Appendix 6 – Figures, tables and data from results

6.2. Results across sites

Frequency of skeletal elements

SHAFT			
LONG BONE	**ABSENT**	**PRESENT**	**TOTAL**
Humerus	11	23	34
Radius	9	26	35
Ulna	4	37	41
Femur	16	21	37
Tibia	7	20	27
Fibula	5	14	19
Unidentified	11		11
TOTAL	63	141	204

Table 19. Shaft presence/absence based on long bone category. Unidentified= either shaft or epiphysis.

EPIPHYSIS			
LONG BONE	**ABSENT**	**PRESENT**	**TOTAL**
Humerus	13	21	34
Radius	19	16	35
Ulna	26	15	41
Femur	8	29	37
Tibia	8	19	27
Fibula	10	9	19
Unidentified	11		11
TOTAL	95	109	204

Table 20. Epiphysis presence/absence based on long bone category. Unidentified= either shaft or epiphysis.

Element completeness

- Complete elements were discovered amongst fragmented and poorly preserved remains. This suggests that remains might not have been exposed to the same environmental conditions and/or taphonomic agents and could reflect differentiation in treatment.

- Complete remains (zone completion - N=206, 31.1%) demonstrated very good surface preservation[1] (score 5) (Figure 33) with more than 60% scoring medium to high (3-5). Complete bones of the hands/feet (N=170)[2] showed the highest surface preservation (N=52/score 5) whilst other bone categories showing zone completeness were much lower in number and surface preservation scores varied on the scale (0-5). These included cranial skull remains (N=2), long bones (N=11), vertebrae (N=18) and flat/irregular bones (N=5).

MNI, demography and pathology

- Only four ossa coxae were used to assign sex whilst not all sexually dimorphic features were present on crania. Four sex assignments from a mandible (Ifton Quarry SNO: 325), two temporals (Gop Cave SNO: 618; Ogof Pant-y-Wennol SNO: 1210) and a pelvis fragment (Little Orme's Head Quarry SNO: 1392) were not included in the statistical analysis. Mandible 325 derived from cranium 324 (SNO), temporal fragments 618 (SNO) and 1392 (SNO) might derive from the same individuals as frontal 617 (Gop Cave/SNO) and cranium 1174 (Ogof Pant-y-Wennol/SNO) whilst the MNI from Little Orme's Head Quarry was one and therefore only the right (female) pelvis (SNO: 1391) was used in the statistical analysis.
- Sex estimations on one surviving mandible (Orchid cave SNO: 435) could not be determined (undiagnosed). Out of the 44 recordable mandibulae (and mandibular fragments), only 11 were used for sex determination, with the vast majority being probable females or males.
- A single individual from Little Orme's Head Quarry exhibited all degenerative changes that was relatively well-preserved. Pathologies on vertebrae, flat/irregular bones, hands/feet and two long bones included lesions (16.7%, N=8), degenerative changes such as porosity, osteophytes and/or lesions (54.2%, N=26) and periostitis (4.3%, N=2).
- Dental pathologies recorded on loose teeth (incisors, canines, premolars, molars) include caries (N=5) and/or calculus (N=16). No evidence of pathology

[1] Overall surface preservation= scored based on the degree of any post-mortem modification (weathering, gnawing, erosion, staining) (see Chapter 4/4.3).
[2] Total of complete bones cross-referenced with surface preservation scores does not include Little Orme's Head Quarry – no primary analysis/unknown surface preservation.

could be identified on several entries (N=32) due to digestion, erosion and/or cave concretion (Figure 64).

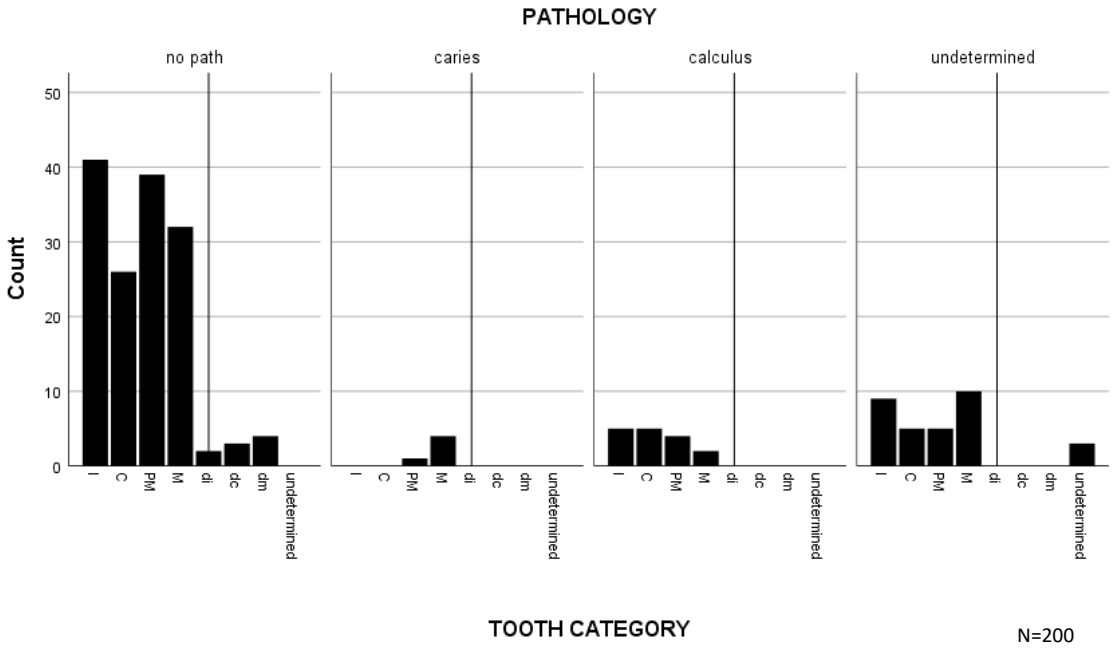


Figure 64. Dental pathologies (presence/absence – no pathology, pathology, undetermined) identified on loose teeth across sites. I= incisor, C= canine, PM= premolar, M= molar, di= deciduous incisor, dc= deciduous canine, dm= deciduous molar, undetermined/

Taphonomy – Macroscopic results

Weathering

- Hands/feet and/or flat/irregular bones (Gop Cave, Ogof Colomendy, Ogof Pant-y-Wennol) were slightly higher in numbers compared to weathered cranial/skull or long bones and had reached weathering stage 1. Whilst evidence of weathering had not severely impacted hands/feet, similarities between complete and fragmented bones were apparent. A low number of both fragmented and complete hands/feet, reached stage one weathering and a low number of complete hands/feet reached stage two weathering. Differentiation in treatment and sub-aerial exposure, either due to depositions in separate parts of the cave (e.g. cave entrances) or excarnation could have been responsible for the presence of weathering.

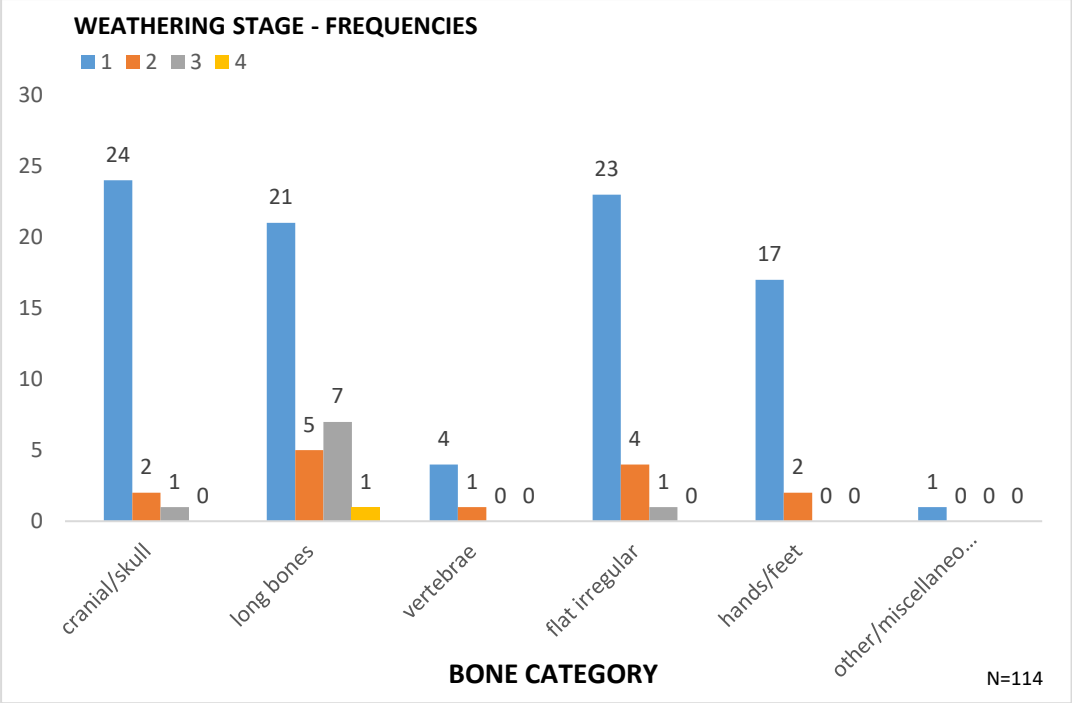


Figure 70. Weathering stage frequencies (1-4) based on bone category across sites.

- A few cranial/skull remains (N=13) exhibited signs of weathering (stage 1) and abrasion (total N=50) whilst a small amount of long bones (N=20) were both weathered (stage 1) and eroded/root etched (total N=67). Abrasion and erosion were present on a low number of disarticulated remains and when either modification was apparent on weathered elements, it primarily reached stage one.

ABRASION											
	ABSENT (TOTAL)	**PRESENT**								**PRESENT TOTAL**	**TOTAL**
WTH		**C/S**	**LB**	**V**	**F/I**	**H/F**	**UN**	**BU**	**O/M**		
0 (NO WTH)	928	58	40	26	70	137	1	3	10	345	1273
1	40	13	10	2	12	12			1	50	90
2	7		3	1	2	1				7	14
3	8		1							1	9
4	1										1
TOTAL	984	71	54	29	84	150	1	3	11	403	TOTAL N=1387

Table 22. Weathered (WTH) and abraded elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

EROSION											
	ABSENT (TOTAL)	PRESENT								PRESENT TOTAL	TOTAL
WTH		C/S	LB	V	F/I	H/F	UN	BU	O/M		
0 (NO WTH)	541	144	74	64	211	186	13	4	36	732	1273
1	23	15	20	2	15	14			1	67	90
2	8	2	3		1					6	14
3	5		4							4	9
4	1										1
TOTAL	578	161	101	66	227	200	13	4	37	809	TOTAL N=1387

Table 23. Weathered (WTH) and eroded elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

- Gnawing was identified on seven elements reaching weathering stage one and two elements reaching stage two.

GNAWING									
	ABSENT (TOTAL)	PRESENT						PRESENT TOTAL	TOTAL
WTH		C/S	LB	V	F/I	H/F	O/M		
0 (NO WTH)	1208	2	42	1	2	17	1	65	1273
1	83		4		1	2		7	90
2	12		1			1		2	14
3	9								9
4	1								1
Total	1313	2	47	1	3	20	1	74	TOTAL N= 1387

Table 24. Weathered (WTH) and gnawed elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

Abrasion

EROSION											
	ABSENT	PRESENT								PRESENT TOTAL	TOTAL
ABRASION		C/S	LB	V	F/I	H/F	UN	BU	O/M		
ABSENT	427	107	69	60	165	111	12	4	29	557	984
PRESENT	151	54	33	6	62	89	1	0	7	252	403
TOTAL	578	161	102	66	227	200	13	4	36	809	TOTAL N=1387

Table 25. Eroded and abraded elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

- The glossy appearance on several weathered elements however (mainly from Gop Cave) resulted from handling (yellow or transparent varnish) and impacted by abrasion. Notes for elements affected by handling/modern damage have been recorded in the 'QC' (Quick Comments) section (Appendix 1//Coding).
- Evidence of gnawing (N=27) and trampling (N=5) on abraded remains was very low possibly resulting from water wear (Tables 26-27). Abrasion and absence of trampling and weathering in caves suggests that taphonomic re-elaborations might have taken place. Most abraded remains with evidence of erosion were bones of the hands/feet (Table 25) whereas abraded mandibulae (N=10) and loose cranial fragments (N=3) were mainly weathered (stage 1) (Table 22). Abraded flat/irregular bones and hands/feet were equally weathered (stage 1) (Table 22) with the former being the second most abraded and eroded bone category (Table 25). Most abraded long bones were almost equally weathered (stage 1) and gnawed after hands/feet (Tables 22, 26).

GNAWING									
	ABSENT (TOTAL)	PRESENT						PRESENT TOTAL	TOTAL
ABRASION		C/S	LB	V	F/I	H/F	O/M		
ABSENT	937	1	36	1		8	1	47	984

PRESENT	376	1	11		3	12		27	403
TOTAL	1313	2	47	1	3	20	1	74	TOTAL N= 1387

Table 26. Gnawed and abraded elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry).

TRAMPLING						
	ABSENT (TOTAL)	**PRESENT**			**PRESENT TOTAL**	**TOTAL**
ABRASION		**C/S**	**F/I**	**H/F**		
ABSENT	982			2	2	984
PRESENT	398	3	1	1	5	403
TOTAL	**1381**	**3**	**1**	**3**	**7**	**TOTAL N=1387**

Table 27. Trampled and abraded elements based on bone category (C/S= cranial/skull, F/I= flat/irregular, H/F=hands/feet. N=excluding Little Orme's Head Quarry.

Staining

- Discolouration was observed on a very high number of eroded/root etched elements (N=437).

EROSION											
	ABSENT	**PRESENT**								**PRESENT TOTAL**	**TOTAL**
STAINING		**C/S**	**LB**	**V**	**F/I**	**H/F**	**UN**	**BU**	**O/M**		
ABSENT	344	77	33	50	97	90	6	4	14	372	717
PRESENT	234	84	68	16	130	110	7		22	437	670
TOTAL	578	161	102	66	227	200	13	4	36	809	TOTAL N =1387

Table 28. Eroded and stained elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

- Abrasion was also identified on 265 stained elements. Abraded hands/feet and flat/irregular bones were the most highly eroded and stained elements a pattern which can be justified with the high frequencies of these remains surviving across sites.

ABRASION											
	ABSENT	**PRESENT**								**PRESENT TOTAL**	**TOTAL**
STAINING		C/S	LB	V	F/I	H/F	UN	BU	O/M		
ABSENT	578	23	10	14	18	68		3	2	139	717
PRESENT	406	48	44	15	66	82	1		9	265	670
TOTAL	984	71	54	29	84	150	1	3	11	403	TOTAL N =1387

Table 29. Abraded and stained elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

- A lower proportion of the assemblage appeared both stained and weathered (N=91) however, no pattern can be highlighted.

STAINING										
	ABSENT	**PRESENT**							**PRESENT TOTAL**	**TOTAL**
WTH		**C/S**	**LB**	**V**	**F/I**	**H/F**	**UN**	**O/M**		
0 (NO WTH)	692	91	95	44	151	160	11	29	581	1273
1	15	20	19	3	22	10		1	75	90
2	5	2	2	1	3	1			9	14
3	4	1	3		1				5	9
4			1						1	1
TOTAL	716	114	120	48	177	170	11	30	671	TOTAL N=1387

Table 30. Stained and weathered (WTH) elements based on bone category (C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry.

Trauma (burning)

- Ogof Colomendy was heavily disturbed (quarrying, cave disturbances and series of excavations) (see Appendices/Site Backgrounds), and no hearth or other burnt elements were recovered to clarify whether these remains were cremated in site or brought at a later stage. Burnt fragments from the George Rock Shelter were recovered from different contexts (1000-1004/1007-9) and according to the excavation report (see Appendix 5/Site Backgrounds), ash deposits and a possible cremation pyre justify the presence of burnt fragments. Distinct burning stages can result from exposure and duration with the fire flames (higher intensities) and stage 0 can even appear from post-fire breakage (e.g. protected internal surface) (see Chapter 4/4.5).

Fractures (fresh vs dry)

- Ogof Colomendy underwent a series of disturbances including animal scavenging, human inflicted trauma (fresh breaks and sharp force trauma), depositions of multi-period deposits and modern damage from quarrying, disturbances by cavers and excavation damage. Animal scavenging in a highly disturbed site is therefore justifiable.

FRACTURED LONG BONES (FFI SCORES)					
FRACTURE FRESHNESS INDEX	**HUMERUS**	**RADIUS**	**FEMUR**	**TIBIA**	**TOTAL**
FRESH	3	3	1	1	8
FFI SCORE 0			1		1
WTH STAGE 1			1		1
FFI SCORE 1	1	1			2
WTH STAGE 1	1	1			2
FFI SCORE 2	2				2
WTH STAGE 2	1				1
WTH STAGE 4	1				1
FFI SCORE 3		2		1	3
WTH STAGE 1		1			1
WTH STAGE 3		1		1	2
DRY (PROX&DISTAL)			1	2	3
PROX=4/DIST=4			1	1	2
WTH STAGE 3			1	1	2
PROX=4/DIST=6				1	1
WTH STAGE 1				1	1

DRY	3		1		4
FFI SCORE 5	1		1		2
WTH STAGE 1	1				1
WTH STAGE 3			1		1
FFI SCORE 6	2				2
WTH STAGE 1	1				1
WTH STAGE 2	1				1
TOTAL	6	3	3	3	15

Table 32. Fractured long bones and FFI scores based on weathering (WTH) presence.

- A single fresh fractured femur (FFI score: 0/SNO: 679) and a single dry fractured humerus (FFI score: 5/SNO: 823) showed evidence of both weathering (stage 1) and gnawing whilst remaining gnawed limbs with fresh or dry breaks did not exhibit any signs of weathering.

FRACTURED LONG BONES (FFI SCORES)					
FRACTURE FRESHNESS INDEX	**HUMERUS**	**RADIUS**	**FEMUR**	**TIBIA**	**TOTAL**
FRESH AND DRY (PROX&DISTAL)		1			1
PROX=2/DIST=4		1			1
WTH ABSENT		1			1
GN PRESENT		1			1
FRESH (PROX&DISTAL)			1	1	2
PROX=3/DIST=2			1	1	2
WTH ABSENT			1	1	2
GN PRESENT			1	1	2
FRESH	1		4	2	7
FFI SCORE 0			1		1
WTH STAGE 1			1		1
GN PRESENT			1		1
FFI SCORE 2			1		1
WTH ABSENT			1		1
GN PRESENT			1		1
FFI SCORE 3	1		2	2	5
WTH ABSENT	1		2	2	5
GN PRESENT	1		2	2	5
DRY AND FRESH (PROX&DISTAL)				1	1
PROX=5/DIST=1				1	1
WTH ABSENT				1	1
GN PRESENT				1	1

DRY	4		3	1	8
FFI SCORE 4			2		2
WTH ABSENT			2		2
GN PRESENT			2		2
FFI SCORE 5	2		1	1	4
WTH ABSENT	1		1	1	3
GN PRESENT	1		1	1	3
WTH STAGE 1	1				1
GN PRESENT	1				1
FFI SCORE 6	2				2
WTH ABSENT	2				2
GN PRESENT	2				2
TOTAL	5	1	8	5	19

Table 33. Fractured long bones and FFI scores based on weathering (WTH) presence/absence and gnawing (GN) presence.

Surface preservation

- Weathering (scores 1-4) fluctuated between surface preservation scores 0-5 (poor-good) with most affected elements (flat/irregular bones and long bones) reaching weathering stages 1-2 and scoring 1-2 surface preservation.

WEATHERING						
SURFACE PRESERVATION	**0**	**1**	**2**	**3**	**4**	**TOTAL**
SCORE 0	335	7		8	1	351
C/S	39	3		1		43
LB	26	1		6	1	34
V	62					62
F/I	52	1		1		54
H/F	47	2				49
UN	18					18
BU	64					64
O/M	27					27
SCORE 1	206	16	5			227
C/S	19	6	2			27
LB	25	2	1			28
V	17	1				18
F/I	74	5	1			80
H/F	48	1	1			50
UN	8					8
BU	4					4

O/M	11	1				12
SCORE 2	258	25	5	1		289
C/S	39	5				44
LB	30	6	2	1		39
V	25		1			26
F/I	71	9	2			82
H/F	75	5				80
UN	2					2
BU	1					1
O/M	15					15
SCORE 3	253	22	2			277
C/S	55	4				59
LB	33	6	1			40
V	28	2				30
F/I	53	5	1			59
H/F	71	5				76
UN	4					4
O/M	9					9
SCORE 4	90	11	2			103
C/S	18	5				23
LB	18	4	1			23
V	8					8
F/I	18	1				19
H/F	26	1	1			28
UN	1					1
O/M	1					1
SCORE 5	131	9				140
C/S	12	1				13
LB	18	2				20
V	16	1				17
F/I	16	2				18
H/F	68	3				71
O/M	1					1
TOTAL	1273	90	14	9	1	1387

Table 34. Surface preservation (0-5) on weathering elements. C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry/unknown surface preservation (no primary analysis).

- Long bones mainly exhibited gnawing marks but were not severely affected (score 2).

GNAWING			
SURFACE PRESERVATION	**ABSENT**	**PRESENT**	**TOTAL**
SCORE 0	345	6	351
C/S	43		43
LB	30	4	34
V	62		62
F/I	53	1	54
H/F	48	1	49
UN	18		18
BU	64		64
O/M	27		27
SCORE 1	213	13	226
C/S	27		27
LB	18	9	27
V	17	1	18
F/I	80		80
H/F	48	2	50
UN	8		8
BU	4		4
O/M	11	1	12
SCORE 2	265	24	289
C/S	44		44
LB	24	15	39
V	26		26
F/I	81	1	82
H/F	72	8	80
UN	2		2
BU	1		1
O/M	15		15
SCORE 3	261	16	277
C/S	58	1	59
LB	29	11	40
V	30		30
F/I	58	1	59
H/F	73	3	76
UN	4		4
O/M	9		9
SCORE 4	96	8	104
C/S	23		23
LB	18	6	24
V	8		8
F/I	19		19
H/F	26	2	28

UN	1		1
O/M	1		1
SCORE 5	133	7	140
C/S	12	1	13
LB	18	2	20
V	17		17
F/I	18		18
H/F	67	4	71
O/M	1		1
TOTAL	1313	74	1387

Table 35. Surface preservation (0-5) on gnawed elements. C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry/unknown surface preservation (no primary analysis).

- Evidence of erosion/root etching was identified on the vast majority of human remains (N=809/excluding Little Orme's Head Quarry)[3] with fluctuating surface preservation scores (0-3) (Table 36). Flat//irregular bones (scores 0-1) demonstrated the lowest surface preservation (scores 0-1) followed by hands and feet (scoring 2) and cranial/skull remains (scoring 3). Hands/feet nonetheless, demonstrated the highest surface preservation amongst eroded bone categories (score 5) which suggests exposure to different depositional environments resulting in distinct surface preservation.

EROSION			
SURFACE PRESERVATION	**ABSENT**	**PRESENT**	**TOTAL**
SCORE 0	174	177	351
C/S	10	33	43
LB	16	18	34
V	28	34	62
F/I	9	45	54
H/F	23	26	49
UN	14	4	18
BU	61	3	64
O/M	13	14	27
SCORE 1	68	158	226
C/S	9	18	27
LB	12	15	27

[3] Surface preservation unknown and therefore no correlations between preservation scores and erosion can be made for this site.

V	8	10	18
F/I	14	66	80
H/F	17	33	50
UN	3	5	8
BU	3	1	4
O/M	2	10	12
SCORE 2	111	178	289
C/S	9	35	44
LB	16	23	39
V	19	7	26
F/I	33	49	82
H/F	26	54	80
UN	1	1	2
BU	1		1
O/M	6	9	15
SCORE 3	101	176	277
C/S	10	49	59
LB	18	22	40
V	22	8	30
F/I	11	48	59
H/F	32	44	76
UN	2	2	4
O/M	6	3	9
SCORE 4	46	58	104
C/S	8	15	23
LB	11	13	24
V	5	3	8
F/I	7	12	19
H/F	14	14	28
UN		1	1
O/M	1		1
SCORE 5	78	62	140
C/S	2	11	13
LB	10	10	20
V	13	4	17
F/I	11	7	18
H/F	42	29	71
O/M		1	1
TOTAL	**578**	**809**	**1387**

Table 36. Surface preservation (0-5) on eroded elements. C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry/unknown surface preservation (no primary analysis).

- Staining was recorded on almost half of the remains (N=671) with most affected elements (flat/irregular bones) indicating low to medium surface preservation (scoring 2-3) and bones of the hands and feet demonstrating the poorest (0) and highest (5) surface preservation on stained bones. The high frequency of hands/feet across the total assemblage justifies fluctuations in preservation as different modes of deposition must have been responsible for the distinct survival of the extremities. Caves are highly disturbed environments and often lack accurate stratigraphic information with consequential movement of interments resulting from natural agents and/or distinct episodes of depositions and clearances. Exposure to separate environmental conditions resulted in hands/feet been impacted severely by some agents or protected by further degradation.

