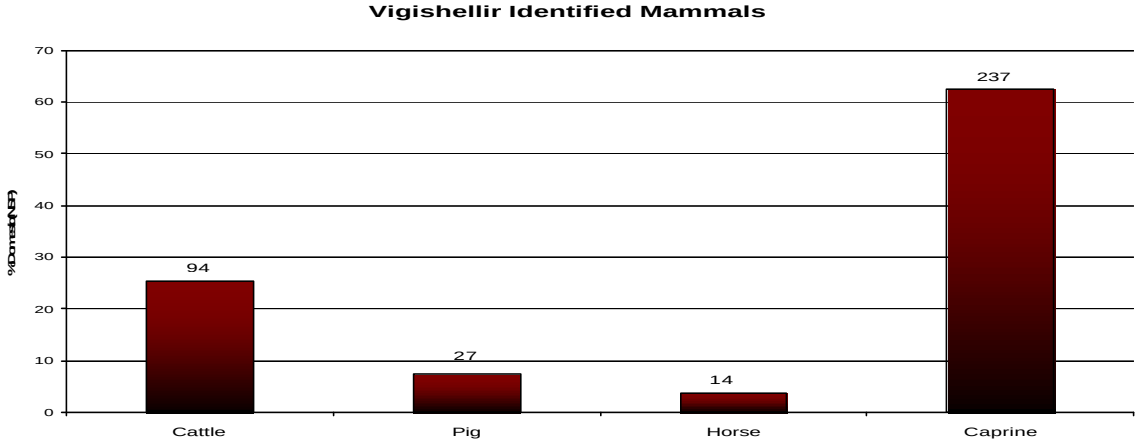
splintering and spalling resulting from blunt impacts (upper right), heavy chopping marks left by a cleaver or axe (upper left), spiral fractures (lower right) and longitudinal splitting of long bones and even marrow poor elements like the cattle first phalanx (lower left). Such systematic fragmentation of bone elements into the size classes most represented at Vígishellir suggests a pattern of collagen ("bone grease") extraction. This pattern is characteristic of many bone collections from Norse Greenland but has not been previously observed in Viking-Early Medieval Iceland (Alan Outram 1999, pers comm. 2001).

A substantial percentage of any collection that can only be identified as coming from "Medium Terrestrial Mammal" (MTM: sheep-goat-pig-dog size) or "Large Terrestrial Mammal" (LTM: cattle-horse size). These categories are usually made up of a mix of long bone shaft fragments (LBF), small vertebral fragments, rib fragments, small cranial fragments, and other small fragments that can be identified as mammalian and of the appropriate size class but not securely identified further. "Unidentified mammal bones" (UNIM) are usually still more fragmented and can only be identified as mammalian rather than fish, bird, or molluscan. A higher degree of fragmentation of a collection typically increases somewhat the MTM & LTM proportion, but tends to increase the UNIM proportion even more. The Vígishellir archaeofauna follows this pattern, but is unusual in the relative proportions of element categories within the broad LTM and MTM categories. Table 2 again compares Vígishellir and Hrísheimar collections, this time in terms of the proportion of long bone shaft fragments (LBF) to total LTM and MTM category counts and percentages:

Table 2

	Vigishellir			*Hrísheimar*		
	LBF	total	%	LBF	total	%
MTM	612	804	76.12	170	985	17.26
LTM	159	181	87.85	78	263	29.66

This indicates that the Vígishellir archaeofauna is somewhat unusual in the high percentage of limb bone fragments (from meat bearing elements) vrs. Axial skeleton elements such as vertebrae and skull fragments in these broad LTM &



MTM taxonomic categories.

Overview of Species Identified

As table 3 and figure 2 illustrate, the Vígishellir identified archaeofauna is made up entirely of domestic mammal bones. The MTM, LTM, and unidentified fragments were carefully searched for fish, bird, or molluscan remains but none were found. While depositional conditions in the cave were certainly atypical, they cannot account for the complete absence of these otherwise common taxa in Viking Age sites in Iceland.

Table 3		Count	% NISP
Domestic Mammals			
Cattle	(Bos taurus dom. Linn)	94	25.27
Pig	(Sus scrofa dom. Linn)	27	7.26
Horse	(Equus caballus dom. Linn)	14	3.76
Sheep	(Ovis aries dom. Linn)	3	0.81
Goat	(Capra hircus dom. Linn)	2	0.54
Caprine		232	62.37
total Caprine		237	63.71
	Total NISP	372	
			% TNF
Large terrestrial Mammal		181	2.44
Medium Terrestrial Mammal		804	10.83
Unidentified		6067	81.72
	Total TNF	7424	

NISP is the Number of Identified Specimens or bone fragments that could be assigned a species or species group identification. TNF or Total Number of Fragments (identified and not identified). Table 4 provides distribution by context.