STAINING			
SURFACE PRESERVATION	**ABSENT**	**PRESENT**	**TOTAL**
SCORE 0	268	83	351
C/S	28	15	43
LB	19	15	34
V	55	7	62
F/I	39	15	54
H/F	28	21	49
UN	15	3	18
BU	64		64
O/M	20	7	27
SCORE 1	80	146	226
C/S	10	17	27
LB	8	19	27
V	11	7	18
F/I	21	59	80
H/F	18	32	50
UN	4	4	8
BU	4		4
O/M	4	8	12
SCORE 2	109	180	289
C/S	18	26	44
LB	12	27	39
V	10	16	26
F/I	29	53	82
H/F	34	46	80
UN	1	1	2

BU	1		1
O/M	4	11	15
SCORE 3	121	156	277
C/S	21	38	59
LB	8	32	40
V	23	7	30
F/I	24	35	59
H/F	39	37	76
UN	1	3	4
O/M	5	4	9
SCORE 4	49	55	104
C/S	7	16	23
LB	8	16	24
V	7	1	8
F/I	8	11	19
H/F	17	11	28
UN	1		1
O/M	1		1
SCORE 5	89	51	140
C/S	11	2	13
LB	9	11	20
V	7	10	17
F/I	14	4	18
H/F	47	24	71
O/M	1		1
TOTAL	716	671	N=1387

Table 37. Surface preservation (0-5) on stained elements. C/S= cranial/skull, LB= long bones, V=vertebrae, F/I= flat/irregular, H/F=hands/feet, UN=unidentified, BU=burnt, O/M=other/miscellaneous). N=excluding Little Orme's Head Quarry/unknown surface preservation (no primary analysis).

- Denser elements (teeth and diaphyses) may also not survive complete when constantly subjected to thermal shock and repeated drying and wetting (Conard *et al.* 2008). The vast majority of shafts (N=56) that survived across sites scored low to medium surface preservation (0-1, 3) with most exhibiting dry fractures. Fractures on long bones with medium surface preservation (score 3) however, were equally fresh and dry. This pattern suggests possible exposure to similar burial conditions with practices involving peri-mortem handling, resulting in fresh breaks, and post-mortem disturbances causing dry breaks.

FRACTURE FRESHNESS INDEX - SHAFTS					
SURFACE PRESERVATION	**HUMERUS**	**RADIUS**	**FEMUR**	**TIBIA**	**TOTAL**
SCORE 0	3	4	2	1	10
FRESH	1	2			3
DRY (PROX&DISTAL)	1	1	1	1	4
DRY	1	1	1		3
SCORE 1	6	3		2	11
FRESH (PROX) AND DRY (DISTAL)		1			1
FRESH	1				1
DRY (PROX) AND FRESH (DISTAL)				2	1
DRY (PROX&DISTAL)		1			1
DRY	5	1			6
SCORE 2	2	1	3	2	8
FRESH	1		1	2	4
DRY (PROX&DISTAL)		1			1
DRY	1		2		3
SCORE 3	4	3	3	4	14
FRESH (PROX&DISTAL)				1	1
FRESH	3	2	1		6
DRY	1	1	2	3	7
SCORE 4	1	2	2	3	8
FRESH	1	2		1	4
DRY (PROX&DISTAL)				1	1
DRY			2	1	3
SCORE 5	1	2	2		5
FRESH (PROX&DISTAL)			1		1
FRESH	1	2	1		4
TOTAL	17	15	12	12	56

Table 38. Surface preservation (0-5) recorded on present shafts across the assemblage.

- Surface preservation on loose teeth was not recorded, nonetheless, evidence of staining, erosion, concretion and digestion was predominantly identified (N=135 of 200 loose teeth). Erosion was present on more than half of the assemblage (57.8%) whilst cave concretion (27.4%) and staining (21.5%) were also recorded. Several loose teeth had been digested (17%), however this modification will be examined on an individual basis. Results from identified taphonomy on loose teeth corresponds to the overall taphonomic modifications

recorded amongst all bone categories whilst digestion clearly mirrors extensive scavenger activity. No particular patterns amongst surviving loose teeth were observed however, analysis on a regional and context-by-context basis will clarify whether any patterns are apparent.

TAPHONOMY /LOOSE TEETH		STAINING		EROSION		CONCRETION		DIGESTION	
		ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
TOOTH CLASS	I1	10	2	5	7	7	5	11	1
	I2	15	3	7	11	13	5	15	3
	C	16	5	8	13	15	6	19	2
	PM1	10	5	9	6	9	6	13	2
	PM2	15	7	12	10	15	7	18	4
	M1	8	3	2	9	10	1	9	2
	M2	8	0	5	3	5	3	6	2
	M3	7	1	3	5	6	2	6	2
	DI1	2	0	0	2	2	0	2	0
	DC	2	1	0	3	2	1	3	0
	DM1	2	0	0	2	1	1	2	0
	I	4	1	2	3	5	0	4	1
	PM	1	0	0	1	1	0	1	0
	M	3	1	2	2	4	0	3	1
	UNDETERMINED	3	0	2	1	3	0	0	3

Table 39. Taphonomic modifications identified on loose teeth. II1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, di1= deciduous 1st incisor, dc= deciduous canine, dm1= deciduous 1st molar, I= incisor, PM= premolar, M= molar: no identification of exact tooth. N=135 includes only recorded taphonomy.

Trampling

- Only five trampled elements were abraded whilst evidence of weathering was entirely absent. Trampled and abraded remains were also eroded with some exhibiting staining marks (black, pink/red stains and a purple mark). Cranial fragment 128 (SNO) exhibited signs of endocranial lesion, erosive and abrasive process (polishing) and nonetheless, very good surface preservation (score 5).

TRAMPLING						
	ABSENT	PRESENT			PRESENT TOTAL	TOTAL
TAPHONOMY		C/S	F/I	H/F		
EROS ABSENT	577			1	1	578
AB ABSENT	426			1	1	427
STAIN ABSENT	282					282
STAIN PRESENT	144			1	1	145
AB PRESENT	151					151
STAIN ABSENT	62					62
STAIN PRESENT	89					89
EROS PRESENT	803	3	1	2	6	809
AB ABSENT	556			1	1	557
STAIN ABSENT	295			1	1	296
STAIN PRESENT	261					261
AB PRESENT	247	3	1	1	5	252
STAIN ABSENT	75	1			1	76
STAIN PRESENT	172	2	1	1	4	176
TOTAL	1380	3	1	3	7	N=1387

Table 40. Evidence of trampling on remains across sites categorised by element type C/S= cranial/skull, F/I= flat/irregular, H/F=hands/feet) and correlated with other taphonomic modifications (abrasion, staining). N=excluding Little Orme's Head Quarry/no primary analysis.

Microscopic results

- Distribution of collagen loss amongst samples showed similarities between medium (score 2) and absence of birefringence (score 0) (N=12, 22%) whilst eight samples (12%) had retained collagen in their microstructure.
- Microstructural staining was detected under both normal and polarised light mainly brown, black/brown and/or orange/red, brown/red in colour with red discolorations sometimes detectable only under polarised light.

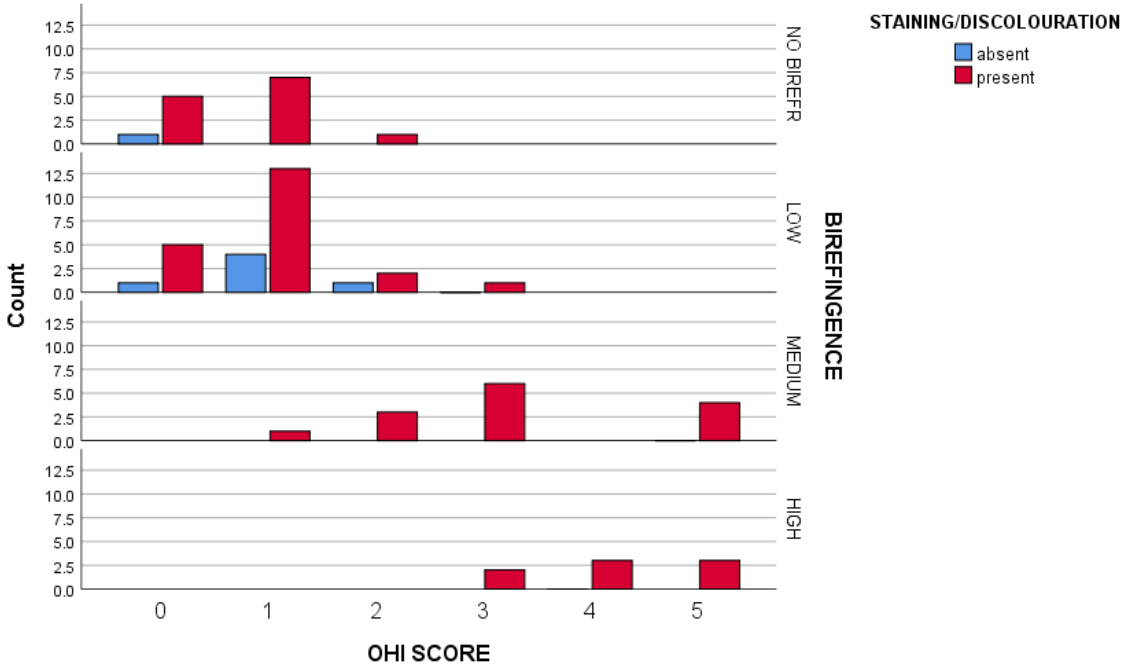


Figure 89. Birefringence scores and absence/presence of microstructural staining/discolouration based on OHI scores across sites. N=63.

- A high number of inclusions and infiltrations (primarily brown or brown/black in colour) and staining (ranging from brown to brown/orange and red) were identified in samples with OHI score of one.

	OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICROFISSURES
	0	10	5	10	1
	1	24	20	21	10
	2	7	7	6	6
	3	9	9	9	8
	4	3	3	3	3
	5	7	7	7	7

Table 46. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=63.

Inclusion and infiltration intensities recorded across the assemblage was primarily low (54% and 34% respectively) with almost half of the assemblage displaying no microcracking evidence (44%).

OHI SCORE		INCLUSION INTENSITY				INFILTRATION INTENSITY				CRACKING INTENSITY			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		ABSENT	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**
	0	2	8	2	0	7	4	1	0	11	1	0	0
	1	1	19	4	1	5	12	6	2	15	9	0	1
	2	0	4	1	2	0	2	3	2	1	3	0	3
	3	0	2	3	4	0	4	3	2	1	1	2	5
	4	0	0	2	1	0	0	1	2	0	0	2	1
	5	0	1	1	5	0	0	0	7	0	2	0	5

Table 47. Inclusion, infiltration and cracking intensities (0-3) and associations with OHI scores across sites. N=63.

6.3. Regional – south-central Wales

Frequency of skeletal elements

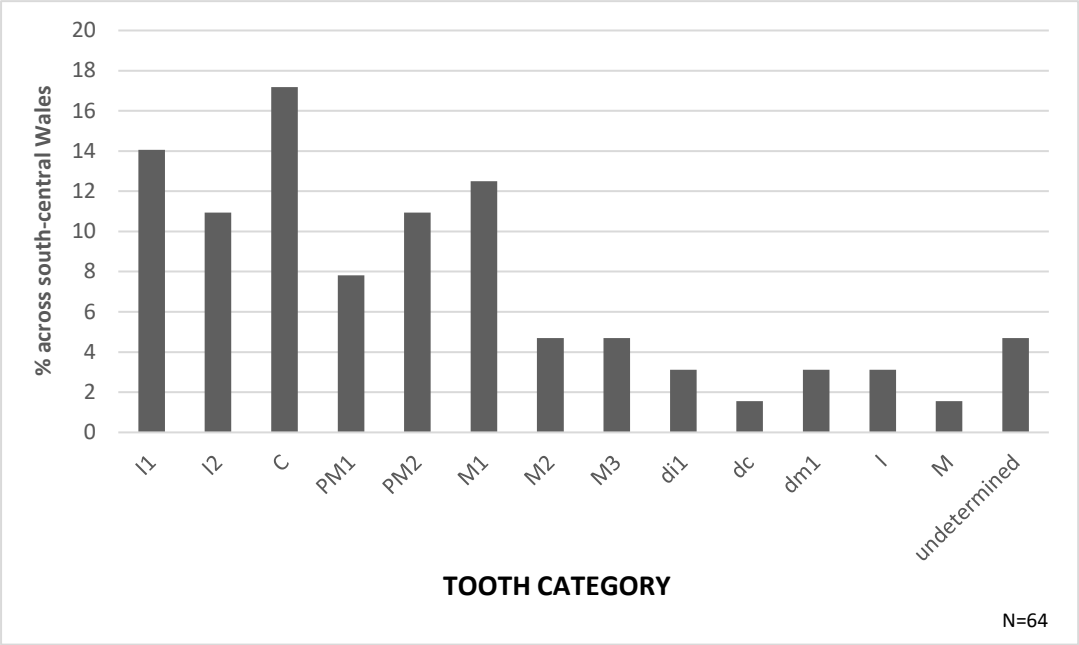


Figure 91. Teeth distributions across south-central Wales. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, di1= deciduous 1st incisor, dc= deciduous canine, dm1= deciduous 1st molar, I= incisor, PM= premolar, M= molar. I (N=2) and M (N=1: no identification of tooth number. Undetermined (N=3): unidentifiable resulting from digestion (Spurge Hole).

LONG BONE	WTH STAGE 1	WTH STAGE 3	EROSION	ABRASION	STAINING
HUMERUS	0	0	3	0	1
RADIUS	0	1	3	0	0
ULNA	1	0	2	1	1
FEMUR	0	2	3	0	0
TIBIA	0	0	0	0	0
FIBULA	0	0	3	1	1
UNIDENTIFIED SHAFT	0	0	6	2	4

Table 50. Taphonomic modifications identified on long bones across sites in south-central Wales. WTH=weathering. N=26 (including unidentified shafts).

Element completeness

- Surface preservation amongst fragmented remains was primarily poor to medium (scores 0-3) whilst the vast majority of complete hands/feet derive from the George Rock Shelter (N=13).
- Erosion was the most common taphonomic modification recorded in the George Rock Shelter and Spurge Hole.
- No pattern can be highlighted amongst fragmented and complete hands/feet from the George Rock Shelter apart from the absence of abrasion in complete elements.

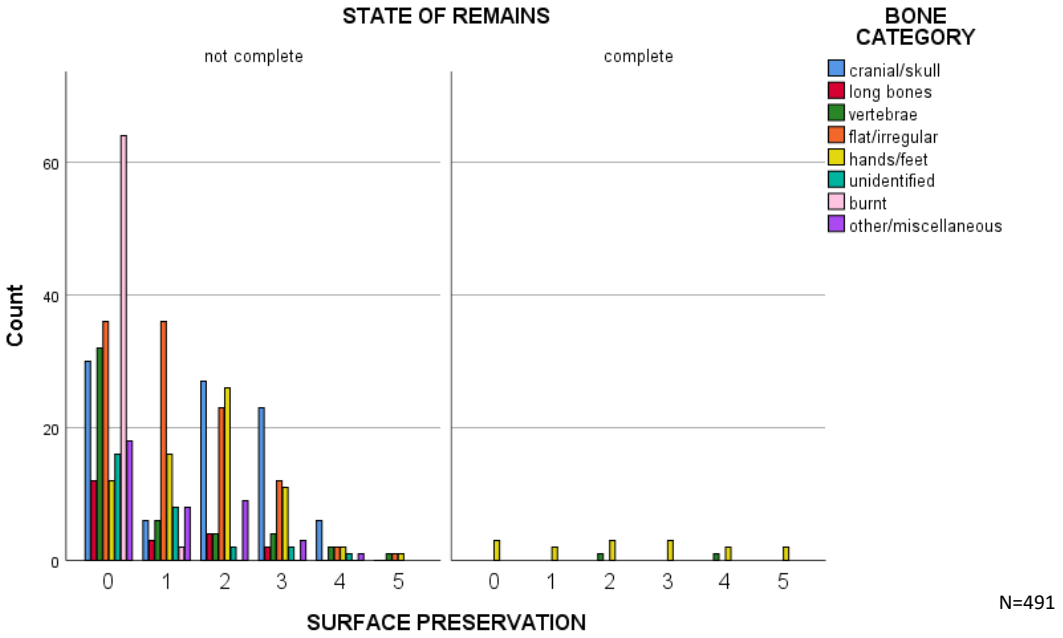


Figure 92. State or remains (complete vs fragmented/not complete) across sites in south-central Wales based on bone category and surface preservation. N=excluding loose teeth.

Dental pathologies

- Caries had affected one premolar (PM2) and two molars (M1, M3) whereas calculus was recorded on one incisor (I1), two canines and one premolar (PM1) (Figure 65).

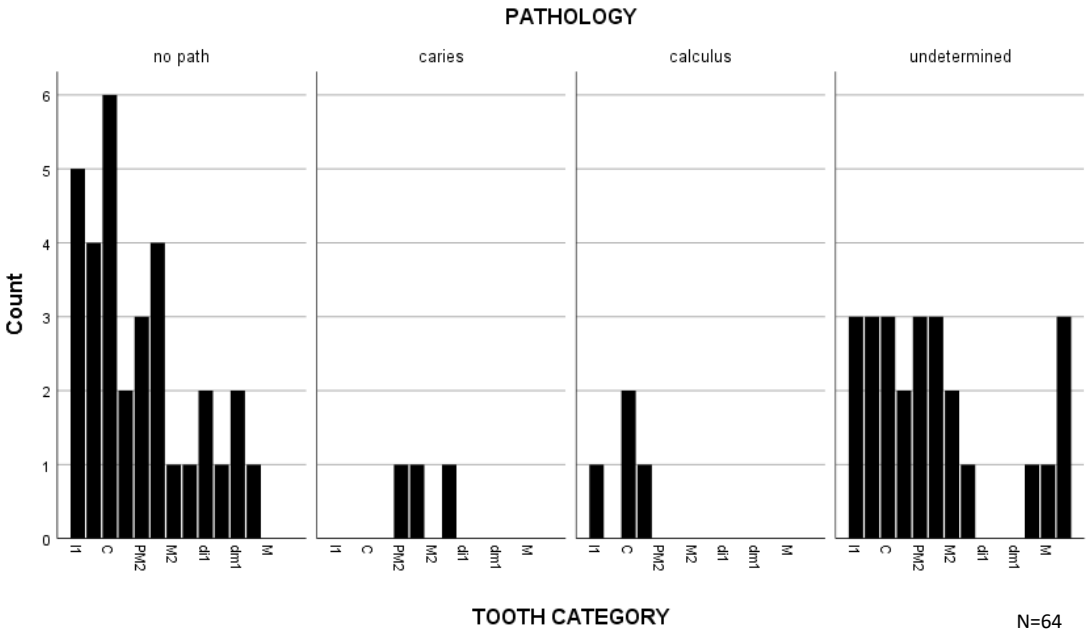


Figure 93. Dental pathologies (caries/calculus) identified on loose teeth across sites in south-central Wales. I1= 1st incisor, C= canine, PM2= 2nd premolar, M2= 2nd molar, M3= 3rd molar, di1= deciduous 1st incisor, dm1= deciduous 1st molar, M= molar (identification of exact tooth).

NUMBER OF DIGESTED TEETH		
TOOTH CLASS	I1	1
	I2	3
	C	2
	PM1	2
	PM2	4
	M1	2
	M2	1
	M3	2
	DI1	0
	DC	0
	DM1	0
	I	1
	PM	0
	M	1
	UNDETERMINED	3

Table 51. Number of digested (loose) teeth from Spurge Hole and the George Rock Shelter based on tooth category. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, di1= deciduous 1st incisor, dc= deciduous canine, dm1= deciduous 1st molar, I= incisor, PM= premolar, M= molar. I, PM and M: no identification of exact tooth.

Taphonomy – Macroscopic results

Weathering

- Three long bones with stage three weathering derived from Spurge Hole were severely eroded and demonstrated poor surface preservation (stage 0). One weathered long bone (SNO: 178) further exhibited dry fractures on both proximal and distal ends suggesting prior sub-aerial exposure followed by disturbances and/or circulation of bone.
- Two more elements from the George Rock Shelter (a probable metatarsal and one ulna) reached weathering stage one with signs of erosion, staining and abrasion and low surface preservation (scores 1 and 2). However these latter elements were unearthed from a fill of late feature (context 1009) with one radiocarbon date confirming post-Medieval activity (see Appendix/Site descriptions) and will not be further examined.

Gnawing

- Gnawing was accompanied with erosion, staining (N=2 of 3) and low to medium surface preservation (scores 1 and 3). Remains were discovered in different layers (1002/1004/1009) and therefore no particular pattern can be highlighted. The site is multi-period (Neolithic and post-Medieval) therefore minor disturbances in-between depositions were anticipated.

Erosion

- Both eroded and non-eroded remains were poorly preserved

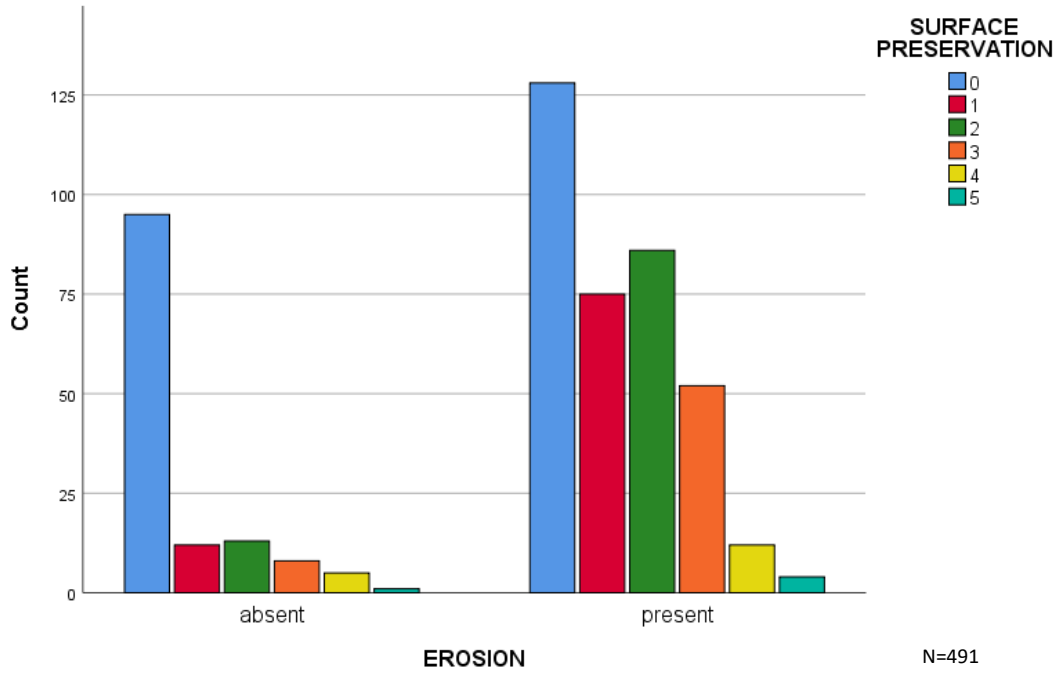


Figure 95. Surface preservation scores on eroded and non-eroded remains across sites in south-central Wales (0-5/poor-good).

- Other modifications (staining N=139, abrasion N=31, weathering N=5) had not severely impacted eroded elements (Table 53/Appendix 6). The vast majority of surviving elements derive from the George Rock Shelter and Spurge Hole had been similarly preserved possibly due to soil acidity. Erosion was identified on a low proportion of loose teeth (N=29) with lower number (N=4) indicating signs of cave concretion. Signs of digestion (N=22) due to animal activity either on-site or prior to deposition were further identified on loose teeth, primarily from Spurge Hole, and the George Rock Shelter suggesting extensive animal disturbances.

	STAIN ABSENT	**STAIN PRESENT**	**ABRASION ABSENT**	**ABRASION PRESENT**	**NO WTH**	**WTH STAGE 1**	**WTH STAGE 3**
EROS ABSENT	118	16	128	6	134	0	0
EROS PRESENT	218	139	326	31	352	2	3

Table 52. Eroded and non-eroded remains compared to other taphonomic modifications (STAIN=staining, abrasion and WTH=weathering).

Abrasion

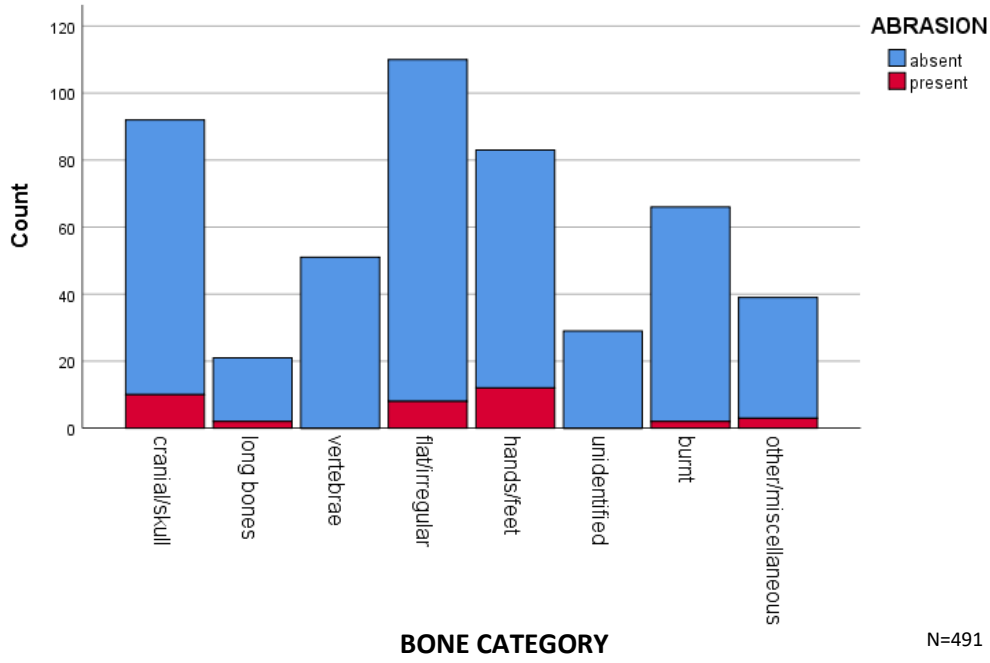


Figure 96. Presence/absence of abrasion based on bone category south-central Wales.

- Most abraded remains showed signs of erosion (N=31), staining (N=26). Abraded elements were discovered in different contexts (1002, 1004, 1007 and 1009) with most (N=24) deriving from context 1009 (fill of later feature with post-Medieval date) and will not be further examined. Two abraded fragments (SNOs: 1117, 1121) were burned (context 1004/Neolithic fill) however abrasion/polishing on the surface could have resulted from different burning degrees.

	EROSION ABSENT	**EROSION PRESENT**	**STAINING ABSENT**	**STAINING PRESENT**
ABRASION ABSENT	128	326	325	129
ABRASION PRESENT	6	31	11	26

Table 53. Abraded and non-abraded remains cross-referenced with other taphonomic modifications (erosion and staining). N=491.

Staining

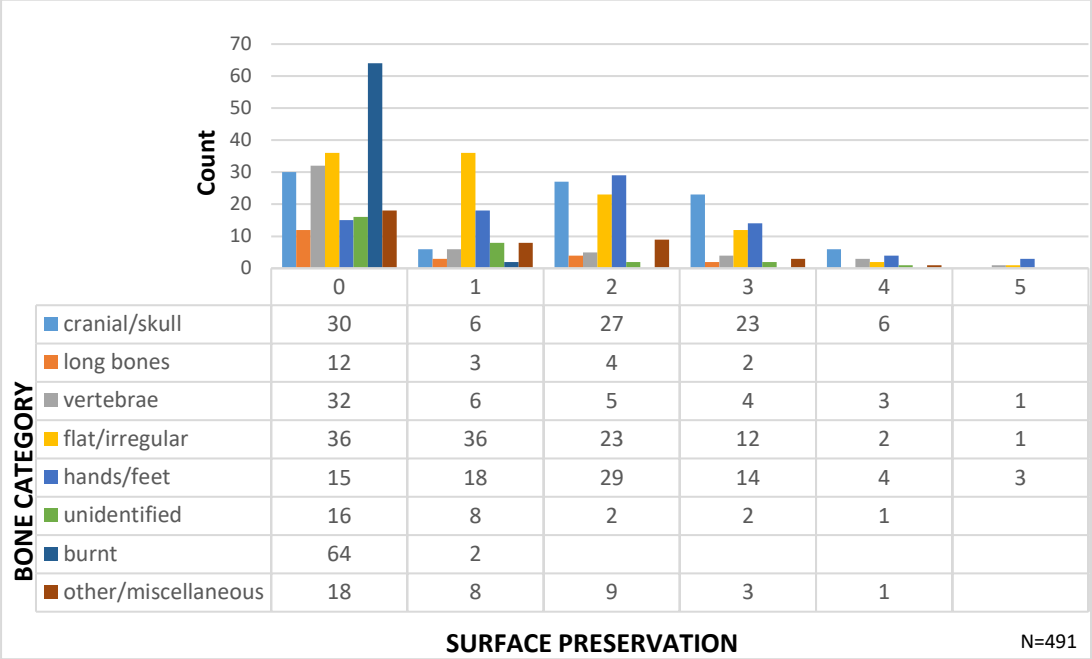
- A very low proportion of stained bones indicated signs of erosion (N=16), abrasion (N=26), gnawing (N=2) and weathering (N=2). Stained and abraded elements were primarily discovered in context 1009 (later fill/post-Medieval date) and therefore this pattern will not be further examined. Remains discovered in this site were in extremely fragile and eroded and therefore, the low representation of staining resonates with their poor surface preservation which either masked or completely destroyed any evidence of taphonomy.

	EROSION ABSENT	**EROSION PRESENT**	**ABRASION ABSENT**	**ABRASION PRESENT**	**GNAWING ABSENT**	**GNAWING PRESENT**	**NO WTH**	**WTH STAGE 1**	**WTH STAGE 3**
STAIN ABSENT	118	218	325	11	335	1	333	0	3
STAIN PRESENT	**16**	**139**	**129**	**26**	**153**	**2**	**153**	**2**	**0**

Table 54. Staining presence/absence compared to other modifications (erosion, abrasion, gnawing and WTH=weathering) in George Rock Shelter. N=491.

Surface preservation

- Cranial/skull remains (N=92, 18.7%) and bones of the hands/feet (N=83, 16.9%) were less represented amongst the assemblage however their surface preservation scores were similarly low. Element representation in other sites across south-central Wales was extremely low. Nonetheless, most elements (N=5 out of 8) from Cathole Cave and Red Fescue Hole scored low (0) whilst the single element (calcaneus) recovered from Pitton Cliff Cave score higher (4).



BONE CATEGORY	0	1	2	3	4	5
cranial/skull	30	6	27	23	6	
long bones	12	3	4	2		
vertebrae	32	6	5	4	3	1
flat/irregular	36	36	23	12	2	1
hands/feet	15	18	29	14	4	3
unidentified	16	8	2	2	1	
burnt	64	2				
other/miscellaneous	18	8	9	3	1	

Figure 97. Frequencies of surface preservation scores in south-central Wales divided by bone type (0-5/poor-good).

Microscopic results

- Samples demonstrated a high number of inclusions and infiltrations (both appearing brown/black in colour), cracking and staining (brown, brown/orange, red), with medium to high birefringence and extensive weathering (stage 3) Non-Wedl attack in long bones 26, 28 was minor and did not interfere with the overall preservation of the microstructure, therefore and OHI score of 5 seemed more suitable for these samples.

SITE	OHI	AT	INCL INTENS	INCL COLOUR	INFIL INTENS	INFIL COLOUR	STAIN COLOUR	CRACK& INTENS	BIREFR
SPURGE HOLE (SNO: 26)	5	NW	3	brown - dark, fair	3	brown - dark, fair	brown – brown/red (under polar)	Present (3)	3
SPURGE HOLE (SNO: 27)	5	None	3	brown - dark, fair	3	brown- dark; black/brown	orange, brown - fair; red	Present (3)	2
SPURGE HOLE (SNO: 28)	5	NW	3	brown - dark, fair; red	3	brown - dark; black/brown	orange/brown - fair	Present (3)	2

Table 55. Samples from Spurge Hole with very good histological preservation (OHI Score 5). Attack (AT), non-Wedl MFD (NW), inclusion (Incl)/infiltration (Infil) intensity (Intens), staining (Stain) discolouration, cracking/microfissures intensity (Crack & Intens) and birefringence scores (2=medium, 3=high).

OHI SCORE	BIREFRINGENCE INDEX			
	NONE (0)	LOW (1)	MEDIUM (2)	HIGH (3)
0	2	3	0	0
1	4	1	0	0
2	1	1	0	0
3	0	1	0	0
5	0	0	2	1

Table 56. Birefringence scores from Spurge Hole and the George Rock Shelter cross-referenced with OHI Scores. N=16.

- Cranial fragments (N=11) demonstrated low to no birefringence (OHI scores 1 & 0) whilst histological preservation on long bones (N=5) varied with OHI scores and birefringence noting a correlation.

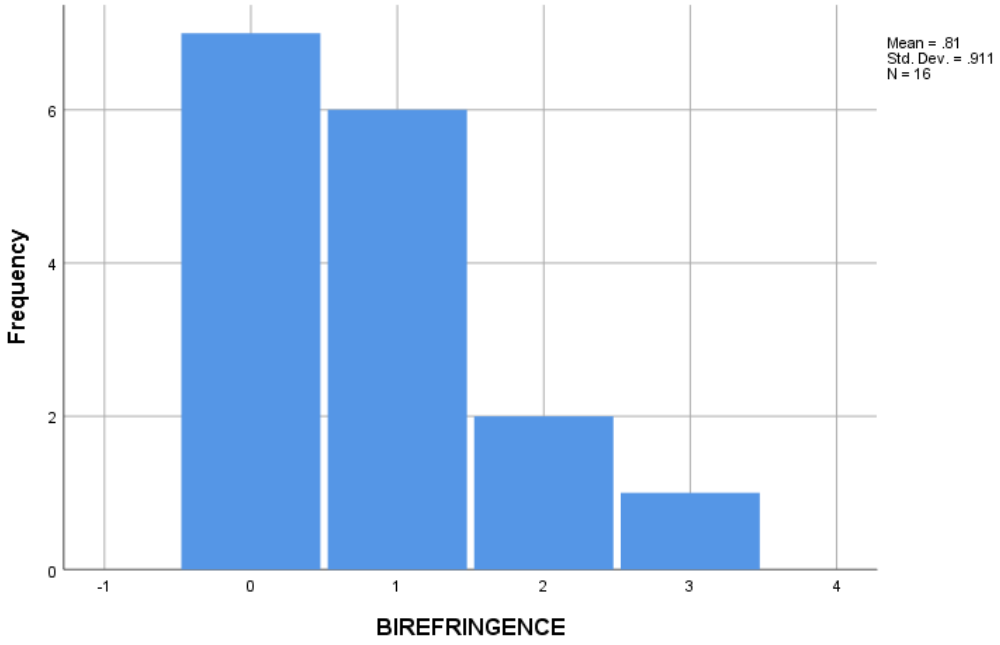


Figure 102. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from Spurge Hole and George Rock Shelter.

- Staining/discolouration persisted throughout the assemblage, staining was also noted in well preserved samples (high OHI scores) and therefore, no particular pattern can be highlighted. Microstructural staining was detected under both normal and polarised light mainly brown, brown/red or brown/orange and one exhibiting a green stain (SNO: 34) showing petrol/green under polar light.

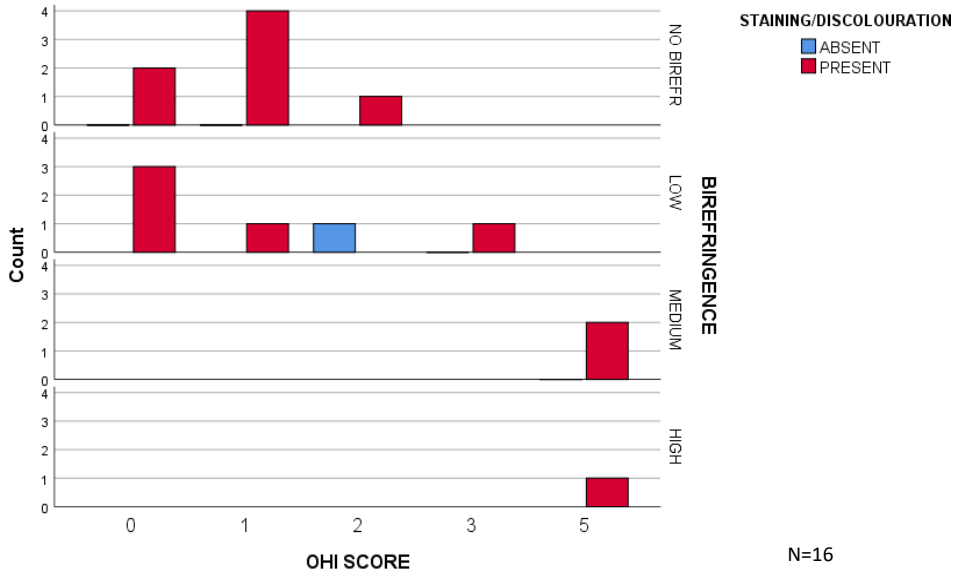


Figure 103. Birefringence scores and absence/presence of microstructural staining/discolouration based on OHI scores from Spurge Hole and the George Rock Shelter.

- Samples with low inclusion intensity had not been well preserved (OHI scores 0-1) whereas those scoring higher (OHI score 5) had the greatest number of inclusions. Low infiltration intensities similarly correlated with low OHI scores (0/1) and well preserved samples (OHI score 5) exhibited the most infiltrations. Cracking intensities correlated with given OHI scores.
- Microcracking was primarily identified in high OHI scores (5), however microfissures were similarly detected in samples with poor histological preservation (Table 56). No pattern can therefore be highlighted. Infiltrations and inclusions were either brown or black/brown in colour whilst staining was ranging from brown (fair/dark) to brown/orange or brown/red under both normal and polar light.

OHI SCORE		INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICROFISSURES
	0	3	3	5	1
	1	4	3	5	2
	2	2	2	1	1
	3	1	1	1	1
	5	3	3	3	3

Table 57. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores.

- Inclusion and infiltration intensities varied between samples, most demonstrating both low and high number of inclusions. Cracking was not extensively recorded amongst samples with half (N=8, 50%) indicating no evidence of microcracking.

OHI SCORE		INCLUSION INTENSITY				INFILTRATION INTENSITY				CRACKING INTENSITY		
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**3**
		ABSENT	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**HIGH**
	0	2	3	0	0	2	2	1	0	4	1	0
	1	1	3	0	1	2	2	0	1	3	2	0
	2	0	0	1	1	0	0	1	1	1	1	0
	3	0	0	1	0	0	0	1	0	0	0	1
	5	0	0	0	3	0	0	0	3	0	1	2

Table 58. Inclusion, infiltration and cracking intensities (0-3) and associations with OHI scores. N=16.

- Microstructural staining was primarily correlated with surface staining in low OHI scores whereas microcracking was accompanied with surface erosion on varied OHI scores.

OHI SCORE	STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)	MICROCRACKING & SURFACE EROSION	MICROCRACKING & WEATHERING (STAGE 3)
OHI 0	5	0	0
OHI 1	1	1	0
OHI 2	0	1	0
OHI 3	0	1	0
OHI 5	0	2	3

Table 59. Stained samples (surface and microstructural staining), eroded (surface) with evidence of microcracking, weathered (surface) with evidence of microcracking.

6.4. Regional – south-east Wales

Frequency of skeletal elements

- The most severe taphonomic modification recorded amongst long bones was staining (N=10, 83.3%) followed by erosion (N=6, 50%). Evidence of trauma and trampling was absent, no pathologies were identified whilst abrasion was insignificant (N=2/SNOs: 343, 348).

LONG BONE		EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
	HUMERUS	3	1	0	4
	RADIUS	1	0	0	1
	FEMUR	1	2	0	3
	TIBIA	1	1	0	2
	FIBULA	0	2	1	1

Table 62. Presence/absence of epiphysis and shafts based on long bone representation in Ifton Quarry. N=12.

Element completeness

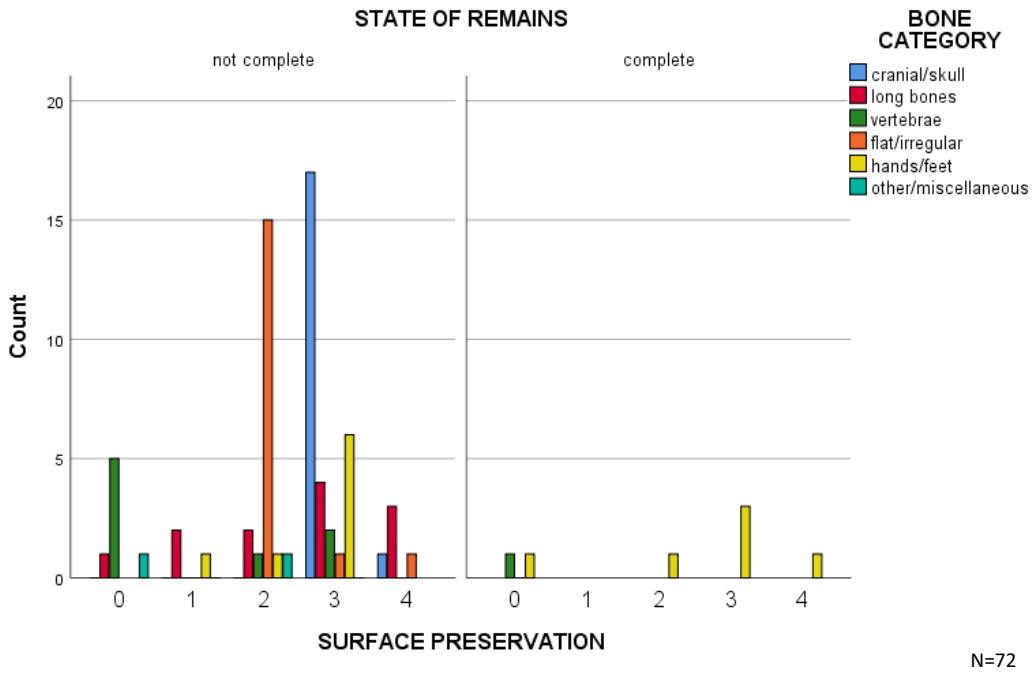


Figure 107. State of remains (complete vs fragmented/not complete) in south-east Wales (Ifton Quarry) based on bone category and surface preservation scores (0-5/poor-good).

- Cranial/skull remains and flat/irregular bones primarily demonstrated medium to low surface preservation (scores 3 and 2) with most taphonomic modifications (primarily staining) relating to the abovementioned surface preservation scores.
- Scores for surface preservation of complete bones of the hands/feet varied (0-4), however with the vast majority surviving well (score 3) and not severely affected by taphonomic modifications.
- Dry fractures were identified on five elements with no visible signs of fresh fracturing on any long bones. Modern damage (noted on some long bones) could have resulted in loss of complete fracture morphology however, lack of trauma (e.g. cutmarks, percussion marks) and other taphonomic modifications that could suggest dismemberment and exposure (e.g weathering) of the bones prior to final burial indicate the fractures resulted at a later stage (e.g. disturbances, circulation of bone).

BONE CATEGORY		STAIN	EROS	GN	AB	WTH (STAGE 1)	SURFACE PRESERVATION				
							0	1	2	3	4
	CRANIAL/SKULL	14	15	1	11	0	0	0	0	17	1
	LONG BONES	10	6	2	2	1	1	2	2	4	3
	VERTEBRAE	1	3	0	0	0	6	0	1	2	0
	FLAT/IRREGULAR	6	1	0	0	1	0	0	15	1	1
	HANDS/FEET	6	1	0	0	0	1	1	2	9	1
	UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0
	BURNT	0	0	0	0	0	0	0	0	0	0
	OTHER/ MISCELLANEOUS	0	0	0	0	0	1	0	1	0	0

Table 63. Taphonomic modifications (STAIN= staining, EROS= erosion, GN= gnawing, AB= abrasion, WTH= weathering) and surface preservation scores (0-5/poor-good) recorded in Ifton Quarry based on bone category. N=72.

MNI, demography and pathology

- Cranium 324 (attached maxilla with dental pathologies) further exhibited signs of sharp force trauma. Medium surface preservation was only noted for cranial/skull remains with both lumbar vertebrae exhibiting degenerative arthritis and low surface preservation.

SNO	CONTEXT/ STRATIGRAPHY	ELEMENT	COMPLETE/ FRAGMENTED	AGE	SEX	EROS	STAIN	SURFACE PRES	TRAUMA	PATHOLOGY
324	no context	cranium	not complete	adult	F	present	present	3	sharp force	ante-mortem tooth loss; calculus; caries; abscesses; periodontal disease
325	no context	mandible	not complete		F?	absent	present	3	no trauma	ante-mortem tooth loss; calculus
340	no context	lumbar vertebra	not complete			present	absent	0	no trauma	degenerative changes (porosity and/or osteophytes; lesions)
341	**no context**	**lumbar vertebra**	**not complete**			**absent**	**absent**	**0**	**no trauma**	**degenerative changes (porosity and/or osteophytes; lesions)**

Table 64. Evidence of pathology on four elements from Ifton Quarry in addition to element identification, state of element, age/sex assignments and recorded taphonomy (erosion, staining, surface preservation, trauma)

Taphonomy – Macroscopic results

Erosion

- Both eroded and non-eroded remains had similar surface preservation (score 3) as non-eroded remains reached the same scores with medium to poor surface preservation (scores 3 and 2).

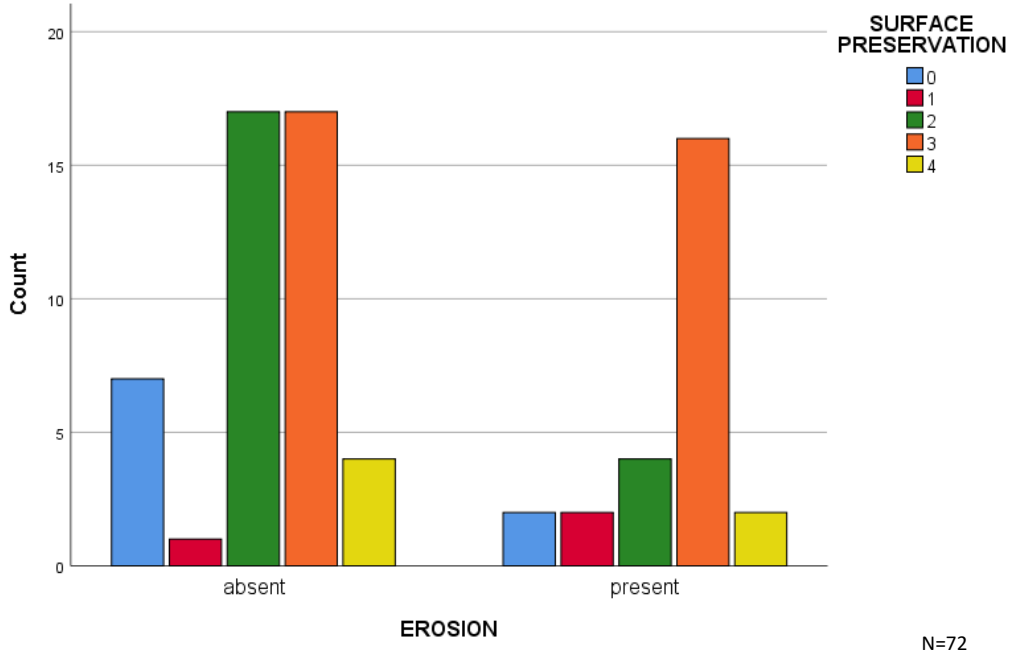


Figure 109. Surface preservation scores on eroded and non-eroded remains in Ifton Quarry (0-5/poor-good).

- The majority of the assemblage (N=46, 63%) had not been impacted by erosive processes and surface preservation scores amongst eroded (primarily crania) and non-eroded remains (primarily flat/irregular bones) did not show wide fluctuations.
- Other taphonomic modifications identified on eroded remains on a larger scale included staining (N= 21) and abrasion (N=10).

	STAINING ABSENT	**STAINING PRESENT**	**ABRASION ABSENT**	**ABRASION PRESENT**
EROSION ABSENT	30	16	43	3
EROSION PRESENT	5	21	16	10

Table 65. Eroded and non-eroded remains compared to other taphonomic modifications (staining and abrasion). N=72.

Abrasion

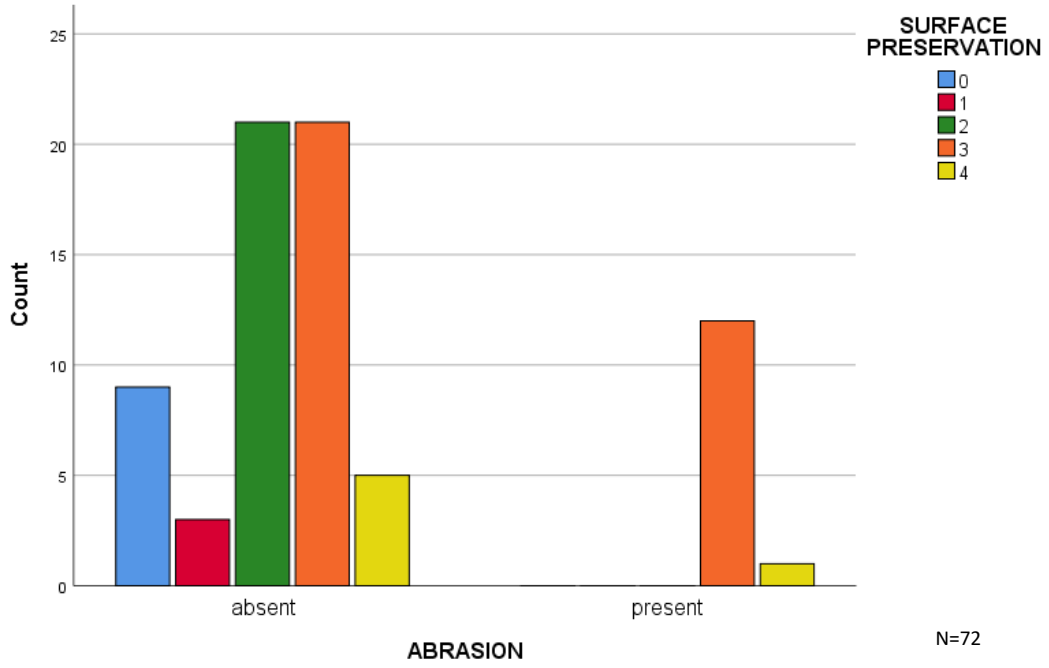


Figure 111. Presence/absence of abrasion based on surface preservation scores in Ifton Quarry (0-5/poor-good).

- Other taphonomic modifications affecting abraded remains include erosion on cranial/skull remains (N=10) and staining on most cranial/skull elements (N=8) and one long bone (Table 66). Trampling marks were recorded on one abraded cranial fragment whilst two abraded crania exhibited both signs of sharp and blunt force trauma. Overall surface preservation scores varied, with most elements demonstrating medium to low (3-2) surface preservation scores.

	EROSION ABSENT	**EROSION PRESENT**	**STAINING ABSENT**	**STAINING PRESENT**
ABRASION ABSENT	43	16	31	28
ABRASION PRESENT	**3**	**10**	**4**	**9**

Table 66. Abraded and non-abraded remains compared to other taphonomic modifications (erosion and staining).