Table 4 Context

Vígishellir	S3	S4	S4 B i	S4 B vi	S4 i	S4 ii	S4 iv	S5 B iv	S 5 iii	S 5 v
Cattle	20	27	19		10	18				
Horse	14									
Pig	9	2	6			6		1		3
Sheep	2		1							
Goat	2									
Caprine	26	178	81		24	28		8		3
total NISP	73	207	107	0	34	52	0	9	0	6
LTM	53	7	46		75					
MTM	148	178	246		219	8		5		
UNIM	474	234	604	1291	436		1102		55	1871
total TNF	748	626	1003	1291	764	60	1102	14	55	1877

Element Distribution

Sample size, fragmentation level, and the restricted area of the excavation unit makes extensive analysis of element distribution within the identifiable fragments inappropriate, as the potential for interdependence (multiple elements from the same skeleton) and simple sampling error raise serious issues about the application of pattern recognition software in this case. However, some qualitative observations can be made. The Vígishellir archaeofauna contains parts of virtually the entire skeletons of the cattle, caprines, pig, and horse whose remains make up the identified part of the collection. Durable elements like teeth, carpals and tarsals, and the denser parts of phalanges and mandibles are the most common identifiable elements. It appears that entire or nearly entire carcasses of these domestic mammals were brought to the cave at one time or another, though the proportion of long bone shaft fragments in the broader LTM & MTM categories suggest that differential transport of meat rich upper limb bones to the cave may have also taken place. It is very clear that this is not a specialized deposit holding only low or high meat value bone elements. The currently unverifiable quantitative impression is that this deposit is if anything skewed in favor of high meat value elements.

Burning, Gnawing, and Butchery Marks

The Vígishellir midden archaeofauna is unusual in that burnt bone (white calcined or blackened) is virtually absent. Most Icelandic archaeofauna have a regular percentage of burnt bone that had either been deliberately used as fuel or (more likely) simply thrown into the fire after meals. In cases of strongly acid soil or heavy leaching, teeth and such calcined bone are often the only fragments surviving (Tinsley & McGovern 2001). While the analyzed Vígishellir midden sample lacks any burnt bone, the excavators report that thin floor like deposits within the dry stone structure and extending outward from it did contain many small calcined bone deposits. It is possible that the occupation of the structure within the cave was brief enough (or specialized enough) that the sort of hearth clearing activities regularly carried out on a normal farm did not regularly occur.

Gnawing by carnivores (almost certainly dogs in Iceland) and rodents (usually mice) is regularly recorded in most N Atlantic archaeofauna. While more common in Greenlandic collections than in Icelandic archaeofauna (McGovern 1992, Enghoff 2003), dog gnawing has been often observed in Iceland (Perdikaris et al 2001). However, the current sample from Vígishellir shows no evidence of animal gnawing.

A full study of butchery practices requires a larger sample size (Lyman 1992), but it is again possible to make some qualitative observations. As noted above, the Vígishellir collection shows unusually extreme levels of marrow extraction and bone fragmentation. All possible sources of bone marrow were exploited-mandibles broken open, phalanges split, even tooth roots smashed in some

cases. Both heavy and fine bladed metal tools (probably axes and knives) were used for butchery, and the many impact fractures indicate the use of some sort of blunt instrument (stone, axe poll) to smash open bones. The basic techniques included chopping and longitudinal splitting of long bones, and there was no indication of the distinctive dual perforation of caprine metapodials most commonly encountered on Icelandic sites after ca AD 1100 (Bigelow 1985). This level of bone fragmentation and completeness of bone processing is familiar from later medieval Greenlandic collections, but is very unusual in earlier Icelandic archaeofauna. Horse butchery clearly indicates that this species was consumed for food at Vígishellir.

Age at Death

The Vígishellir collection is too small and too fragmented to allow reliable reconstruction of age profiles. However, it is clear from the teeth preserved that fully mature cattle, pigs, horse, sheep, and goat were consumed and also that some juveniles were also eaten. The tooth wear on the pigs, cattle, and caprines in particular indicate multiple individuals of different ages were present in the collection. One caprine tooth (dp4) could be assigned to Grant's (1982) wear class "h", which places it near the end of this deciduous tooth's period of wear. While conversion of wear stage to chronological age is always somewhat problematic (see discussion in Enghoff 2003:54-56), this tooth would conventionally be placed in the 9-12 month range. If born in May (as are most Icelandic sheep, Aðalsteinsson 1991) this would suggest the animal died in late winter or early spring of its first year. One late fetal or very newly born piglet phalanx was present, but may have been transported within a pregnant sow. Missing entirely from the Vígishellir collection at present are the remains of newborn (neonatal) cattle bones. These are common on most Icelandic farm sites, regularly reaching 40% of all identified cattle bones as at our comparative site of Hrísheimar (table 5).