Staining

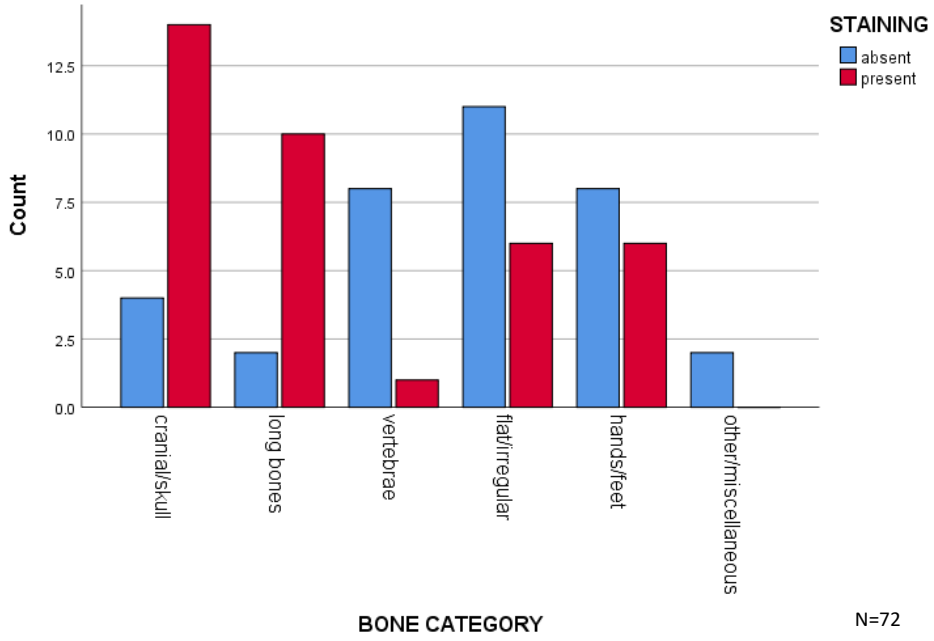


Figure 112. Staining presence/absence based on bone category in Ifton Quarry.

Stained elements were not severely affected by other taphonomic agents with erosion (N=21) accompanying most stained elements (N=13 cranial/skull remains, N=6 long bones, N=1 vertebrae and N=1 flat/irregular bones) (Table 67). Surface preservation scores demonstrated fluctuations with most elements showing medium preservation (score 3/N=23). Elements with no evidence of staining were less well preserved (score 2/N=13 and score 0/N=8) compared to bones that had been affected by staining which could suggest that elements might have derived from separate contexts prior to deposition in the site and indicate exposure of elements in different environments resulting in distinct taphonomic trajectories.

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1
STAINING ABSENT	30	5	31	4	35	0		
STAINING PRESENT	16	21	28	9	34	3		

Table 67. Staining absence/presence correlated with other taphonomic modifications (WTH= weathering)

Surface preservation

- Cranial/skull remains demonstrated medium to good surface preservation (scores 3 and 4) with remaining post-cranial remains showing fluctuations in surface preservation (Figure 84). Long bones in particular had distinct patterns of preservation, vertebrae were primarily poorly preserved (score 0) whilst flat/irregular bones and hands/feet scored higher (2 and 3 respectively).

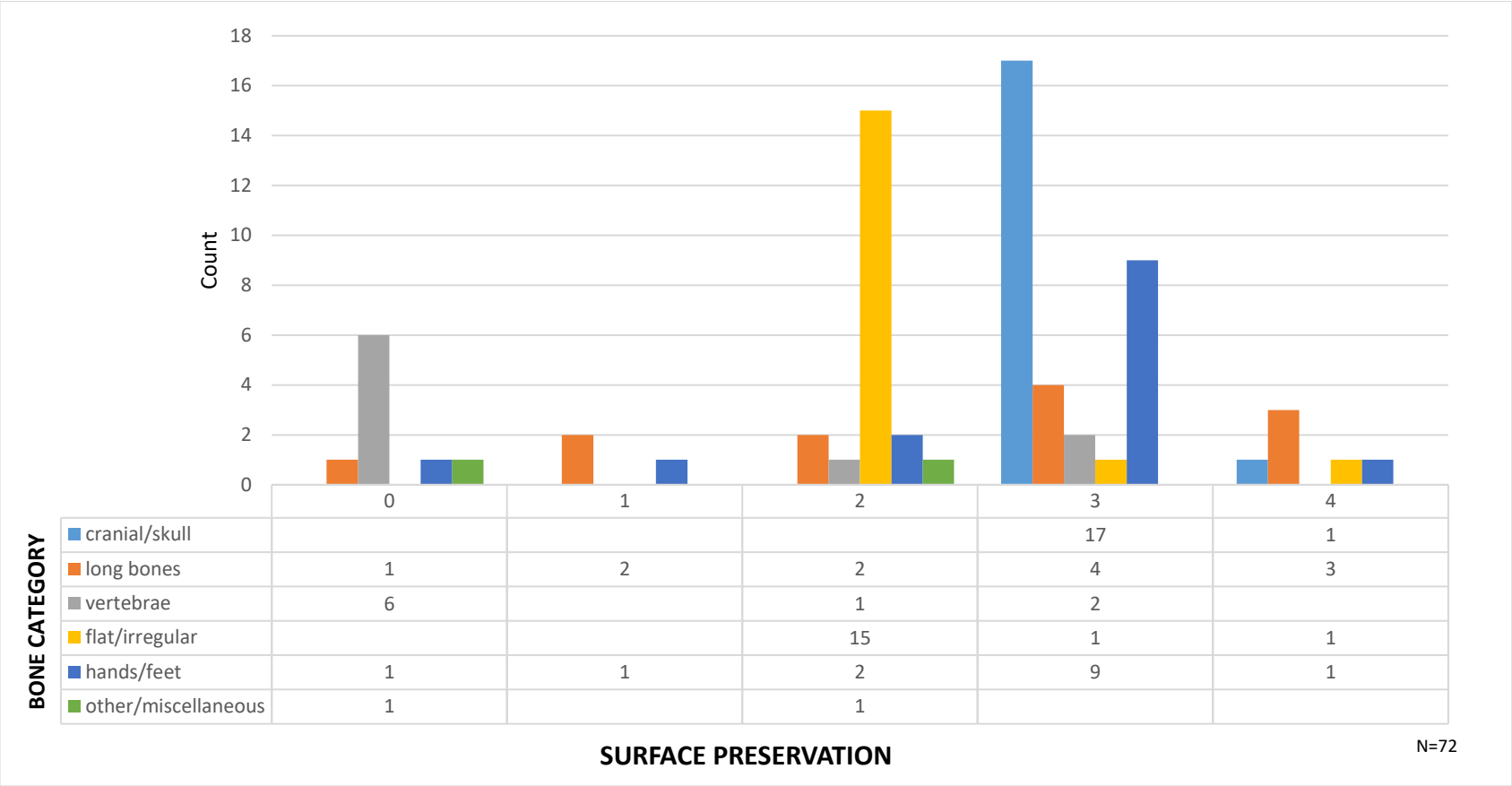


Figure 117. Frequencies of surface preservation scores in south-east Wales based on bone category (0-5/poor-good).

Microscopic results

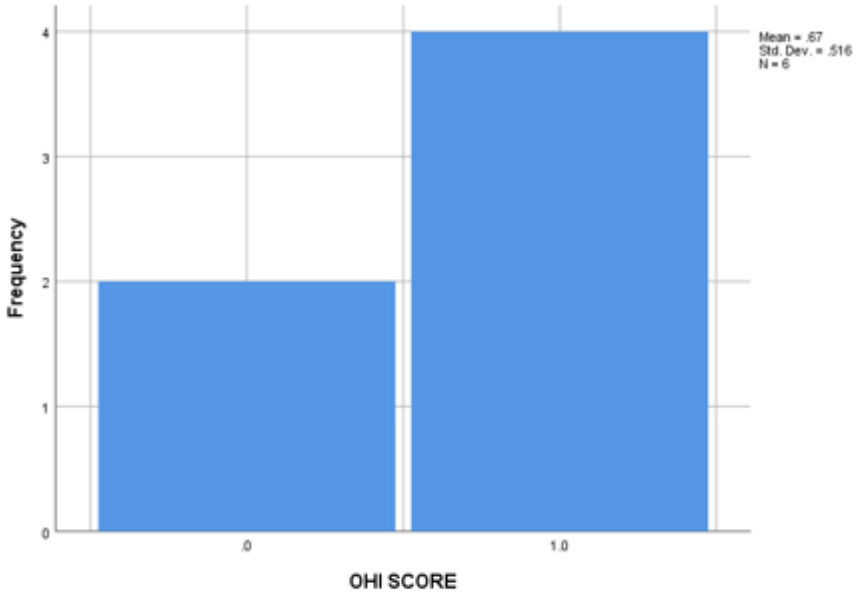


Figure 118. Histogram indicating OHI scores from Ifton Quarry.

- Half the samples (SNOs: 18-20) exhibited signs of surface erosion (N=3, 50%) with most further impacted by surface staining (N=5, 83%). Abrasion was noted on two samples (33%) (SNOs: 17, 22) with two long bones further exhibiting dry fractures (33%) (SNOs: 18-19). Surface preservation ranged low to medium (scores 1-3) with the majority demonstrating medium to poor surface preservation (score 3/N=3; score 2/N=2).
- Loss of collagen birefringence was not always accompanied by microstructural staining, as observed in overall results across sites and samples from south-central Wales. Microstructural staining was observed under both normal and polar light ranging from brown (dark/fair) to red/brown and brown/grey under polar light. Surface staining on the other hand, was recorded on almost all samples, excluding on element (SNO: 19) which also scored the lowest on the surface preservation scale (score 1).

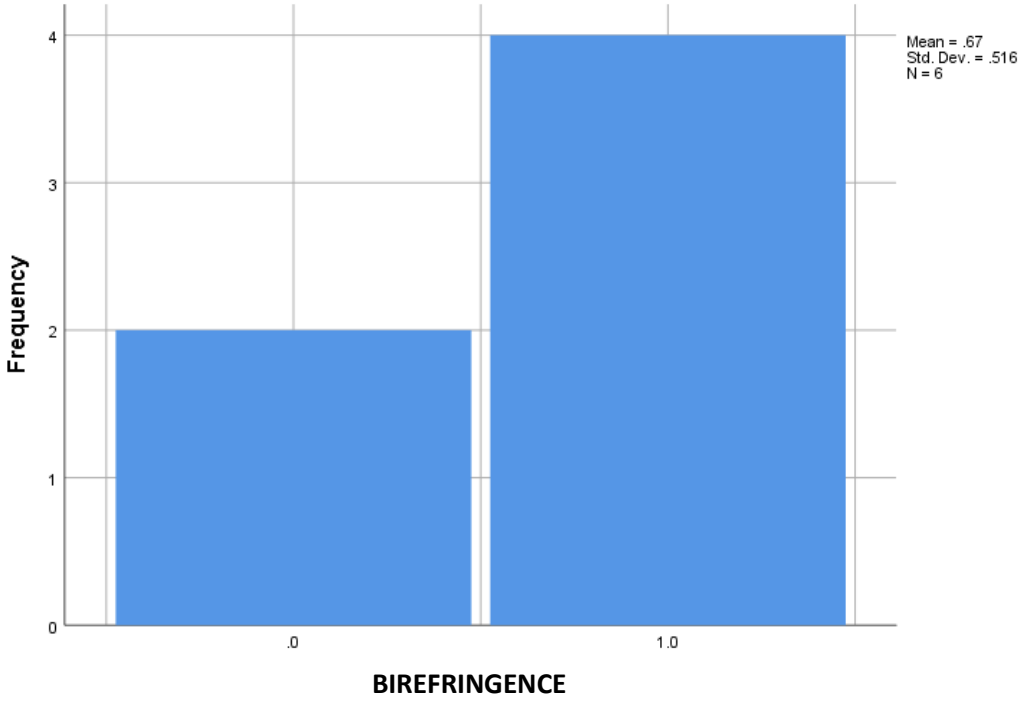


Figure 121. Frequency of birefringence scores (0=no birefringence, 1=low) from Ifton Quarry.

- Microstructural staining varied according to sample from (dark) brown discolourations around the trabecular bone to brown (fair) - red/brown (around periosteal surface) and brown/grey discolourations visible under polar light. Surface staining on the majority of human remains from Ifton Quarry appeared in sporadic black stains, most likely resulting from manganese dioxide and/or mould staining.
- Dry fractures on two long bones (SNOs: 18-19) however were eroded/root etched with low surface preservation scores (2 and 1 respectively), low to no birefringence and complete destruction of the microstructure (OHI scores 1 and 0 respectively).
- Samples that displayed microcraking/microfissures did not exhibit any signs of surface erosion and signs of weathering were absent.

	OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICROFISSURES
	0	2	0	1	0
	1	4	1	2	2

Table 69. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=6.

- Inclusion, infiltration and cracking intensities correlated with OHI scores (Table 71/Appendices) and no patterns appeared irregular (primarily low intensities). Inclusion colours fluctuated from brown/fair-dark to red/brown visible in one sample (long bone SNO: 19, OHI score: 0, surface preservation 1; dry fracture). Correlations between microscopic taphonomy and surface taphonomy indicate an association of micro- and surface staining.

OHI SCORE		**INCLUSION INTENSITY**		**INFILTRATION INTENSITY**		**CRACKING INTENSITY**	
		1	**2**	**0**	**1**	**0**	**1**
		LOW	**MEDIUM**	**ABSENT**	**LOW**	**ABSENT**	**LOW**
	0	1	1	2	0	2	0
	1	2	2	3	1	2	2

Table 70. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=6.

6.5. South-west Wales

Frequency of skeletal elements

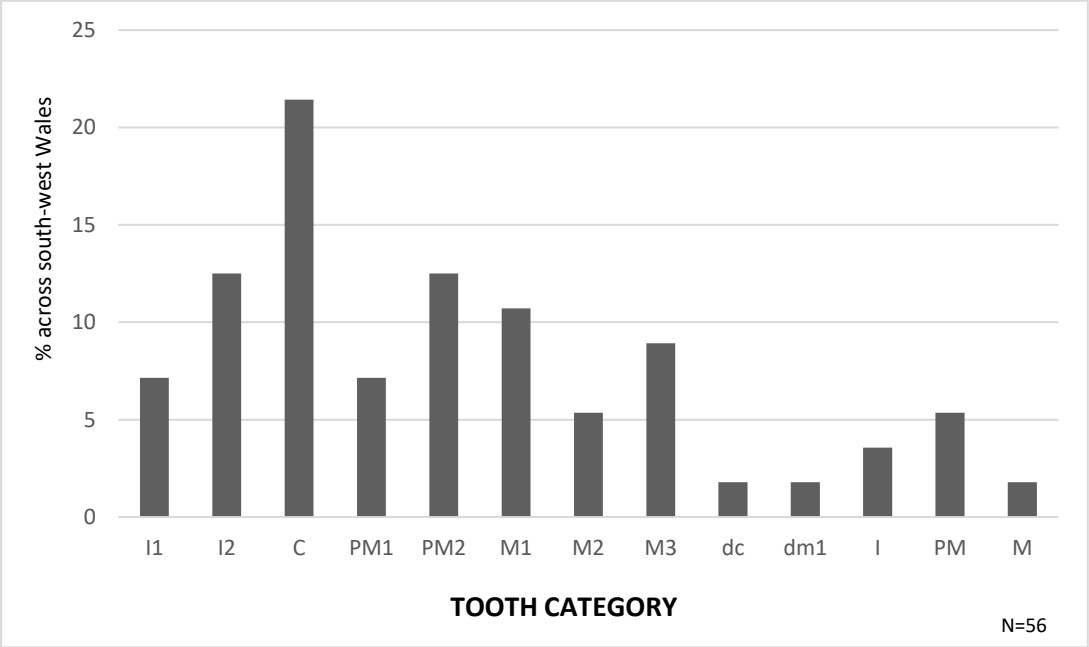


Figure 124. Teeth distributions across south-west Wales. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dc= deciduous canine, dm1= deciduous 1st molar, I= incisor, PM= premolar, M= molar. I (N=2) and M (N=1): no identification of exact tooth.

LONG BONE		EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
	HUMERUS	3	3	2	4
	RADIUS	4	4	0	8
	ULNA	2	3	0	5
	FEMUR	1	5	5	1
	TIBIA	0	1	1	0
	FIBULA	2	2	0	4
	SHAFT UN	0	0	0	0

Table 72. Long bone and zone representation across south-west Wales. SHAFT UN=shaft unidentified. N=30.

- The majority of long bones demonstrated low surface preservation scores (2-0) with only a small number of limbs (N=9) demonstrating higher scores (4-5). In particular radii frequencies were accompanied by high surface preservation scores.

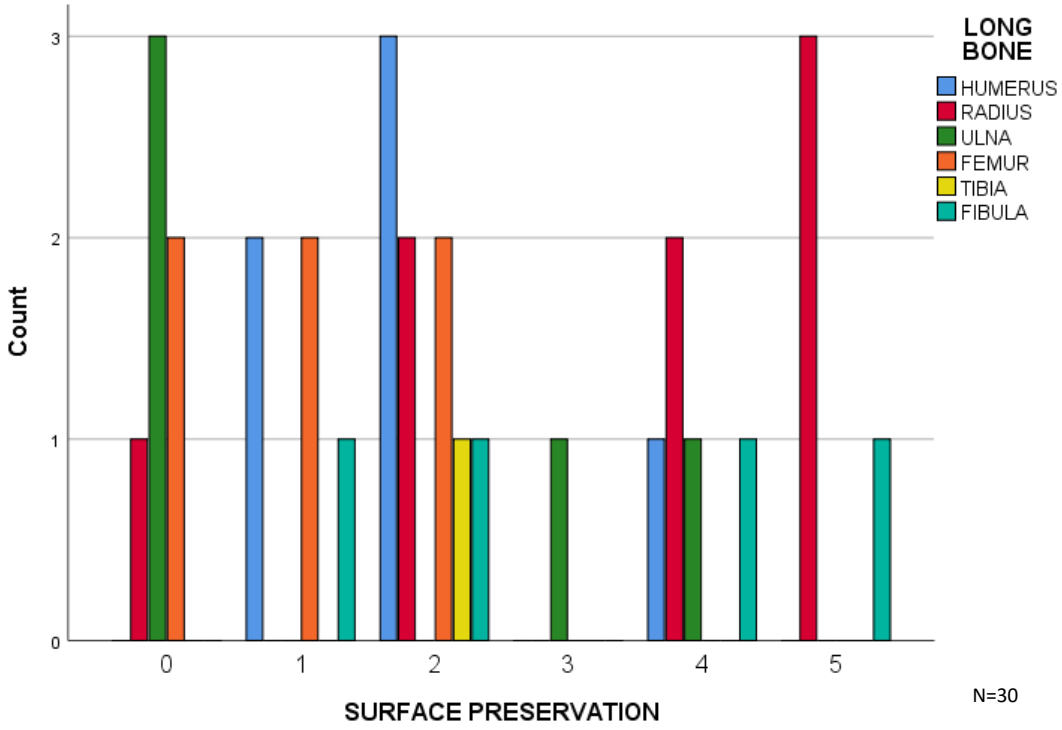


Figure 125. Surface preservation scores based on long bone representation in south-west Wales (0-5/poor-good).

- Whilst one long bone (radius) reached an advanced weathering stage (3), the majority of weathered long bones (N=8) demonstrated lower weathering stages (1-2) similar to assemblages from other sites in Wales (Table 74). Gnawing was present on three long bones with abrasion (N=8) recorded on less than one third of the assemblage (26.7%). Fractures were recorded on almost half of the long bones (N=14) and included both fresh and dry (primarily fresh).

LONG BONE		GN	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	EROS	AB	STAIN
	HUMERUS	1	1	0	0	5	2	4
	RADIUS	0	1	1	1	5	3	3
	ULNA	1	2	1	0	4	2	3
	FEMUR	1	0	0	0	1	0	4
	TIBIA	0	0	0	0	0	0	0
	FIBULA	0	1	1	0	1	1	2
	SHAFT UNIDENTIFIED	0	0	0	0	0	0	0

Table 73. Taphonomic modifications (GN=gnawing, WTH= weathering, EROS= erosion, AB= abrasion, STAIN= staining) identified on long bones across sites in south-west Wales. N=30.

Element completeness

- Complete hands/feet had mainly been impacted by erosive and abrasive processes with signs of weathering also been identified on more complete hands/feet (however in low numbers).
- Two sites (Nanna's Cave and Priory Farm Cave) are multi-period (Mesolithic, Bronze Age & Iron Age) and the overall assemblage has undoubtedly integrated observations on non-Neolithic human remains (see Chapter 4/Limitations and sampling selection).

STATE OF REMAINS	NO WTH	WTH STAGE 1	WTH STAGE 2	GN ABSENT	GN PRESENT	EROS ABSENT	EROS PRESENT	STAIN ABSENT	STAIN PRESENT	AB ABSENT	AB PRESENT
FRAGMETED	39	1	0	36	4	20	20	29	11	29	11
COMPLETE	58	5	1	62	2	34	30	54	10	36	28

Table 74. State of remains and taphonomic modifications (WTH= weathering, GN= gnawing, EROS= erosion, STAIN= staining, AB= abrasion) from bones of the hands/feet across south-west Wales. N=104.

MNI, demography and pathology

- Both dental (abscesses, possible ante-mortem tooth loss, calculus, caries and periapical cavities) (N=9) and degenerative pathologies with four lesions noted on cranial fragments (Little Hoyle Cave/SNOs: 119, 128, 132, and 136).

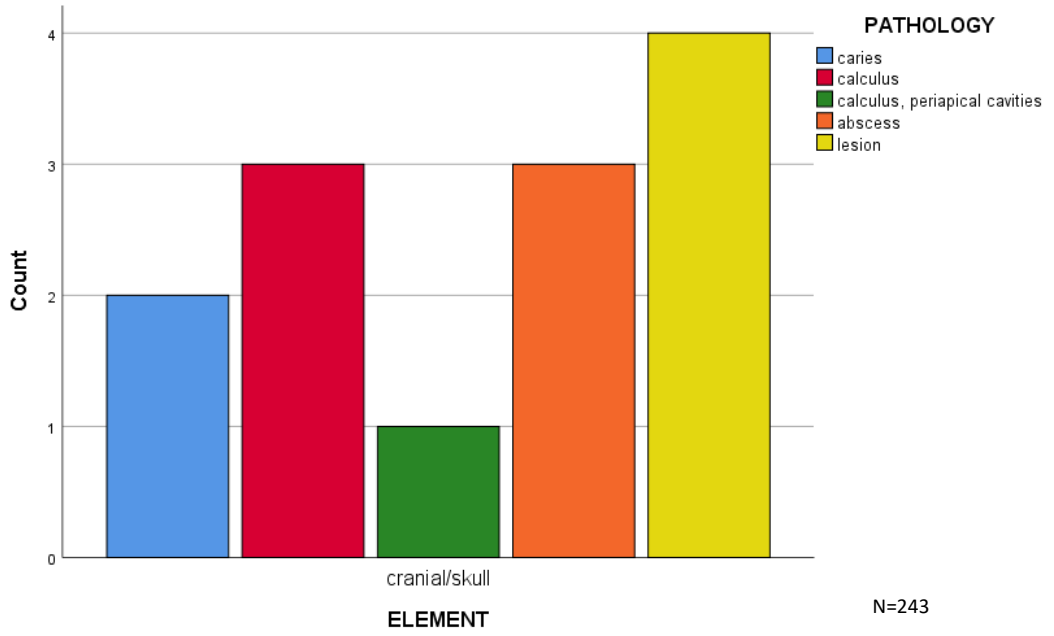


Figure 127. Evidence of pathology on disarticulated remains. N=excluding loose teeth.

- Dental pathologies (N=7) included calculus (majority) and caries (one single tooth and one probable case of caries). Pathological conditions therefore were mainly confined to dental issues.

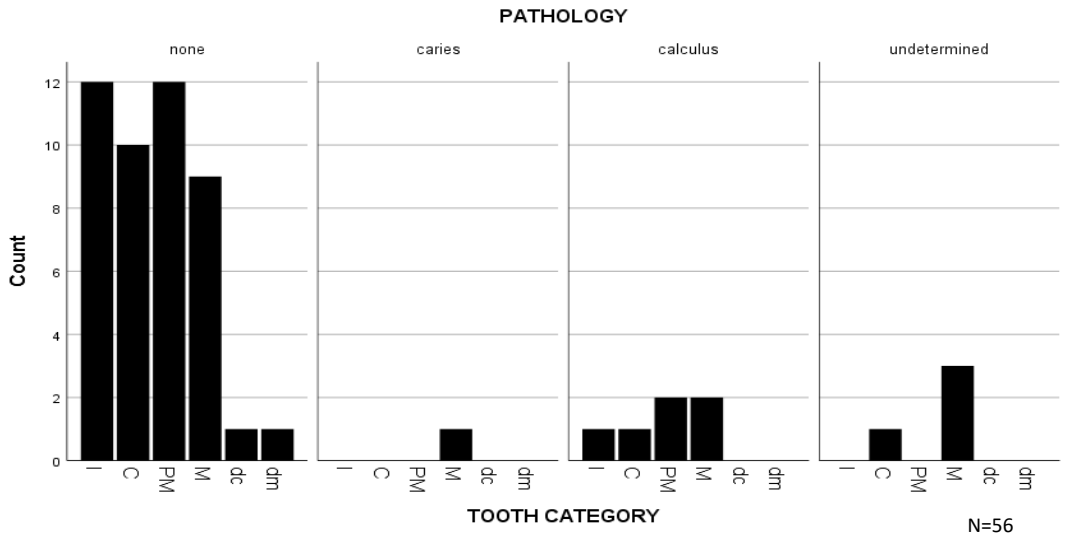


Figure 128. Dental pathologies (calculus/caries) identified on loose teeth across sites in south-west Wales. I= incisor, C= canine, PM= premolar, M= molar, dc= deciduous canine, dm= deciduous molar.

Taphonomy – Macroscopic results

Weathering

- Stage three weathering was observed on one mandible fragment from Little Hoyle Cave (SNO: 115) and a radius from Priory Farm Cave (SNO: 25). Priory Farm Cave comprises of a multi-period deposit (Middle Neolithic, Late Bronze Age and Middle/Late Iron Age) therefore no associations can be made as the radius has not been radiocarbon dated. Nonetheless, both elements support prolonged sub-aerial exposure prior to final deposition.

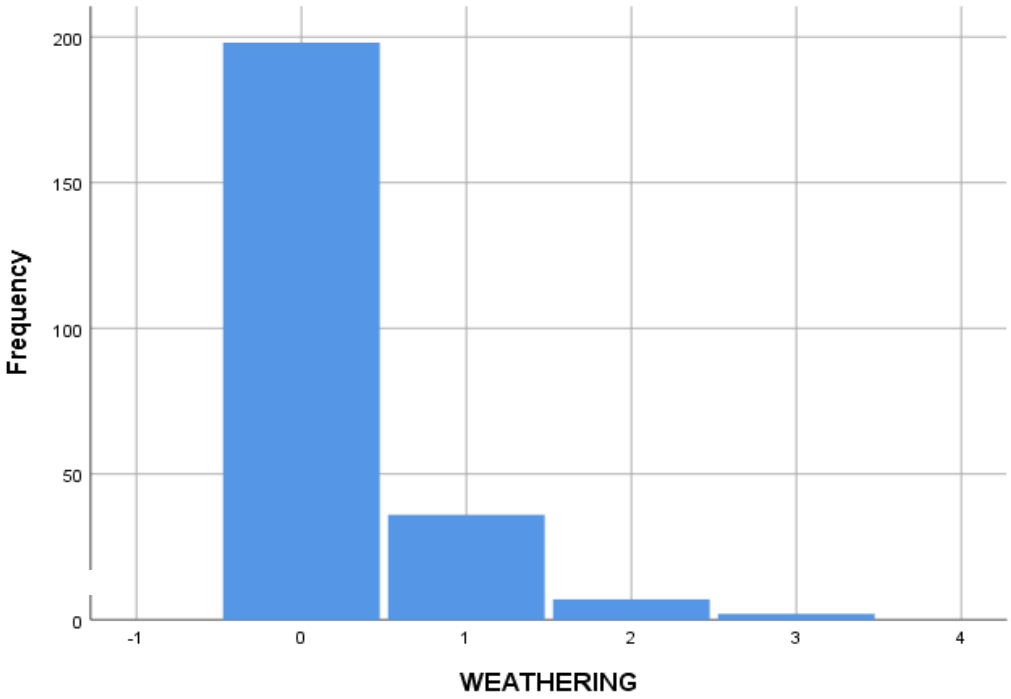


Figure 129. Frequency of weathered (stages 1-3) vs none weathered bones (stage 0) across south-west Wales.

- Gnawing marks were recorded on one weathered ulna (SNO: 23/Priory Farm Cave) reaching stage two with further evidence of staining, abrasion and good surface preservation (stage 4). However, due to the multi-period activity/burials recovered from this site (Middle Neolithic/Late BA and M/L IA), accurate results on the well-preserved weathered and gnawed ulna must be interpreted with caution.

WTH STAGE		EROSION		STAINING		ABRASION	
		ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
	1	9	27	10	26	21	15
	2	4	3	4	3	4	3
	3	2	0	0	2	1	1

Table 75. Weathering presence (stages 1-3) correlated with other taphonomic modifications. N=45 (only weathered elements).

- Overall, surface preservation of non-weathered elements was medium to good (stages 3 and 5/N=40 and 40 respectively) whereas weathered elements correlated with very low surface preservation scores (0) (Figure 97).

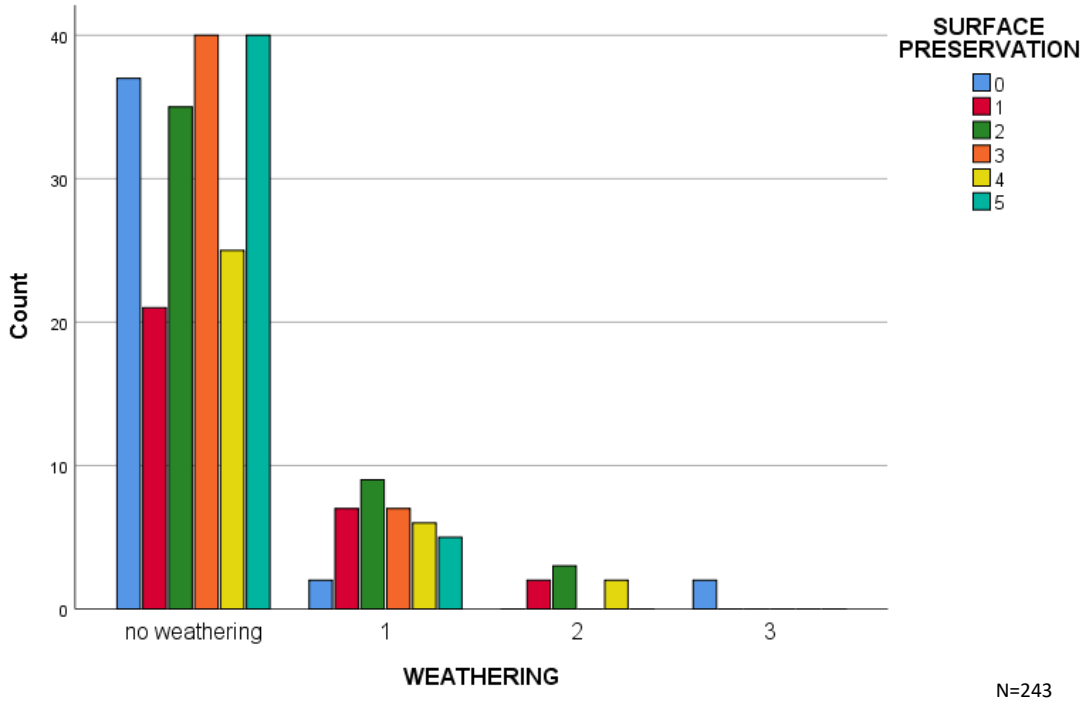


Figure 131. Weathering absence/presence (stages 1-3) based on surface preservation scores across sites in south-west Wales (0-5/poor-good).

Gnawing

- Gnawed elements (N= 3 long bones/6 hands/feet) derive from three separate contexts (Priory Farm's Cave, Hoyle's Mouth Cave, Little Hoyle Cave) and were primarily impacted by surface staining and abrasion. Surface preservation scores of these elements varied with those recovered from Priory Farm Cave

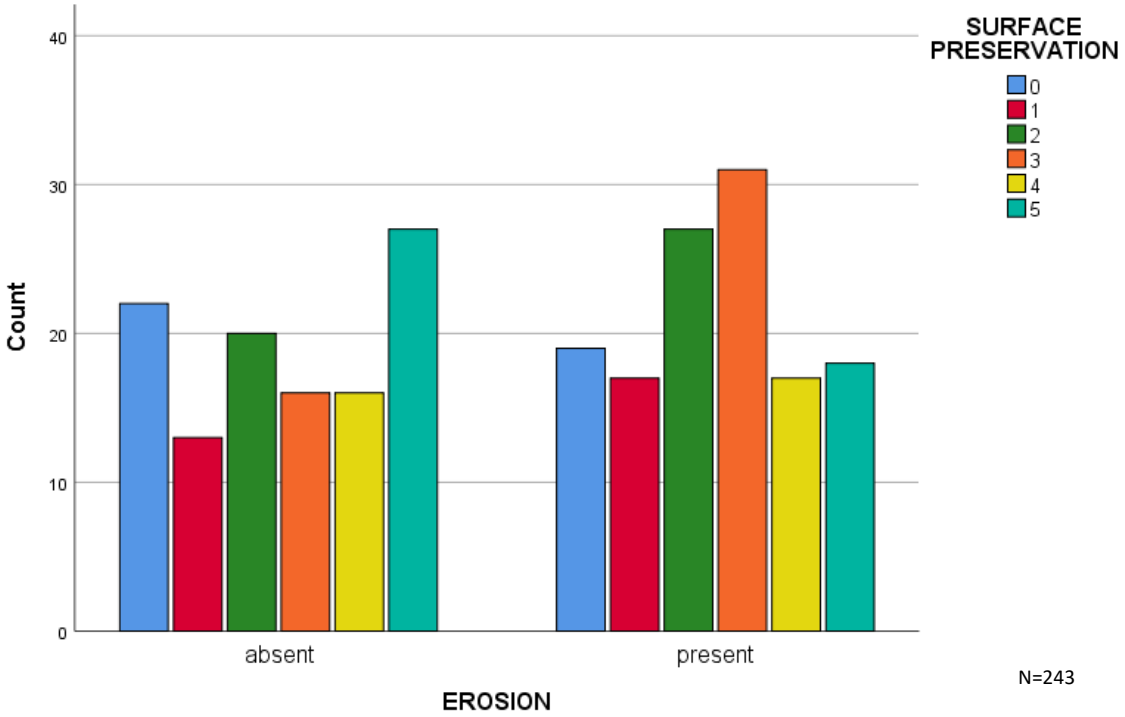
demonstrating very good surface preservation whereas lower scores were recorded primarily from Little Hoyle Cave and Hoyle's Mouth Cave.

- Gnawed elements were fragmented with two bones of the hands/feet (SNOs: 51, 167) demonstrating full zone completeness and one shaft (SNO: 20) exhibiting a fresh fracture on the proximal end and only. Evidence of modern damage on the gnawed shaft however, interfered with the history of fracture morphology whilst the distal end had been gnawed and no fracture pattern could be identified. As previously mentioned, Priory Farm Cave is a multi-period site and due to absence of secure stratigraphic information, interpretations on available remains must be made with caution.

Erosion

- Overall surface preservation between eroded and non-eroded human remains in south-west Wales demonstrated a fluctuation in scores. The majority of non-eroded remains had been well preserved (score 5) whilst the second most recorded surface preservation score was the lowest (score 0) (Figure 99). Differentiation in treatment between the individuals and exposure to different depositional environments possibly resulted in distinct surface preservation scores. Eroded remains nonetheless retained a more stable character with medium/poor surface preservation scores (2-3) demonstrating higher concentrations.

Figure 135. Surface preservation scores on eroded and non-eroded remains across sites in south-west Wales (0-5/poor-good).



- Other taphonomic modifications further impacting eroded remains included weathering (N=30), staining (N=55) and abrasion (N=46) (Table 78). A single eroded metatarsal (SNO: 73) and cranial fragment (SNO: 128) demonstrated signs of gnawing (metatarsal) and trampling (cranial). Erosion/root etching was recorded on a notable number of loose teeth (N=25) across sites with a few impacted by cave concretion, staining (N=9 respectively) and digestion (Nanna's Cave - SNO: 93/possible digestion with root etching and SNO 74/digested). These modifications might have occurred either due to exposure to these agents at different ratios (i.e. affecting only a number of loose teeth) or due to deposition in different parts of the caves (e.g. stalagmite/tufa residues on loose teeth – burial next to a cave wall).

	WTH STAGE 1	**WTH STAGE 2**	**WTH STAGE 3**	**STAINING ABSENT**	**STAINING PRESENT**	**ABRASION ABSENT**	**ABRASION PRESENT**
EROSION ABSENT	9	4	2	78	36	71	43
EROSION PRESENT	27	3	0	74	55	83	46

Table 76. Eroded and non-eroded remains across south-west Wales compared with other taphonomic modifications (WTH=weathering, staining and abrasion). N=243.

Abrasion

- A notable number of abraded elements were eroded (N=46) (Table 78) with weathering (N=19), staining (N=39), a few cases of gnawing (N=5) and trampling (SNO: 128) recorded (Table 79).

	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	STAINING ABSENT	STAINING PRESENT	GNAWING ABSENT	GNAWING PRESENT
ABRASION ABSENT	21	4	1	102	52	150	4
ABRASION PRESENT	15	3	1	50	39	84	5

Table 77. Abraded and non-abraded remains across south-west Wales correlated with other taphonomic modifications (WTH= weathering, staining and gnawing). N=243.

- Surface preservation scores on abraded remains were primarily high, with 24 elements surviving with very good surface preservation (score 5) and 22 showing medium surface preservation (score 3) (Figure 101).

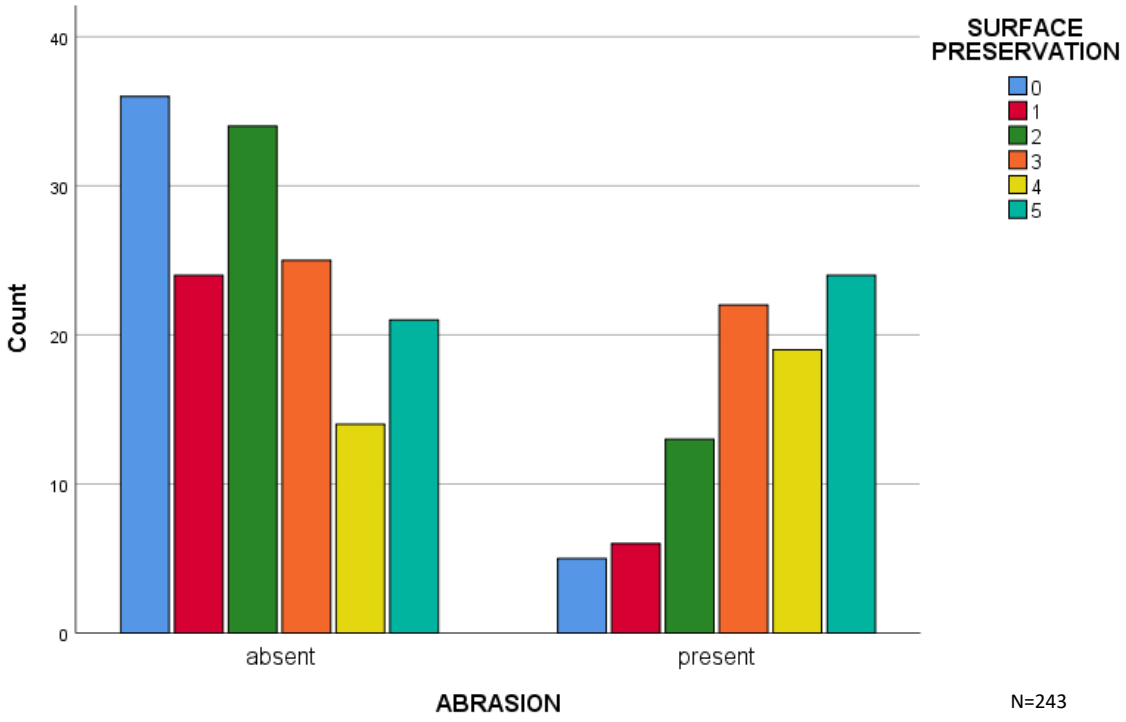


Figure 101. Surface preservation scores of abraded/non-abraded remains across sites in south-west Wales (0-5/poor-good).

- Presence of abrasion on weathered elements (with the majority reaching stage 1) shows correlations with better surface preservation from non-abraded weathered remains (Figure 102). Abrasion nonetheless will rarely be common in weathered, eroded or poorly preserved remains as these modifications lead to taphonomic overprinting.

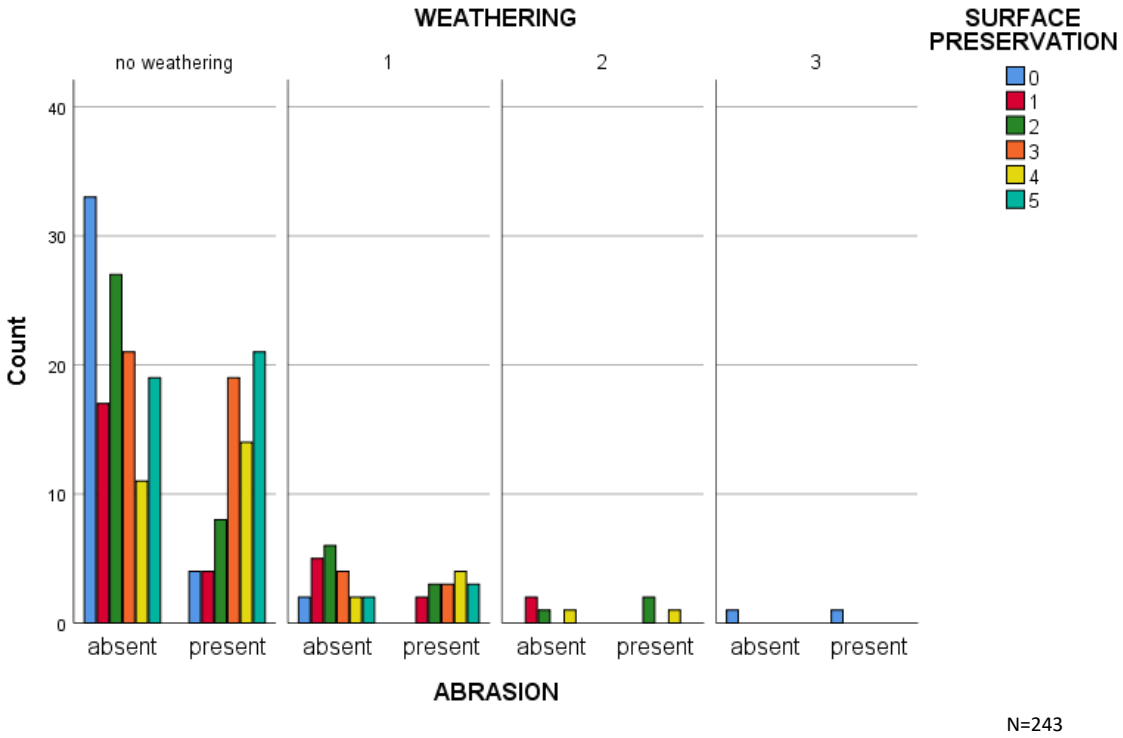


Figure 102. Weathering (stages 1-3) of abraded/non-abraded remains based on surface preservation scores across south-west Wales (0-5/poor-good).

Staining

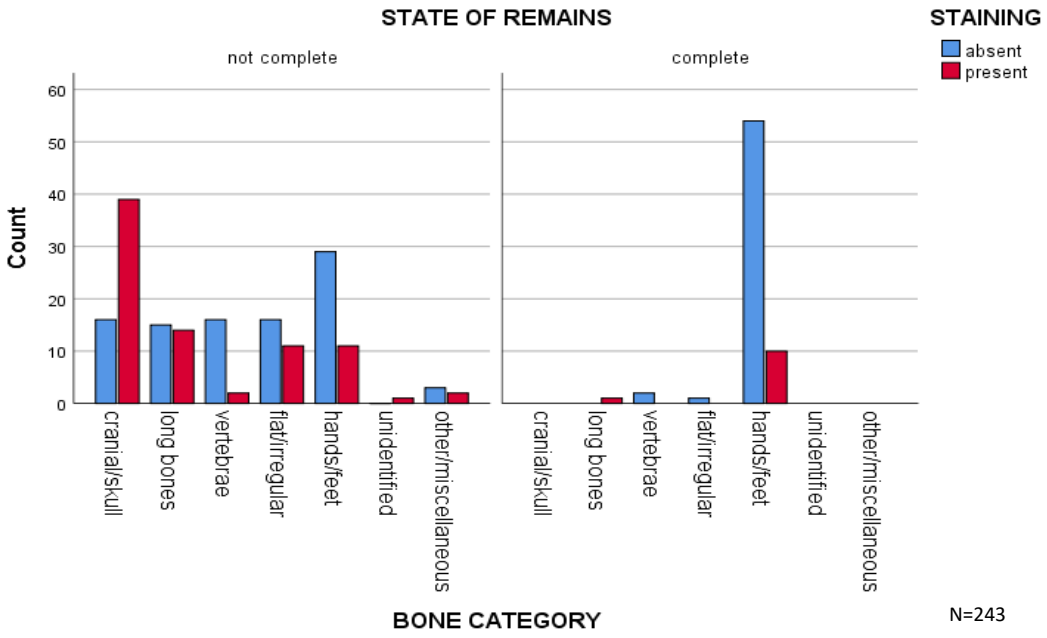


Figure 135. Staining presence/absence based on bone category and level of completeness across sites in south-west Wales.

- Surface preservation scores were almost equally recorded amongst stained bones whilst unstained elements demonstrated fluctuations in preservation (Figure 104). Other taphonomic modifications recorded on stained elements did not lead to further degradation (Table 80). A single vertebra fragment (SNO: 533/Nanna's Cave) with evidence of grey discolouration and a single metacarpal (SNO: 1386/ Ogof Brân Goesgoch) with green marks (from plants or soil) and slight concretion residues were further identified. Staining was further recorded on nine loose teeth whilst the majority had not been impacted by this modification. Exposure to different environments might have been the cause for presence/absence of staining.

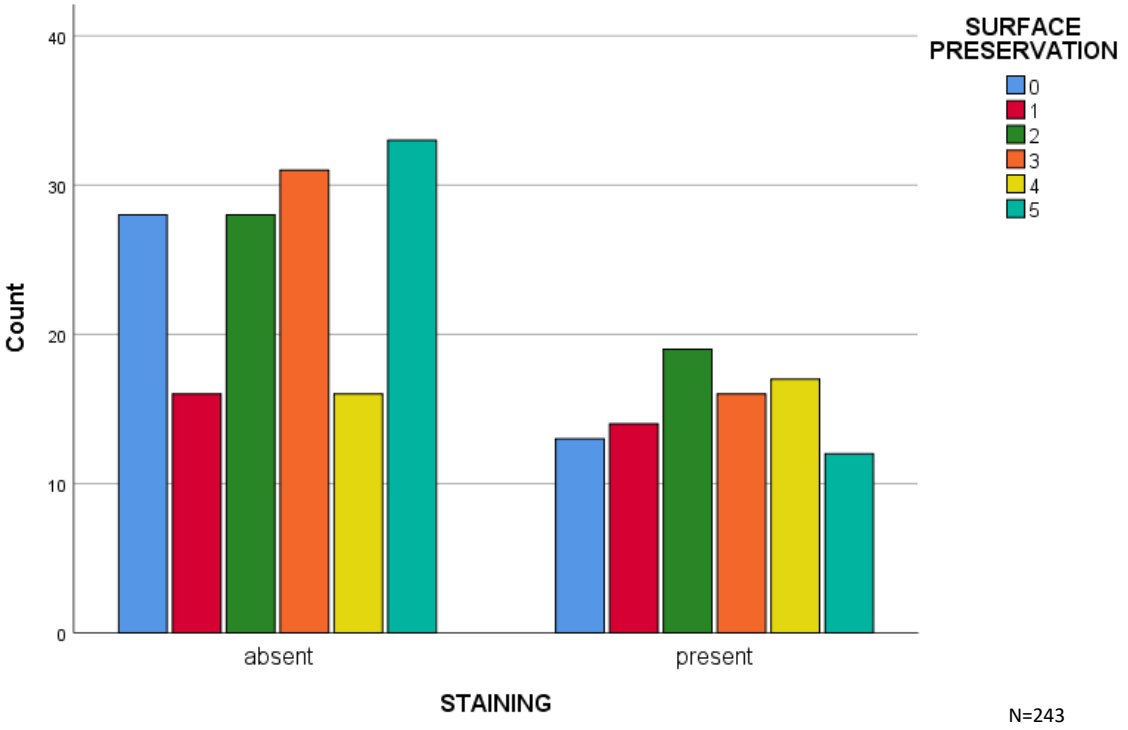


Figure 136. Staining absence/presence across south-west Wales based on surface preservation scores (0-5/poor-good)

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	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
STAINING ABSENT	78	74	102	50	148	4	10	4	0
STAINING PRESENT	36	55	52	39	86	5	26	3	2

Table 78. Staining presence/absence compared to other modifications (erosion, abrasion, gnawing and WTH=weathering) in south-west Wales.

Trauma (sharp/blunt force)

- Long bones (SNOs: 460, 462/ Nanna's Cave) were recovered from a stalagmite layer against the north wall of the cave (1976 excavation) which explains the presence of cave concretion/stalagmite residues. Based on new radiocarbon dating evidence (this thesis), Nanna's Cave was used for burial in the Mesolithic, therefore any associations must be made with caution. The fractured humerus might have derive from the same individual (based on the probable continuation of practice) which would further support intentional manipulation of bones followed by deposition in the cave.

Fractures (fresh vs dry)

- Fresh fractures demonstrated poor surface preservation (scores 2-0), however four long bones (SNOs: 20/24, 148/149) were very well preserved (scores 4 and 5 respectively). Dry breaks further demonstrated poor surface preservation (scores 1/2) although the elements' surface were not severely impacted by other modifications.
- Modern damage (Priory Farm Cave, Little Hoyle Cave) interfered with accurate recording of the fractures' morphology (mixture of breaks) on several occasions.
- Whilst the number of long bones across sites is not significant, fresh breaks were identified in four different sites (Priory Farm Cave, Little Hoyle Cave, Hoyle's Mouth Cave and Nanna's Cave). Further radiocarbon dating is required to verify whether the limbs exhibiting fresh breaks from Priory Farm Cave and the single freshly broken limb from Nanna's Cave are in fact Neolithic.
- Erosion, staining and abrasion had mostly affected long bones with fresh breaks compared to those exhibiting dry fractures whilst gnawing was recorded on a single long bone (SNO: 20/fresh fracture).

		WTH STAGE		EROSION	ABRASION	GNAWING	STAINING
		1	3				
FFI	DRY	0	0	1	1	0	2
	DRY (PROXIMAL &DISTAL)	0	0	1	0	0	1
	FRESH	2	1	6	3	1	5

Table 79. FFI correlated with taphonomic modifications across south-west Wales (WTH= weathering). N=30/only fractured long bones.