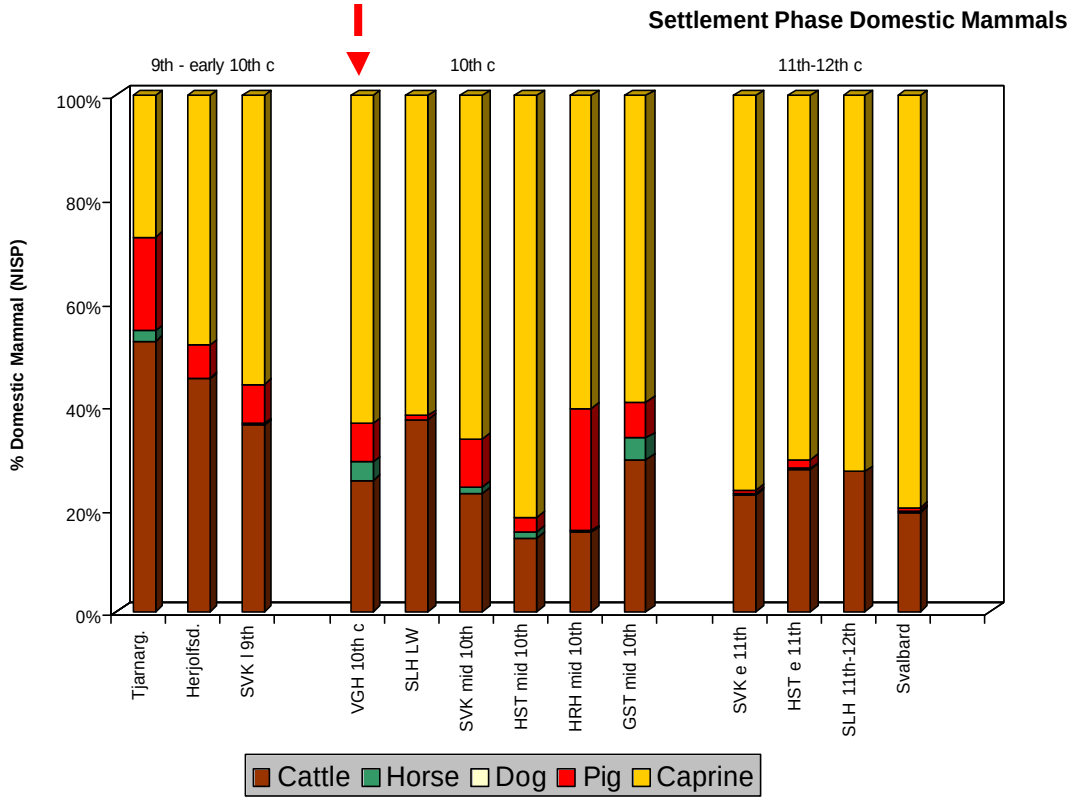
Table 5		%
Hrísheimar 01	Neonatal	Adult & Older Juvenile
Cattle	39.7	60.3
Caprine	1.0	99.0
Pig	7.4	92.6

Size

Three (unfortunately un-measurable) pig phalanges (toe bones) recovered are fully mature and exceptionally large for Icelandic pigs. No other elements were measurable, but the fragments generally fall within the usual size range for medieval Icelandic stock.