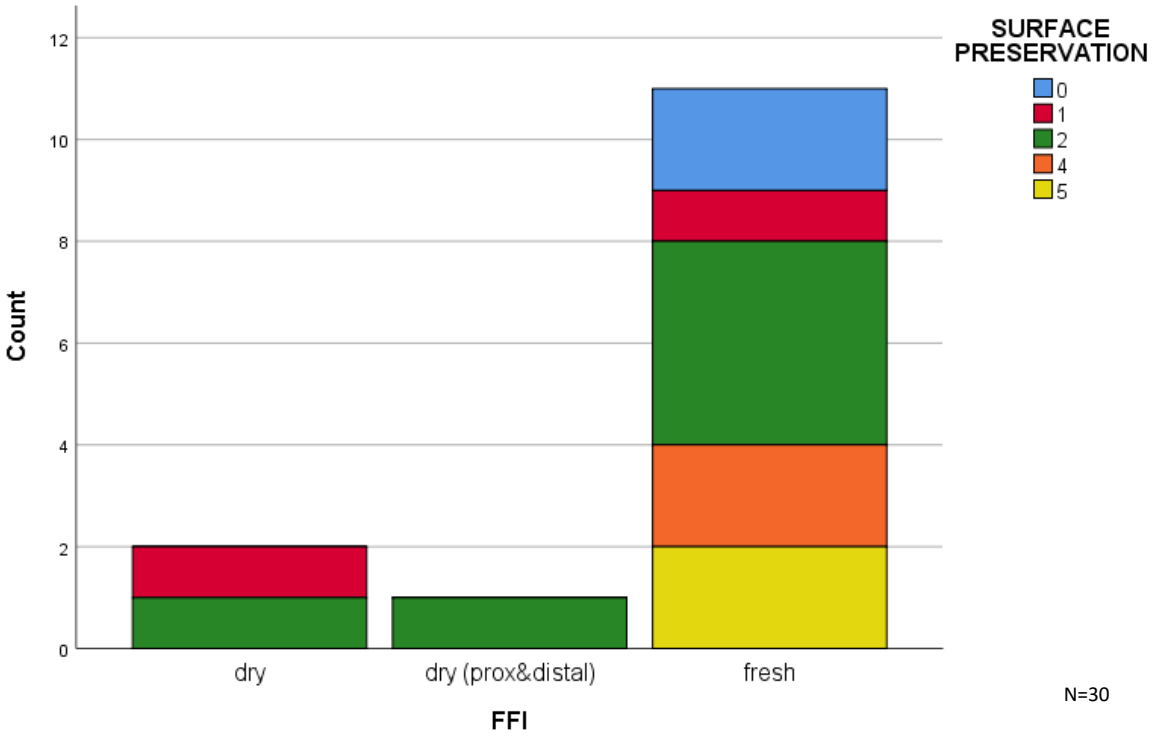

Figure 139. Fracture Freshness Index (FFI dry/fresh breaks) based on surface preservation scores across sites in south-west Wales. N=only fractured long bones (0-5/poor-good).

Surface preservation

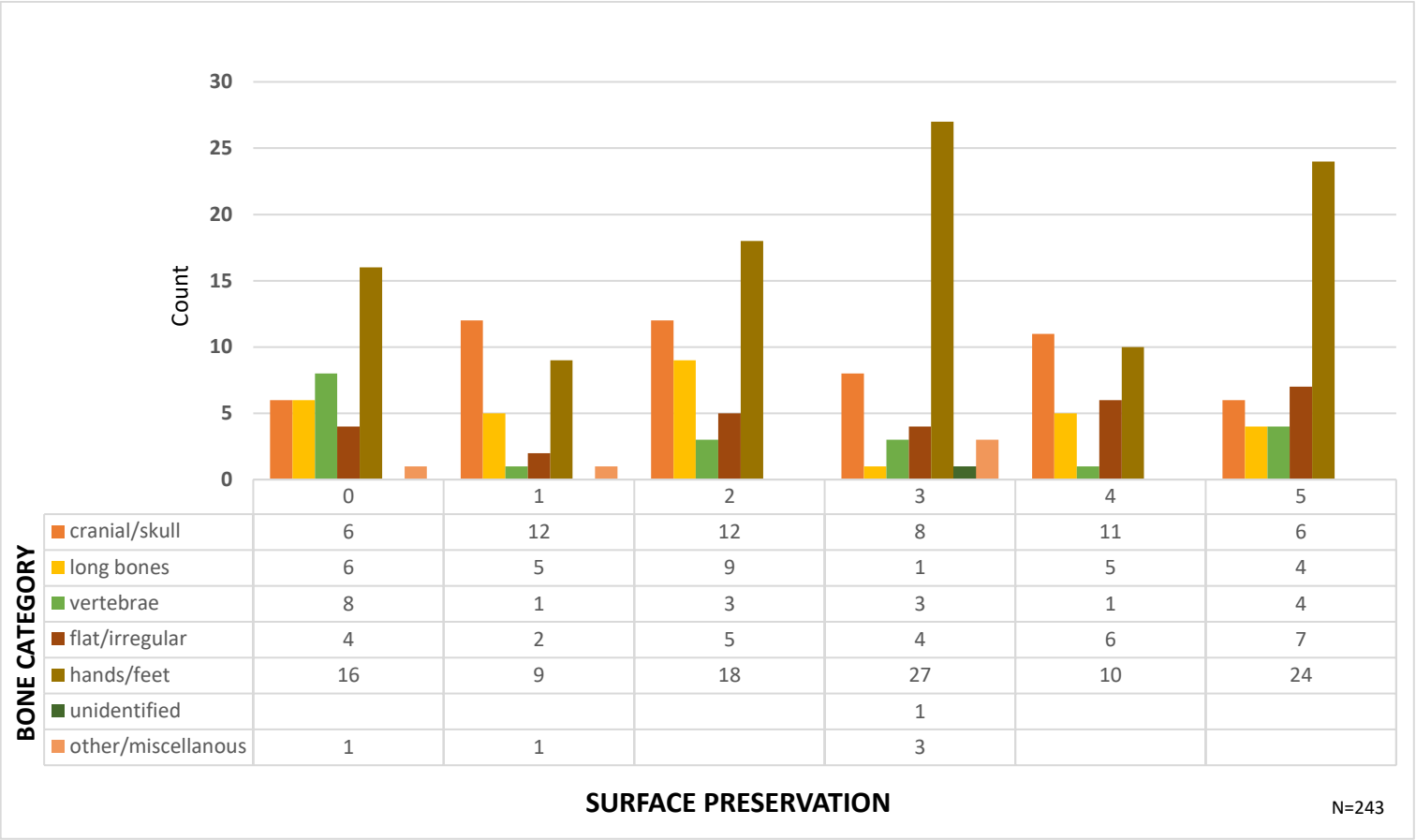

Figure 140. Frequencies of surface preservation scores in south-west Wales divided by bone type. Colour-coded with the order they are listed in the table (bone category) (0-5/poor-good).

Trampling

- Elements 128/497 (SNOs) were eroded with abrasion apparent on the cranial fragment further showing very good surface preservation (score 5). The metatarsal did not exhibit other evidence of surface taphonomy but was less well preserved (score 2). Both elements derive from separate assemblages with one deriving from a multi-period deposit (Nanna's Cave) which was disturbed from re-use of the site in the Middle Neolithic, and the second from an infilled shaft where sediment pressure and movement of interments occurred. Therefore, no patterns can be highlighted. Trampling marks were not often encountered in caves, however low presence of trampling across Wales (N=7) was exclusively noted on small elements which could support that practices, such as circulation of bones or selection of body parts for secondary deposition, might not have included smaller bones.

Microscopic results

- Ulna 54 (SNO/Ogof Garreg Hir) further scored high on the OHI scale (4) with signs of slight bacterial attack in places that however, did not interfere with the overall preservation of the microstructure. Ulna 54 demonstrated the highest birefringence score (3) amongst samples from south-west Wales and was similarly infiltrated with extraneous material. No patterns were noted as to why the mandible with a higher OHI score from Little Hoyle Cave showed collagen loss compared to the less preserved ulna from Ogof Garreg Hir.

SITE	OHI	AT	INCL INTENS	INCL COLOUR	INFIL INTENS	INFIL COLOUR	STAIN COLOUR	CRACK& INTENS	BIREFR
LITTLE HOYLE CAVE (SNO: 2)	5	NW	2	black/brown	1	brown - dark, fair	brown – orange	present (1)	2

Table 80. Sample from Little Hoyle Cave with very good histological preservation (OHI Score 5). Attack (AT), non-Wedl (NW), inclusion (Incl)/infiltration (Infil) intensity (Intens), staining (Stain) discolouration, cracking/microfissures intensity (Crack & Intens) and birefringence scores (1=low, 2=medium)

- Half the samples showed weathering (stage one) and were impacted by abrasive forces (N=9, 50%). Two long bones (SNOs: 14-15) further exhibited fractures (dry and fresh respectively) whilst surface preservation scores amongst samples were largely medium/poor (scores 2 and 3/N=6, 33% and N=4/22%).
- Other parameters such as intense wetting/drying conditions, change of depositional environments or endogenous bacterial attack might have played a more definitive role in the loss of birefringence.
- Low intensity weathering (stage 1) might not be as pivotal a parameter of collagen loss compared to prolonged weathering (e.g. long bones from Spurge Hole/weathering stage 3) which causes severe splitting of the surface and high demineralization of the bone. The microstructure of the single Neolithic mandible sampled from Priory Farm Cave had been destroyed by MFD (OHI score 1/linear longitudinal, budded and lamellate MFD), inhibited by extraneous material, staining, microcracking and demonstrated poor surface preservation (stage 1). No pattern was observed however it appears that the taphonomic trajectory of the aforementioned element follows a similar pattern to most elements from Little Hoyle Cave which involved full articulation of the individuals with enteric gut bacteria attacking the microstructure of the bone.

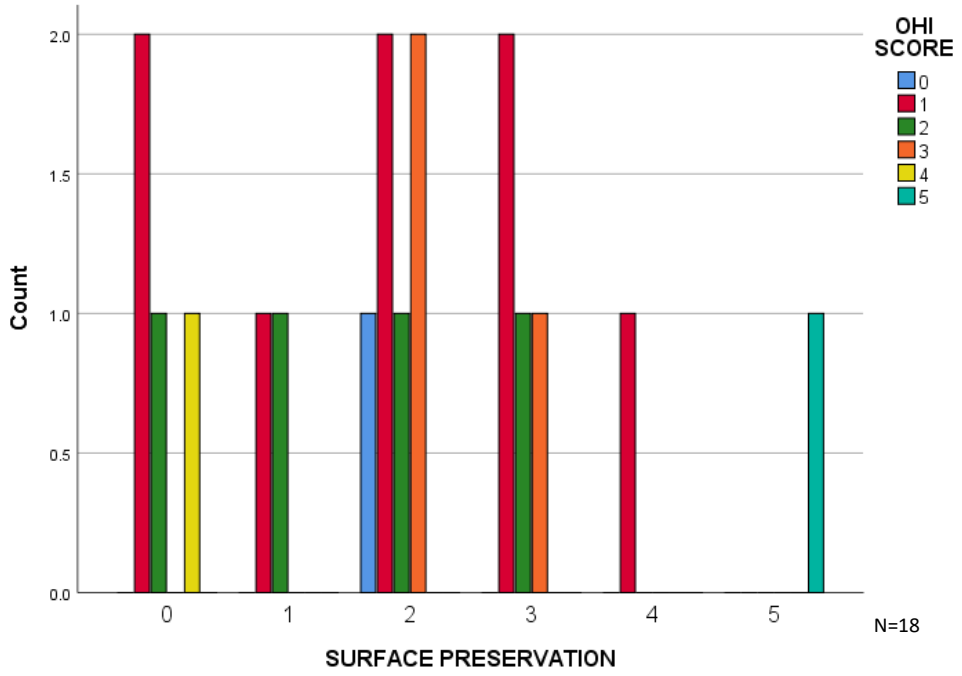

Figure 144. Surface preservation scores correlated with OHI scores from samples in south-west Wales (0-5/poor-good).

- Microstructural staining was observed in all samples under both normal and polar light. Loss of birefringence and low OHI scores were therefore not solely accompanied by microstructural staining as observed in overall results across sites and in samples from south-central Wales and therefore no pattern that correlates with loss of birefringence and microstructural staining is evident.

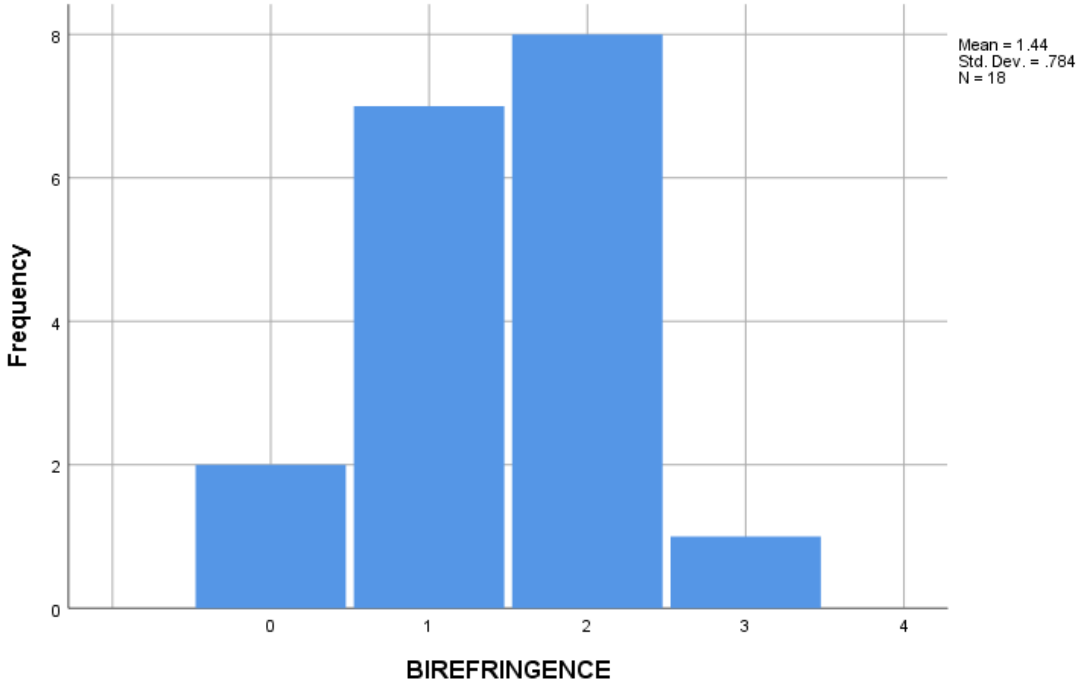

Figure 145. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium) from Little Hoyle Cave and Priory Farm Cave (south-west Wales).

OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/ MICROFISSURES
0	1	1	1	0
1	8	8	8	4
2	4	4	4	4
3	3	3	3	3
4	1	1	1	1
5	1	1	1	1

Table 83. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=18.

- Intensity patterns were primarily low to medium whilst four elements with low OHI scores did not exhibit any signs of microcracking (Table 85). Inclusion and infiltration colour indicated similarities (ranging from black/brown to

brown/dark or fair) with one mandible (SNO: 7) exhibiting a grey inclusion and a different mandible (SNO: 5) orange/brown infiltrations.

- Microstructural staining ranged from brown (fair/dark) to brown/orange and orange/red. One mandible (Priory Farm Cave, SNO: 45) exhibited intense red staining/marks, possibly resulting from a fungal fruiting body. Similar stains were identified on four other samples (SNOs: 18, 28, 43, 63) from four separate sites (Ifton Quarry, Spurge Hole, Gop Cave, Backwell Cave) and no particular patterns were identified. Sampled elements included cranial, mandible and long bones, OHI scores were low with one radius (Spurge Hole/SNO: 28) scoring high. Infiltrations, inclusions and microstructural staining were present on most aforementioned samples (SNO 43/no staining identified).

OHI SCORE		INCLUSION INTENSITY			INFILTRATION INTENSITY			CRACKING INTENSITY			
		1	**2**	**3**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		LOW	**MEDIUM**	**HIGH**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**
	0	1	0	0	1	0	0	1	0	0	0
	1	6	2	0	4	3	1	4	3	0	1
	2	3	0	1	2	1	1	0	1	0	3
	3	1	1	1	2	1	0	0	1	1	1
	4	0	1	0	0	0	1	0	0	0	1
	5	0	1	0	0	0	1	0	1	0	0

Table 82. Inclusion, infiltration, cracking intensities (0-3) and associations with OHI scores. N=18.

OHI SCORE	STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)	MICROCRACKING & SURFACE EROSION	MICROCRACKING & WEATHERING (STAGE 1)
OHI 0	1	0	0
OHI 1	7	3	4
OHI 2	3	2	2
OHI 3	3	2	2
OHI 4	1	1	1
OHI 5	0	1	0

Table 84. Stained samples (surface and microstructural staining), eroded (surface) with evidence of microcracking, weathered (surface) with evidence of microcracking. Total N=1

6.6. North Wales

Frequency of skeletal elements

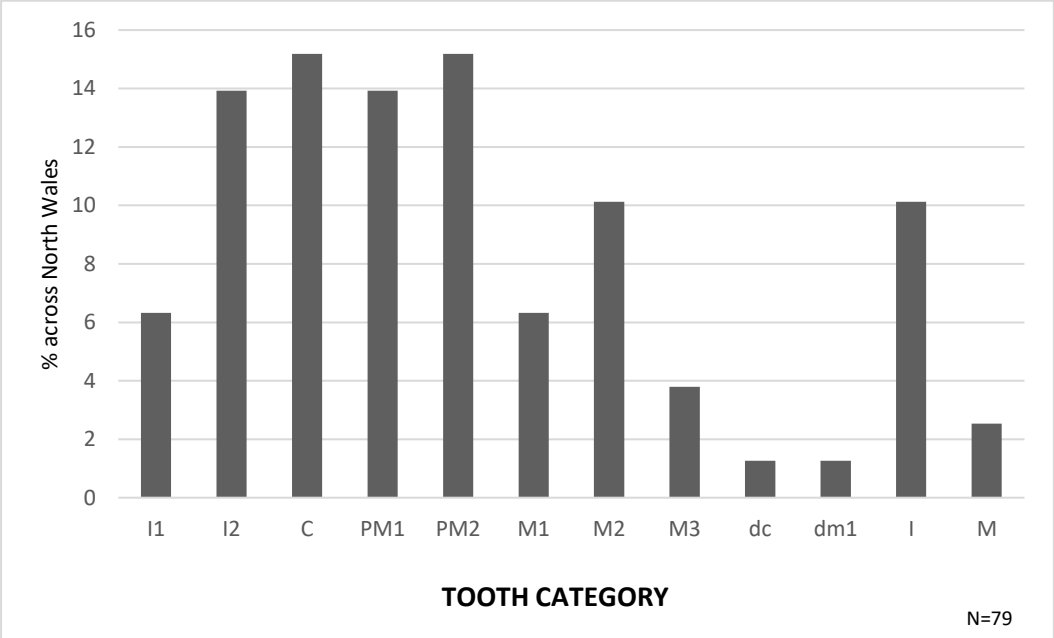

Figure 148. Frequency of loose teeth recorded in north Wales. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dc= deciduous canine, dm1= deciduous 1st molar, I= incisor, PM= premolar, M= molar. I (N=8) and M (N=2): no identification of exact tooth.

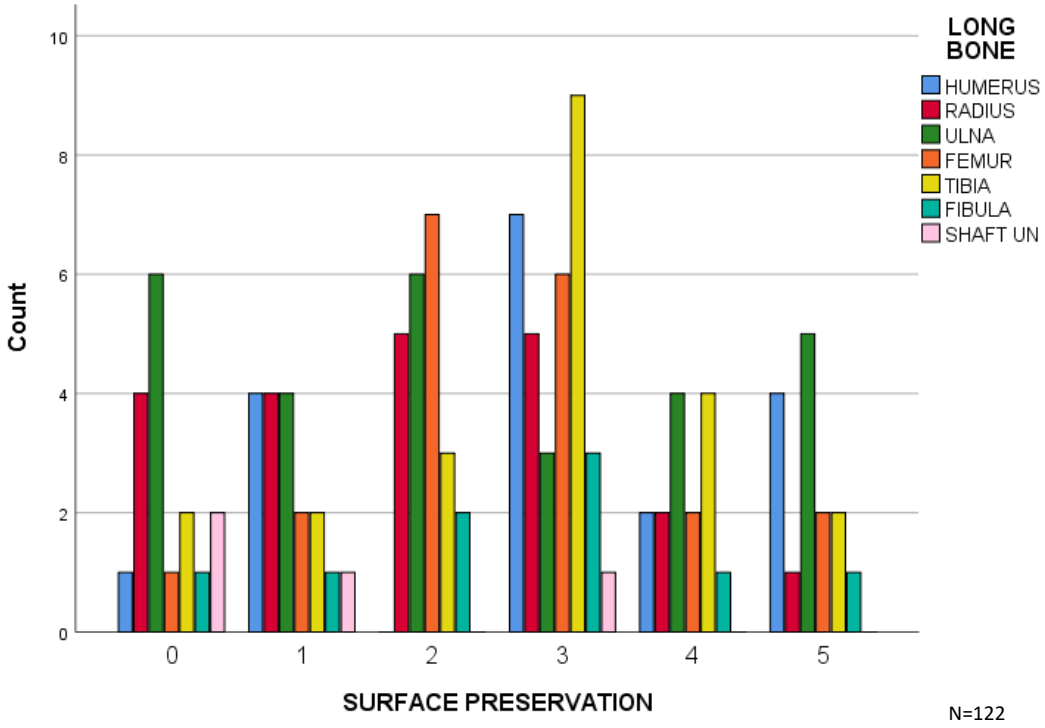

Figure 149. Surface scores based on long bone representation in north Wales. N= excluding Little Orme's Head Quarry/secondary data – unknown surface preservation.

- Staining was further recorded on the vast majority of long bones (N=93) with abrasion and gnawing were present on a lower number of limbs (N=45 and 41 respectively). The level of disturbances in sites from north Wales must therefore have been significant.
- Two humeri (SNOs: 543, 686) displayed evidence of sharp force trauma; A (peri-mortem) percussion mark on humerus 543 (Gop Cave) appeared to have been interrupted by weathering (stage 1) and a (later-resulting) dry fracture whilst humerus 686 (Ogof Colomendy) exhibited a peri-mortem cutmark under the femoral head. Both humeri were handled at an early stage (prior to burial) with either subsequent sub-aerial exposure or deposition close to the entrance of the caves resulting in weathering.

LONG BONE	GN	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4	AB	STAIN
HUMERUS	5	3	2	0	1	9	12
RADIUS	4	2	0	0	0	8	19
ULNA	11	5	0	0	0	10	22
FEMUR	13	2	0	1	0	7	15
TIBIA	7	2	0	2	0	5	18
FIBULA	1	0	0	0	0	3	5
SHAFT UN	0	0	0	0	0	3	2

Table 87. Taphonomic modifications (GN=gnawing, WTH= weathering, AB= abrasion, STAIN= staining) identified on long bones across sites in north Wales. N= 122 excluding Little Orme's Head Quarry (secondary data/unknown taphonomy).

Element completeness

- Surface preservation amongst fragmented elements demonstrated that most scored medium to low (3-0). Surface preservation of flat/irregular bones (N=164) in particular fluctuated between one (N=41) and three (N=41).

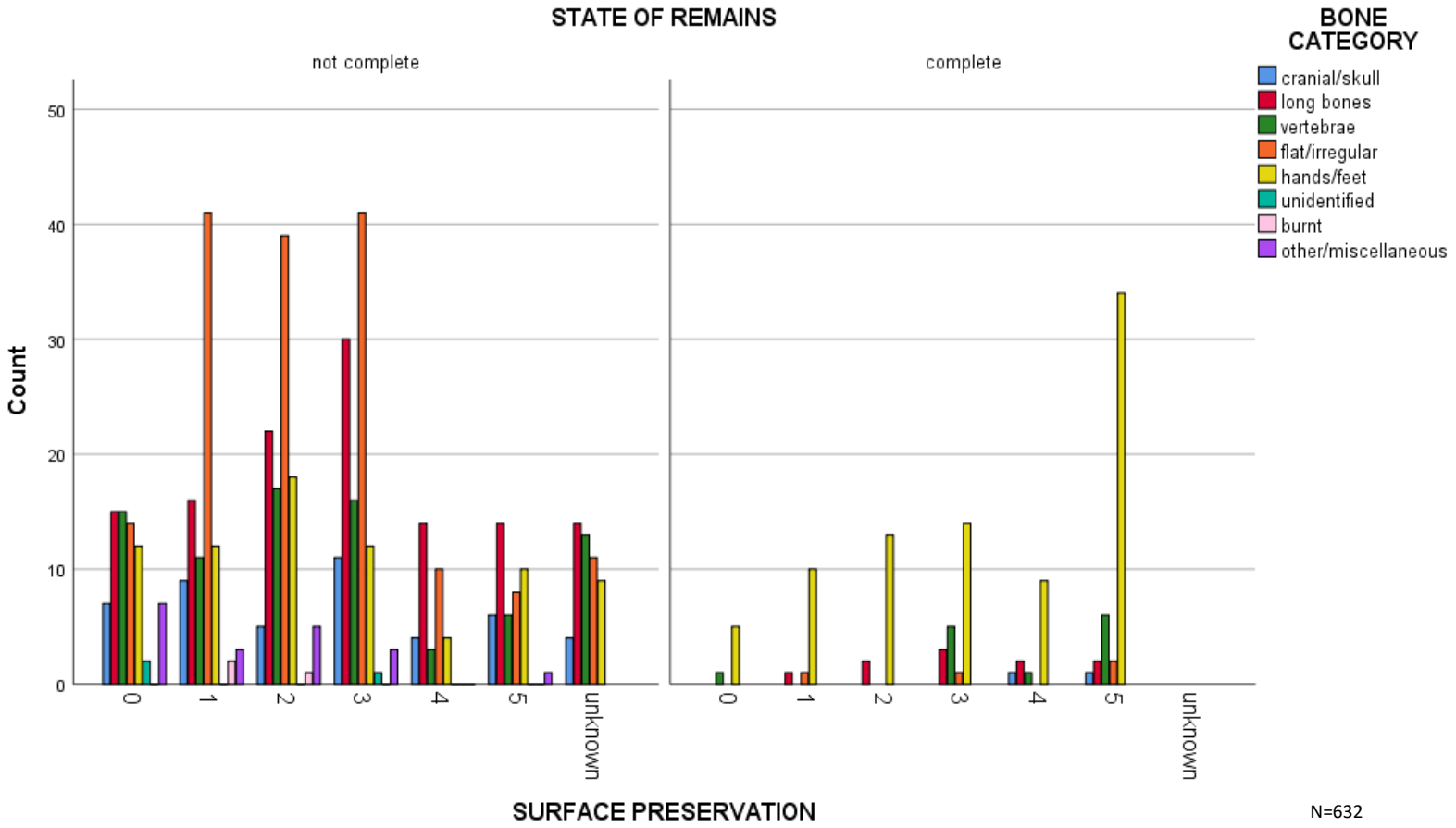

Figure 150. State or remains (complete vs fragmented/not complete) across sites in north Wales based on bone category and surface preservation. N=excluding loose teeth. Unknown= Little Orme's Head Quarry assemblage (N=51)/unknown surface preservation (secondary data)

- Fragmented flat/irregular bones that demonstrated scores ranging from one to three in high frequencies, displayed signs of weathering (N=21), staining (N=127) and erosion (N=108) which affected the overall surface preservation of bones more severely than flat/irregular bones with full zone completeness.