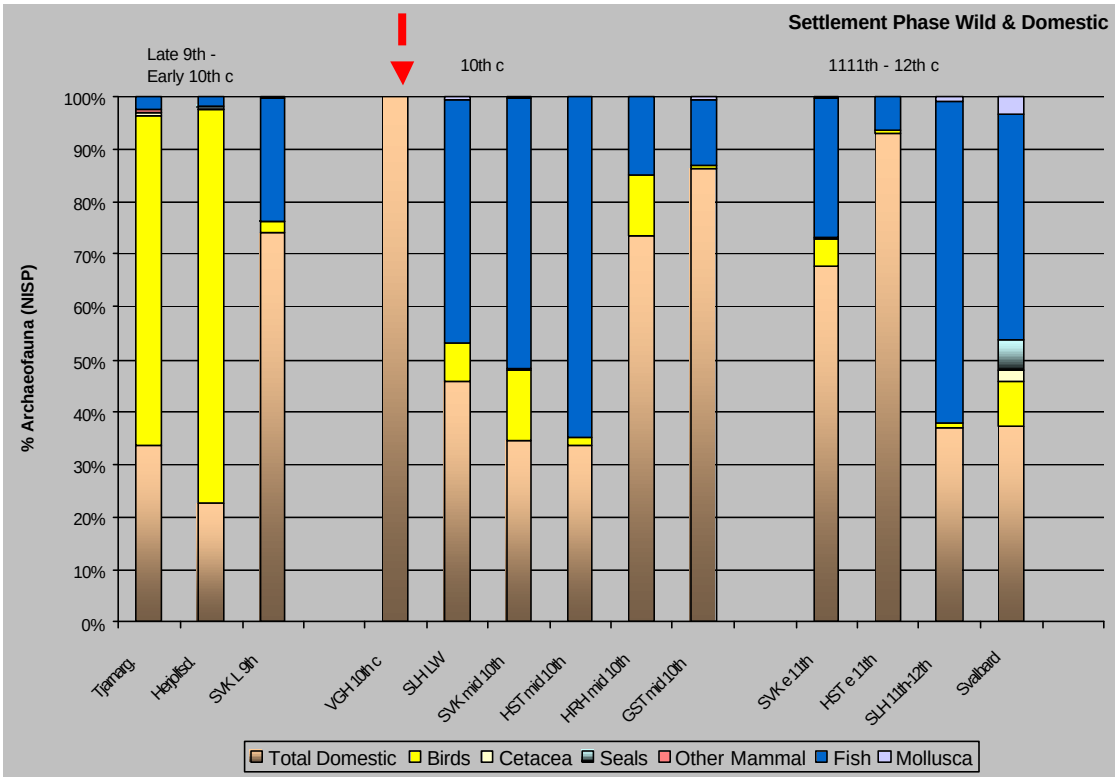
Comparative Patterns

Figure 3 presents a comparison of the Vígishellir domestic mammal collection with the other currently available quantifiable Icelandic archaeofauna dating to the 9th-early 12th centuries (the collections are arranged from left to right in rough chronological order). Tjarnargata 4 is from Reykjavík, Herjolfsdalur is from the Westman Islands, Sveigakot (SVK) is a stratified collection from Mývatnssveit, VGH (arrow) is Vígishellir, Selhagi (SLH) is a stratified collection from Mývatnssveit, Hofstaðir (HST) is a stratified collection from Mývatnssveit, Hrísheimar (HRH) is our comparative farm collection from Mývatnssveit, Granastaðir (GST) is from Eyjafjord, and Svalbarð is from Þistilfjord in NE Iceland (see McGovern et al 2001 for discussion of these sites).



The Vígishellir domestic mammal collection is certainly not out of place in this graphic comparison of early archaeofauna from Iceland, and its mix of cattle, pigs, horses, and caprines resembles that of several middle to upper ranked farms of the late 9th and 10th centuries. If we had only these data, we might conclude that this bone collection was from a fairly prosperous settlement age farm.

Figure 4 presents *all* the major identified taxa for the same archaeofauna as figure 3. In this case the Vígishellir collection shows itself to be exceptional- no other Icelandic collection from any period is entirely made up of domestic mammals, and many settlement age collections are instead dominated by wild species.



The 2001 sample from Vígishellir, while small and fragmented, shows both similarities and important differences from the other currently known Icelandic archaeofauna dating to the settlement age and early commonwealth. It is clearly a special case.

Interpretation and Speculation

The Vígishellir archaeofauna would be anomalous (except in relative proportions of domestic mammals) even if it did not come from a cave with such a colorful legend. It lacks any of the fish, birds, and shellfish common on so many settlement age sites in Iceland, making this archaeofauna unique. Recent work indicates that from early in the settlement period, farms were normally tied together by complex social and economic interactions, and that even farms 60 km or more from the coast were regularly provisioned with preserved marine fish, sea birds, and sea mammals (Perdikaris & McGovern in press). If they were indeed outlaws, the occupants of the cave would have been cut off from regular access to some resources, perhaps because they no longer had access to the social networks that allowed for such provisioning. The mix of domestic mammals present suggest that the cave's occupants had the ability to take a wide range of domestic stock from surrounding farms, pointing to some success as raiders. The absence of newborn calf bones (so common in farm middens) may indicate some seasonality in the raiding activity, problems in capturing young animals normally kept within the immediate farmyard, or a simple focus on larger adults who could be more easily driven away and who would provide more meat when slaughtered. The apparent surplus of meat rich long bones may reflect butchery of some captured animals some distance from the cave, or raids on farm smokehouses or meat stores. The pattern of bone fragmentation suggests that while the raiders may have enjoyed considerable success in carrying off domestic stock, they felt compelled to maximize their processing of the captured animal carcasses for meat, marrow, and bone grease. Perhaps because they lacked other food sources (dairy produce, fish, birds, cereals) they were attempting to get the most out of the meat animals they caught, or possibly they attempted to limit their exposure to community retaliation by spacing their raids as widely as possible. Given the density of this midden and its composition, it would appear that the occupants of the cave must have had a heavy impact on the economies of the farms around them. The Vígishellir midden deposit raises many interesting questions and certainly provides at least partial support to the traditional outlaws' tale.

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