STATE OF REMAINS	**NO WEATHERING**	**WEATHERING STAGE 1**	**WEATHERING STAGE 2**	**WEATHERING STAGE 3**
FRAGMENTED	132	17	3	1
SURFACE PRESERVATION SCORE 0	12	1	0	1
SURFACE PRESERVATION SCORE 1	36	4	1	0
SURFACE PRESERVATION SCORE 2	32	6	1	0
SURFACE PRESERVATION SCORE 3	35	5	1	0
SURFACE PRESERVATION SCORE 4	9	1	0	0
SURFACE PRESERVATION SCORE 5	8	0	0	0
COMPLETE	4	0	0	0
	STAINING ABSENT	STAINING PRESENT		
FRAGMENTED	26	127		
SURFACE PRESERVATION SCORE 0	2	12		
SURFACE PRESERVATION SCORE 1	2	39		
SURFACE PRESERVATION SCORE 2	4	35		

SURFACE PRESERVATION SCORE 3	10	31		
SURFACE PRESERVATION SCORE 4	2	8		
SURFACE PRESERVATION SCORE 5	6	2		
COMPLETE	3	1		
	EROSION ABSENT	EROSION PRESENT		
FRAGMENTED	45	108		
SURFACE PRESERVATION SCORE 0	7	7		
SURFACE PRESERVATION SCORE 1	9	32		
SURFACE PRESERVATION SCORE 2	17	22		
SURFACE PRESERVATION SCORE 3	7	34		
SURFACE PRESERVATION SCORE 4	2	8		
SURFACE PRESERVATION SCORE 5	3	5		
COMPLETE	**4**	**0**		

Table 88. State of remains and surface preservation scores (0-5/poor-good) cross-referenced with taphonomic modifications from flat/irregular across north Wales. N=153 (excluding Little Orme's Head Quarry/secondary data – unknown taphonomy analysed in this table).

- A higher number of hands/feet (Total N=162) demonstrated full zone completeness (N=85) with the majority of completed bones indicating very high surface preservation (score 5/N=44). Abrasive and erosive processes (Tables 91-2) affected complete hands/feet more severely compared to fragmented extremities. Evidence of gnawing was similarly more frequent on complete hands/feet (Table 91). This pattern suggests smaller elements that disarticulate from the body rapidly were possibly less affected by constant movements (compared to larger elements). Smaller elements with full zone completeness subsequently remained undisturbed or were buried deeper in the cav. These

elements were impacted by abrasion and erosion more severely than those undergoing constant movements (e.g. large disturbances at Ogof Colomendy).

STATE OF REMAINS	NO WTH	WTH STAGE 1	WTH STAGE 2	GN ABSENT	GN PRESENT	STAIN ABSENT	STAIN PRESENT	AB ABSENT	AB PRESENT
FRAGMETED	61	7	0	63	5	22	46	32	36
COMPLETE	80	4	1	78	7	41	44	22	63

Table 89. State of remains and taphonomic modifications (WTH= weathering, GN= gnawing, STAIN= staining, AB= abrasion) from bones of the hands/feet across north Wales. N=153 (excluding Little Orme's Head Quarry/secondary data – unknown taphonomy).

STATE OF REMAINS	EROS ABSENT	EROS PRESENT
FRAGMETED	42	35
COMPLETE	39	46

Table 90. State of remains cross-referenced with erosion (EROS) absence/presence from bones of the hands/feet across north Wales. N=162 (including Little Orme's Head Quarry – secondary data/erosion presence recorded).

MNI, demography and pathology

- Degenerative changes were largely identified on elements recovered from Little Orme's Head Quarry that derived from a single individual (adult/female). The extensive evidence of degenerative changes therefore does not reflect the overall pattern across sites in Wales (See Appendix 5/Site Backgrounds).
- Dental pathologies were further recorded on a low number of loose teeth (N=7) including caries (N=1), calculus (N=6) and two unidentified (probable calculus or cave concretion SNOs: 182/183).

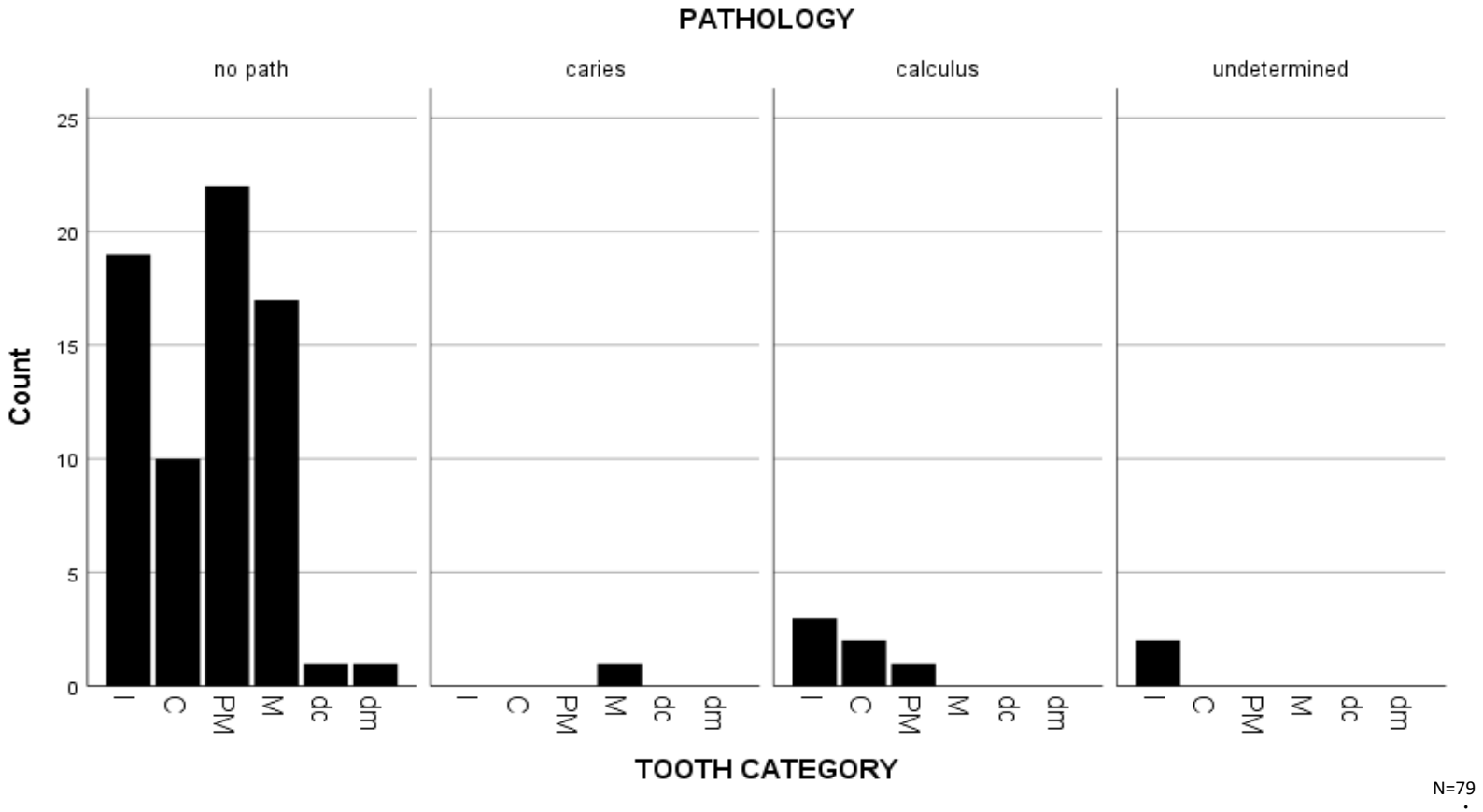

Figure 151. Dental pathologies (calculus/caries) identified on loose teeth in north Wales. I= incisor, C= canine, PM= premolar, M= molar, dc= deciduous canine, dm= deciduous molar

Taphonomy – Macroscopic results

Weathering

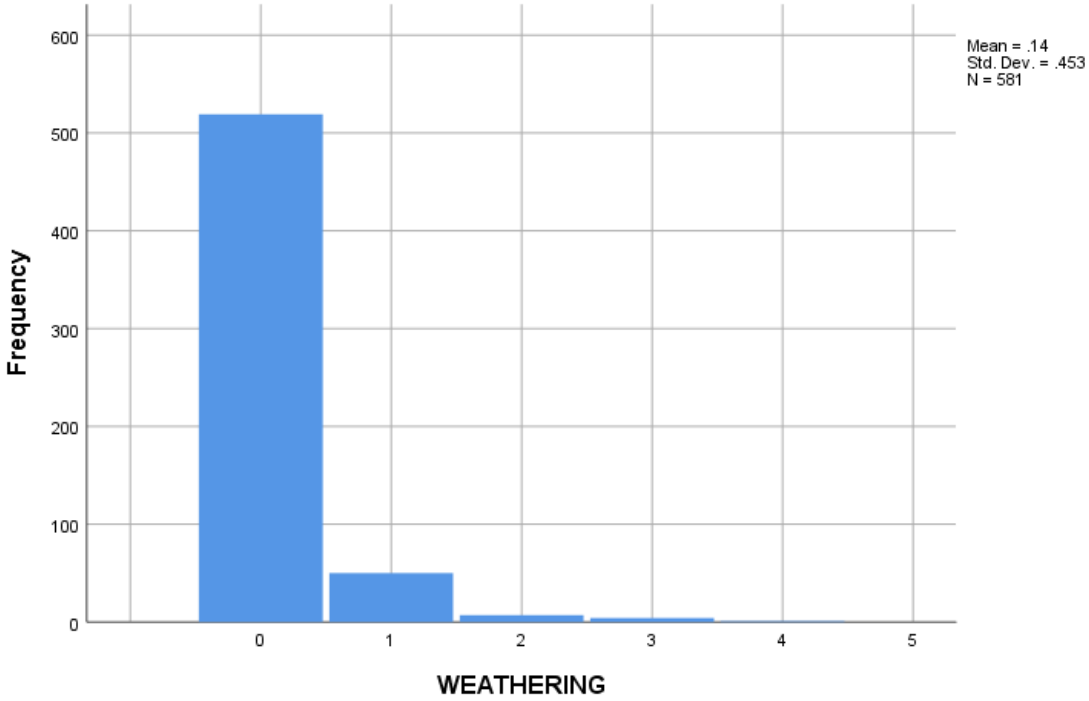

Figure 152. Weathering scores 0 to 5 (0= no weathering) across north Wales. N= excluding human remains from Little Orme's Head quarry (no primary analysis).

- Affected elements that primarily reached weathering stage one, demonstrated further signs of erosion, staining and abrasion.

WTH STAGE		EROSION		STAINING		ABRASION	
		ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
	1	14	36	5	45	17	33
	2	4	3	1	6	3	4
	3	3	1	1	3	4	0
	4	1	0	0	1	1	0

Table 91. Weathering (WTH) stages 1-4 correlated with other taphonomic modifications. N=581 (excluding Little Orme's Head Quarry/unknown modifications).

- Overall surface preservation scores on weathered elements was medium to poor (scores 3/2) which could indicate the severity of other taphonomic agents on weathered elements. Four elements demonstrated very good surface preservation (score 5/SNOs: 10, 447, 553 and 679).
- Evidence of gnawing (SNOs: 553, 679), erosion/staining (SNOs: 447, 553, 679) and abrasion (SNOs: 10, 447, 553) did not severely affect well-preserved elements from Pontnewydd Cave, Orchid Cave, Gop Cave and Ogof Colomendy. Their good surface preservation could indicate that short-subaerial exposure or deposition in cave entrances was not followed by ongoing disturbances (e.g. gnawing). However, these elements present a minority amongst weathered bones.

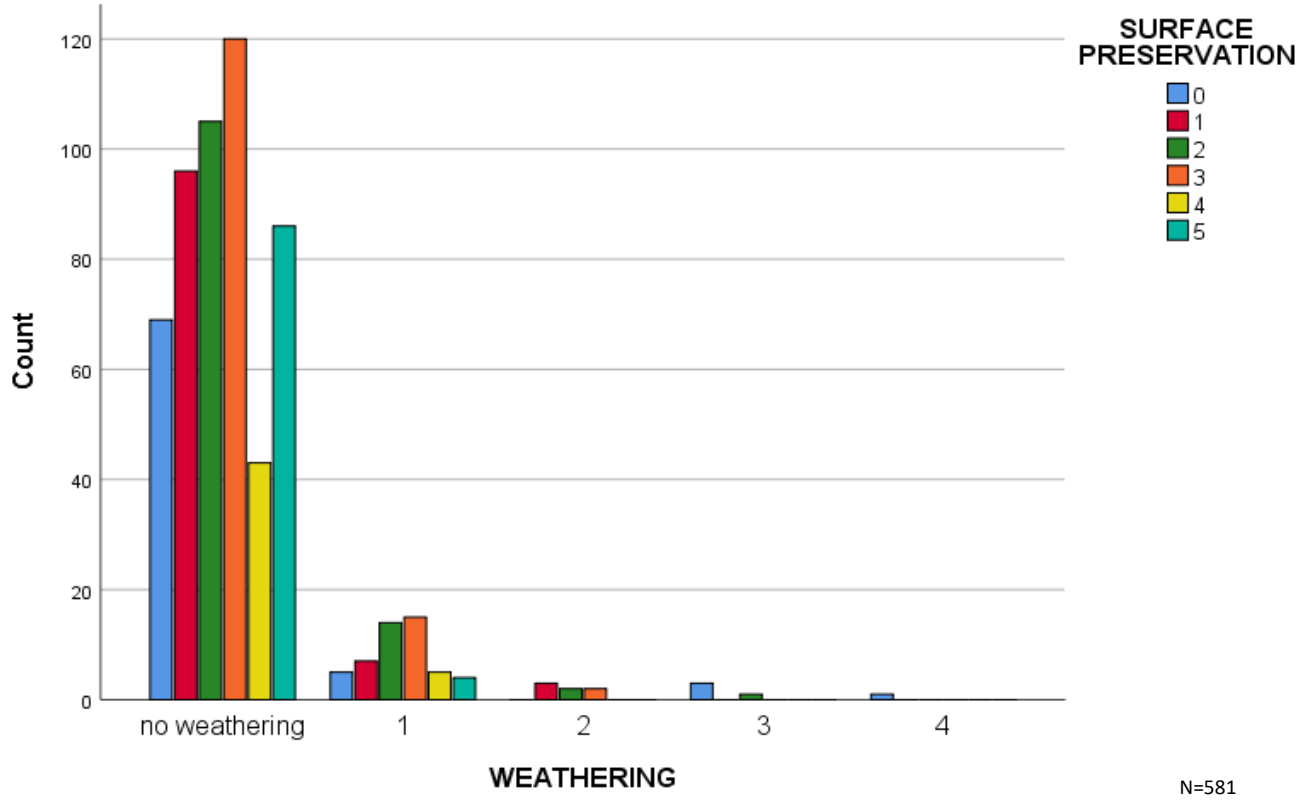

Figure 155. Weathering absence/presence (stages 1-4) based on surface preservation scores across sites in north Wales (excluding Little Orme's Head Quarry/unknown surface preservation) (0-5/poor-good).

Gnawing

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT
GNAWING ABSENT	256	266	180	342	280	242
GNAWING PRESENT	**28**	**31**	**13**	**46**	**37**	**22**

Table 92. Gnawing absence/presence cross-referenced with other taphonomic modifications. N=581 (excluding Little Orme's Head Quarry).

Erosion

- Gnawing (N=59) was almost equally observed on both eroded (N=31) and non-eroded (N=28) human remains, suggesting that scavenger activity could have affected the remains either prior to deposition in the caves (e.g. during sub-aerial exposure) or whilst remains were deposited in the caves (if taphonomic re-elaborations did occur). Presence of weathering and gnawing on eroded remains could further support this hypothesis with remains being handled differently (i.e. sub-aerial exposure) and burials in caves comprising of a series of practices.
- Evidence of erosion, concretion (N=24 respectively) and staining (N=16) was observed on a low number of loose teeth. Similarly to surviving loose teeth from south-west Wales, these modifications might have occurred either due to exposure to these agents at different degrees (i.e. affecting only a number of loose teeth) or due to deposition in different parts of the caves (e.g. stalagmite/tufa residues on loose teeth – burial next to a cave wall).

	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4	GN ABSENT	GN PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT
EROSION ABSENT	14	4	3	1	256	28	118	166	185	99
EROSION PRESENT	36	3	1	0	266	31	75	222	132	165

Table 93. Eroded and non-eroded remains across north Wales compared with other taphonomic modifications (WTH=weathering, GN=gnawing, staining and abrasion). N=581 (excluding Little Orme's Head Quarry/no primary analysis, unknown surface modifications).

- The vast majority of eroded remains demonstrated medium to poor surface preservation scores (3-1) whereas non-eroded elements demonstrated similar distributions between low and medium scores (0/5) (Figure 125/Appendices). This pattern could further support differentiations in treatment and separate depositions with remains being impacted to different extents.

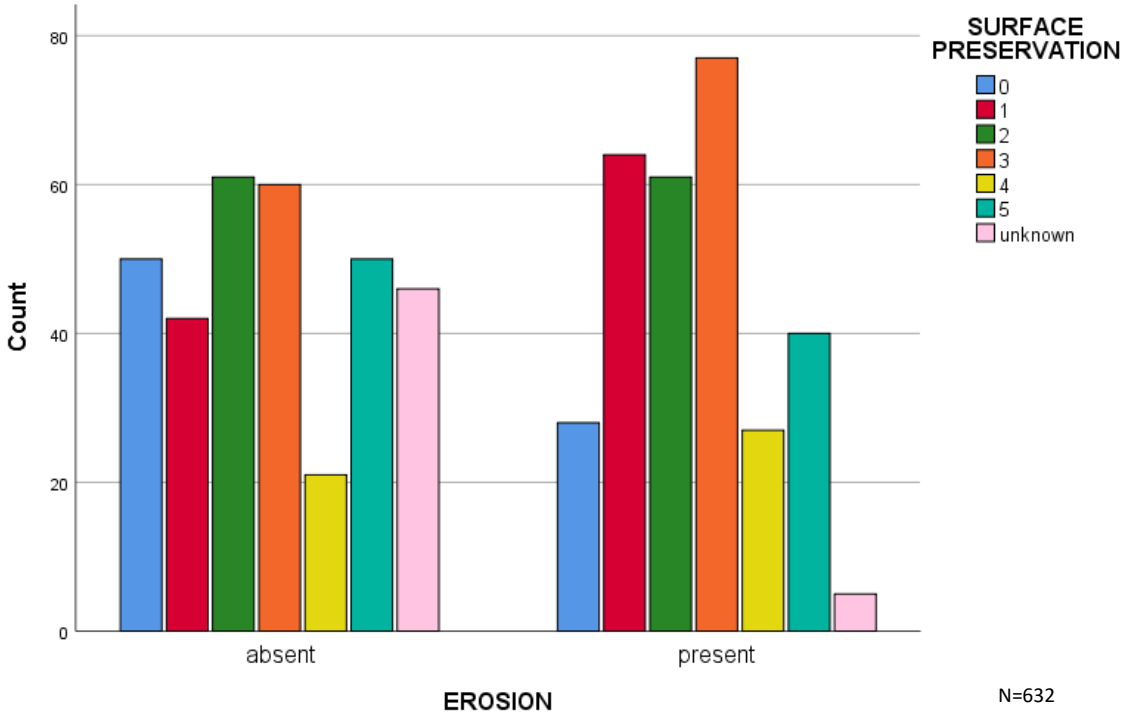

Figure 159. Surface preservation scores on eroded and non-eroded remains across sites in north Wales including Little Orme's Head Quarry (secondary data) (0-5/poor-good).

Abrasion

- Abraded elements demonstrated medium to good surface preservation (scores 3 and 5) whilst non-abraded human remains showed poor surface preservation (scores 3-2) (Figure 167).

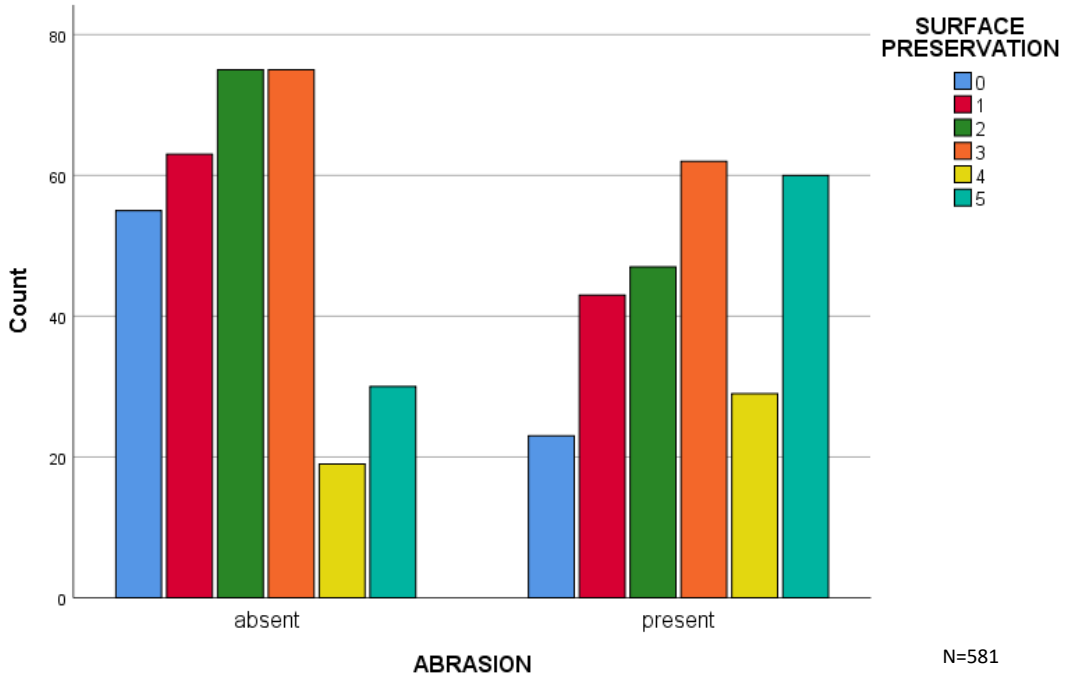

Figure 161. Surface preservation scores of abraded/non-abraded remains across sites in north Wales. N=excluding Little Orme's Head Quarry (unknown modification and surface preservation) (0-5/poor-good).

	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4	STAINING ABSENT	STAINING PRESENT	GNAWING ABSENT	GNAWING PRESENT
ABRASION ABSENT	17	3	4	1	120	197	280	37
ABRASION PRESENT	33	4	0	0	73	191	242	22

Table 94. Abraded and non-abraded remains across south-west Wales correlated with other taphonomic modifications (WTH= weathering, staining and gnawing). N=581 (excluding Little Orme's Head Quarry/unknown modifications).

Staining

- Surface preservation scores between stained and unstained elements differed with the majority of stained bones demonstrating medium to poor surface preservation (Figure 130). Absence of staining, however, was accompanied by higher surface preservation score (5).

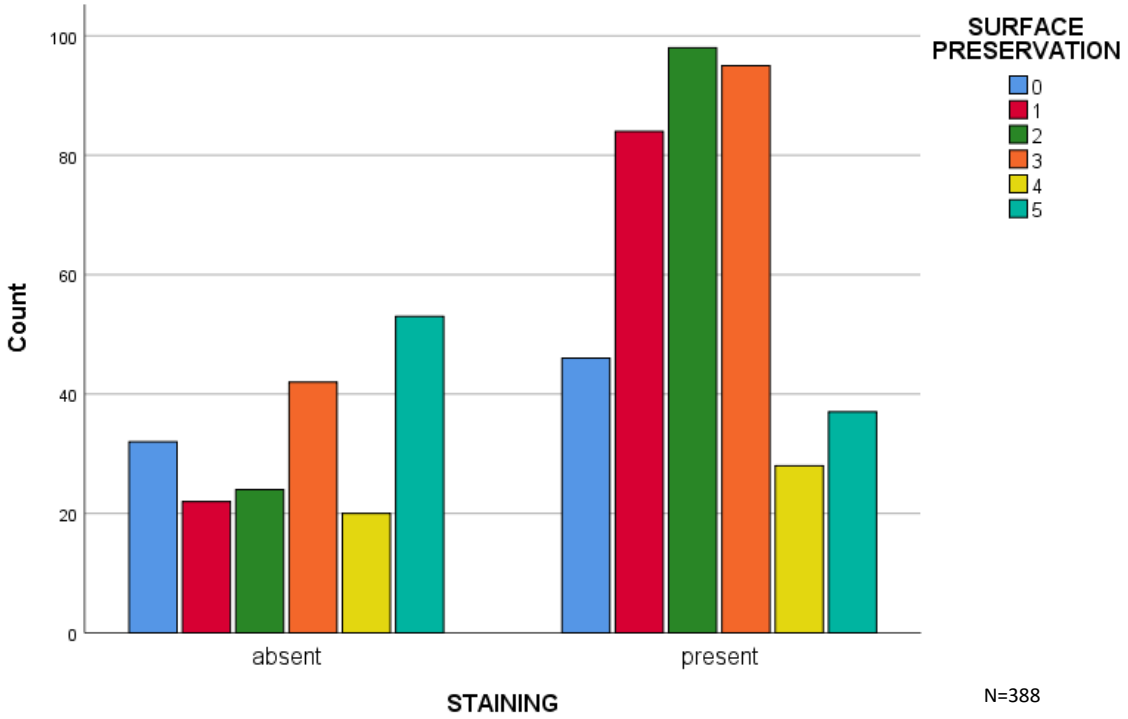

Figure 163. Staining absence/presence across north Wales based on surface preservation scores. N=excluding Little Orme's Head Quarry (unknown modification) (0-5/poor-good).

- Erosion and staining can initiate from any contact of bone with the ground and therefore, deposition in or outside of caves could have produced similar taphonomic modifications.

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4
STAINING ABSENT	118	75	120	73	180	13	5	1	1	0
STAINING PRESENT	166	222	197	191	342	46	45	6	3	1

Table 95. Staining presence/absence compared to other modifications (erosion, abrasion, gnawing and WTH=weathering) in north Wales. N=581 (excluding Little Orme's Head Quarry/unknown modifications).

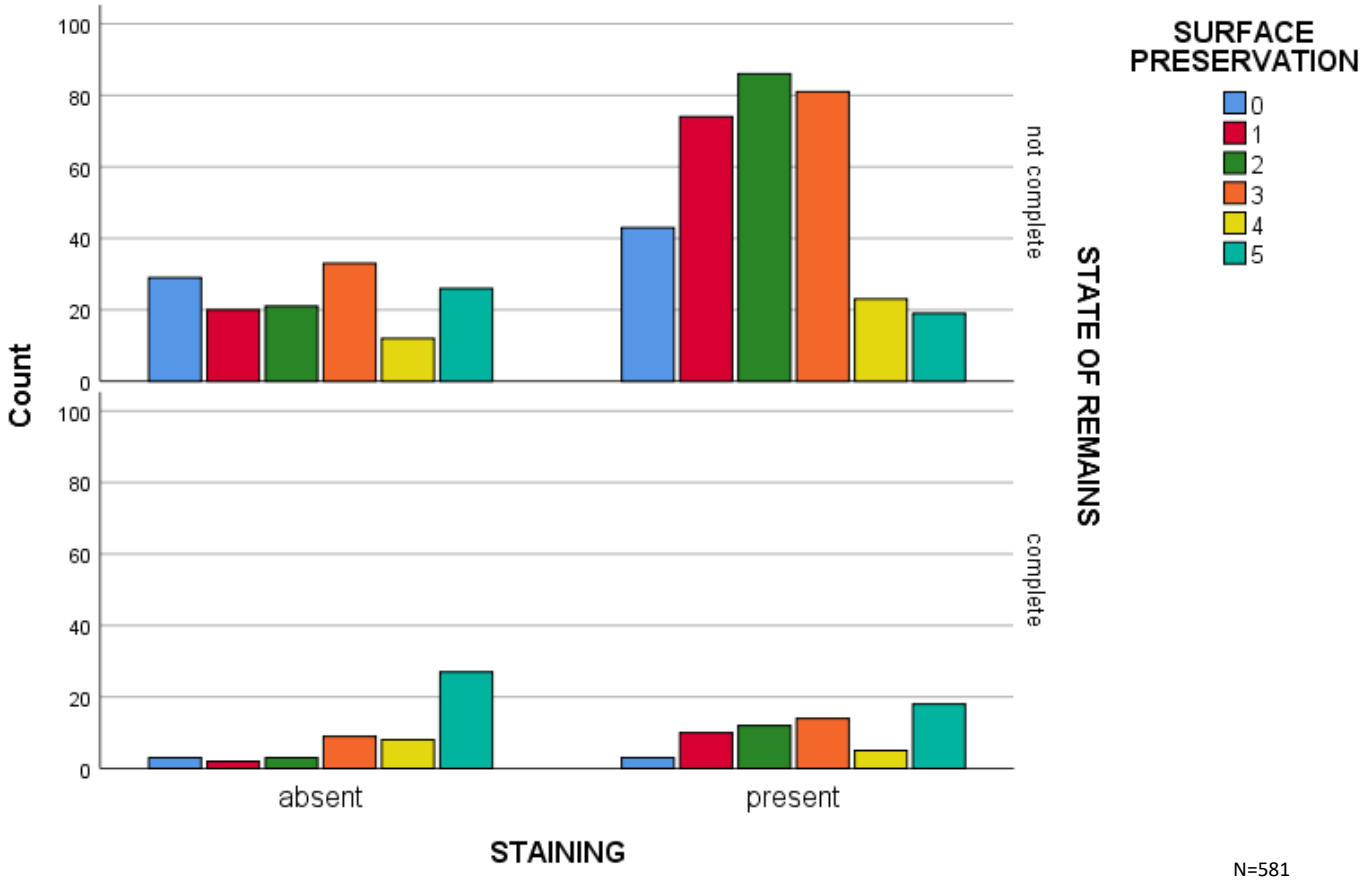

Figure 164. Staining absence/presence across north Wales based on surface preservation scores and state of remains. N=excluding Little Orme's Head Quarry (unknown modification) (0-5/poor-good)

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Trauma (sharp/blunt force)

- Histological analysis of the humerus however, demonstrated a low OHI score (0) which suggests that the element underwent a series of processing involving defleshing, deposition/burial, possible exhumation and sub-aerial exposure followed by re-burial.

Trauma (burning)

- Cranial fragment 753 demonstrated various stages of burning (0/4/5) (see Chapter 5/5.3.8) whereas fragments SNOs 754-55 indicated burning stage four. Fragment 755 further demonstrated signs of polishing/abrasion on the surface that could have resulted from burning.

Fractures (fresh vs dry)

- Surface preservation scores of both fresh and dry fractures primarily demonstrated medium to poor surface preservation scores (3-0). High surface preservation scores (4-5) on dry breaks suggests that certain limbs' taphonomic modifications did not impact their surface extensively when deposited or when they were later disturbed. High surface preservation scores were similarly identified on limbs exhibiting fresh fractures which could indicate early processing of the bones, primary deposition and lack of disturbances.
- Weathering stages one and two were accompanied by medium to high surface preservation scores on both dry and fresh fractures suggesting exposure was either not prolonged or long bones were deposited close to cave entrances.

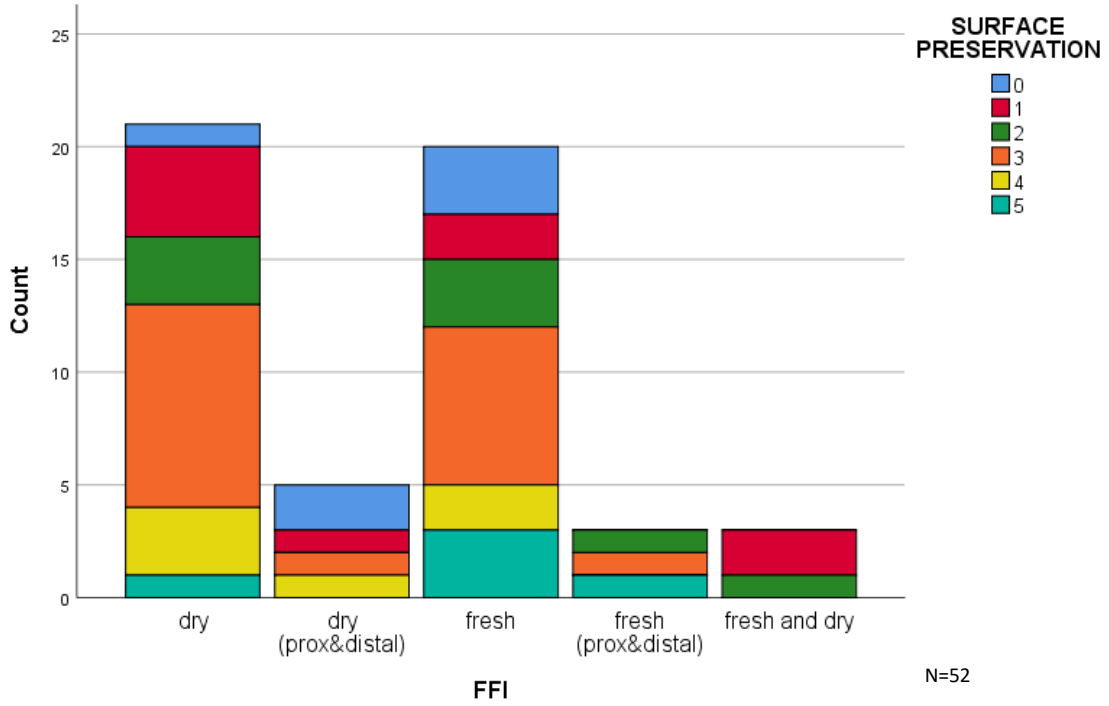


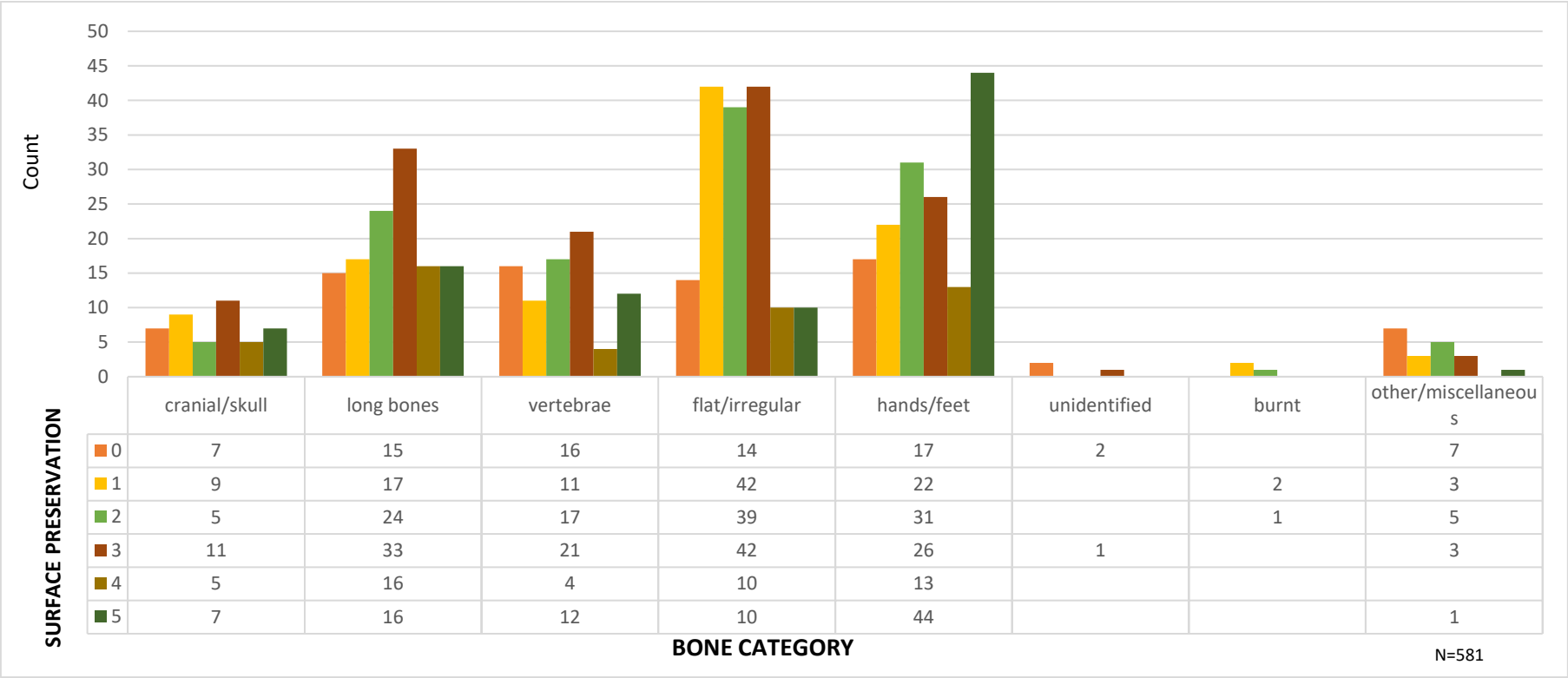
Figure 168. Fracture Freshness Index (FFI dry/fresh breaks) based on surface preservation scores across sites in north Wales. N=only fractured long bones (excluding Little Orme's Head Quarry/unknown FFI scores) (0-5/poor-good).

- Other taphonomic modifications on shafts with both fresh and dry breaks included erosion, abrasion, gnawing and staining almost equally identified amongst elements (Table 98). Sub-aerial exposure nonetheless could have entailed all aforementioned modifications resulting from exposure in a range of environments.

FFI		WEATHERING STAGE				EROSION	ABRASION	GNAWING	STAINING
		1	2	3	4				
	DRY	2	1	1	0	15	11	7	18
	DRY (PROXIMAL &DISTAL)	1	0	1	0	3	2	0	5
	FRESH	2	1	1	1	10	8	6	17
	FRESH (PROXIMAL &DISTAL)	0	0	0	0	3	1	2	2
	FRESH AND DRY	0	0	0	0	2	0	2	3

Table 96. FFI correlated with taphonomic modifications across north Wales. N=52 (fractured long bones/excluding Little Orme's Head Quarry).

Surface preservation



SURFACE PRESERVATION	cranial/skull	long bones	vertebrae	flat/irregular	hands/feet	unidentified	burnt	other/miscellaneous
0	7	15	16	14	17	2		7
1	9	17	11	42	22		2	3
2	5	24	17	39	31		1	5
3	11	33	21	42	26	1		3
4	5	16	4	10	13			
5	7	16	12	10	44			1

Figure 169. Frequencies of surface preservation scores in north Wales divided by bone type. N=excluding Little Orme's Head Quarry (unknown surface preservation) (0-5/poor-good).

Trampling

- Erosion and abrasion were recorded on the talus and cranial and rib fragments whilst evidence of staining was identified on all four elements. Talus SNO 591 exhibited pink/red stains on its plantar view where trampling signs were also recorded. Phalanx SNO 827 on the other hand exhibited a purple stain. Surface preservation scores amongst elements varied; the talus demonstrated high surface preservation (score 5) whilst the phalanx (score 3) and cranial and rib fragments (score 1) had been more impacted by taphonomic modifications. No patterns can be highlighted, however, all trampled elements derived from disturbed contexts where evidence of processing (Ogof Colomendy), prior sub-aerial exposure (Ogof Pant-y-Wennol) and positioning of bodies in separate passages (Gop Cave) would have involved movement and assortment of elements whilst later disturbances (e.g. scavengers, modern damage or re-use of a site) could have also been responsible for these marks.

Microscopic results

SITE	OHI	AT	INCL INTENS	INCL COLOUR	INFIL INTENS	INFIL COLOUR	STAIN COLOUR	CRACK& INTENS	BIREFR
OGOF PANT-Y-WENNOL (SNO: 57)	5	Non-Wedl	3	black; brown-fair	3	black	brown/ orange - fair	present (3)	2
OGOF PANT-Y-WENNOL (SNO: 59)	5	Non-Wedl	3	black	3	black/ brown	brown - fair	present (3)	3
OGOF PANT-Y-WENNOL	5	Non-Wedl	1	black; brown - dark	3	black/ brown	brown - fair, dark; orange/	present (3)	3

(SNO: 60)							brown - fair; red - fair		

Table 97. Samples from Ogof Pant-y-Wennol with very good histological preservation (OHI score 5). Attack (AT), inclusion (Incl)/infiltration (Infil) intensity (Intens), staining (Stain) discolouration, cracking/microfissures intensity (Crack & Intens) and birefringence scores (1=low, 2=medium).

- Staining, erosion and/or abrasion were correlated with various surface preservation scores and no particular pattern was identified.
- Elements exhibiting weathering one to four (N=4) demonstrated different levels of bacterial attack (OHI scores: 0, 3, 5).

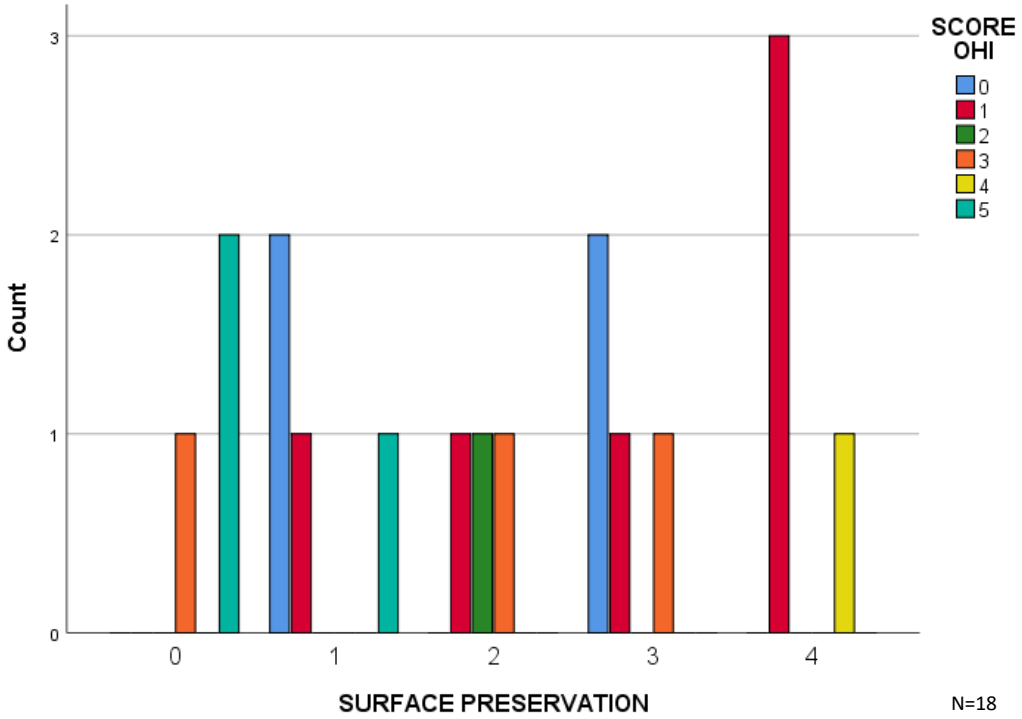


Figure 172. Surface preservation scores correlated with OHI scores from samples in south-west Wales (0-5/poor-good).

- Microstructural staining was observed in the vast majority of samples with no particular pattern observed amongst OHI and birefringence scores. Loss of birefringence and low OHI scores were therefore not solely accompanied by microstructural staining as observed in overall results across sites and samples from south-central Wales
- Humerus SNO 57 exhibited a fresh fracture, extensive weathering (stage 4), microcracking and slight budded MFD. Prolonged exposure could have been responsible for collagen loss in the microstructure as repeated wetting/drying conditions might have also affected the microstructure of the bone.

OHI SCORE		BIREFRINGENCE INDEX			
		NONE (0)	LOW (1)	MEDIUM (2)	HIGH (3)
	0	2	2	0	0
	1	1	5	0	0
	2	0	1	0	0
	3	0	0	3	0
	4	0	0	0	1
	5	0	0	1	2

Table 98. Birefringence scores from samples across north Wales cross-referenced with OHI scores. N=18.

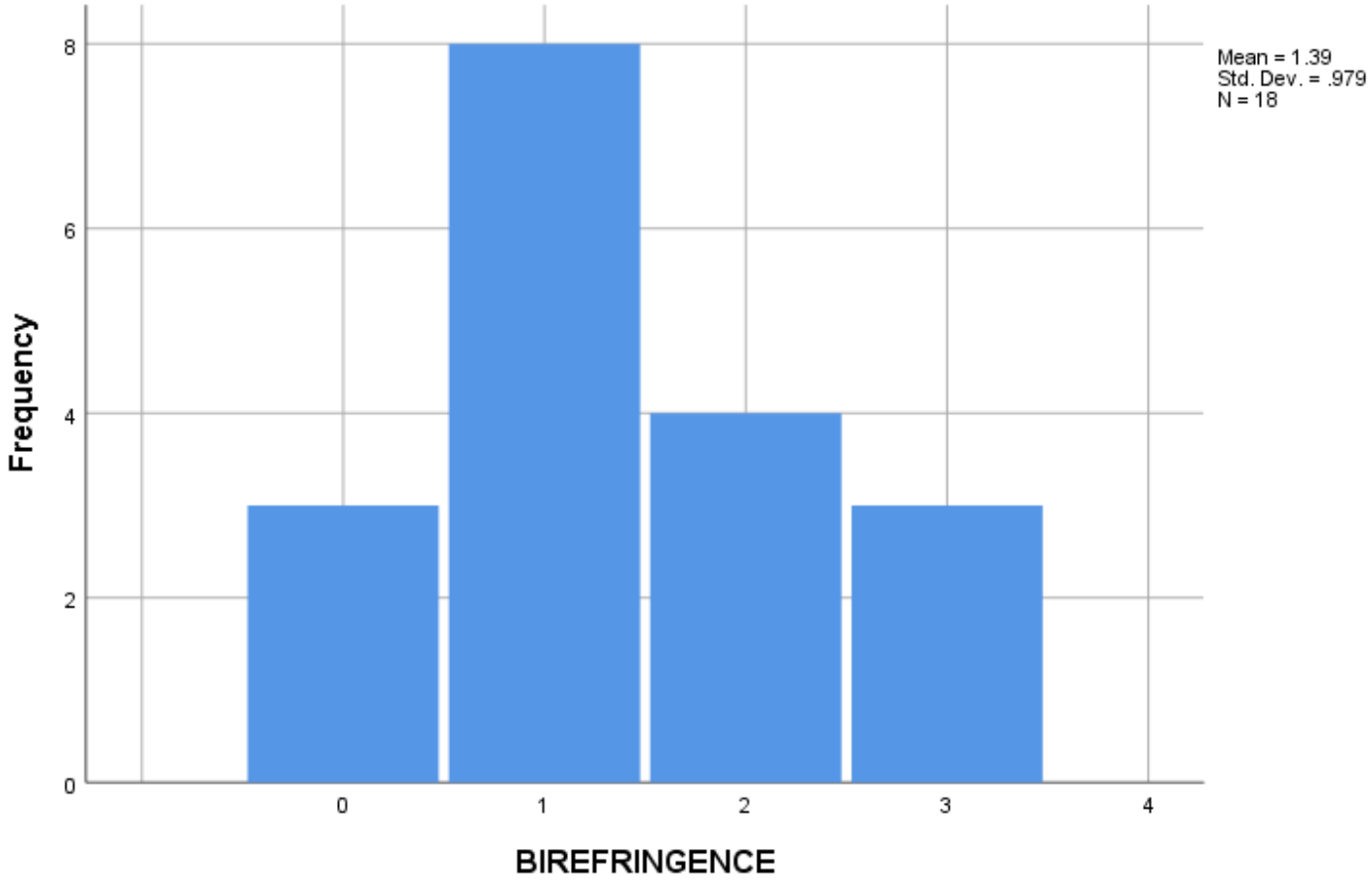


Figure 173. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3-high) from north Wales.

- Inclusion and infiltration colour indicated similarities ranging from black/brown to brown/dark or fair with some samples further demonstrating fair grey or brown/red (under polar light) inclusions and/or infiltrations. Red discolorations were not frequently encountered amongst samples. Microstructural staining ranged from brown (fair/dark) to brown/orange.
- One radius exhibited brown/red (dark) and blue discolouration under polar light (SNO: 36/Gop Cave) whilst one humerus (SNO: 39/Gop Cave) demonstrated red, brown/red microstructural staining (fair/dark). The aetiology of these small discolourations cannot be deciphered and no particular patterns were observed. One cranial fragment (SNO: 43/Gop Cave) further displayed signs of a possible red fungal fruiting body in the microstructure combined with black, black/brown infiltrations and inclusions, low OHI score (1) and lack of microstructural staining. Similar marks were identified on four other samples from four separate sites and no particular patterns were identified apart from fungal organisms invading the microstructure along with extraneous material.

OHI SCORE		INCL	INFIL	STAIN/DISCOLOURATION	CRACK/ MICROFISSURES
	0	4	1	3	0
	1	6	6	4	2
	2	1	1	1	1
	3	3	3	3	2
	4	1	1	1	1
	5	3	3	3	3

Table 99. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=18.

- Intensity patterns were primarily low with medium to higher OHI scores (3/4-5) demonstrating higher inclusion, infiltration and microcracking intensities (Table 102/Appendices).
- Elements with low OHI scores did not exhibit any signs of microcracking similarly to samples examined from south-west Wales. This suggests that higher OHI scores may be associated with a higher degree of handling, disturbances, circulation and/or exposure in different environments

OHI SCORE	**INCLUSION INTENSITY**			**INFILTRATION INTENSITY**				**CRACKING INTENSITY**			
	1	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
	LOW	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**
		1	0	3	1	0	0	4	0	0	0
1	6	0	0	0	5	1	0	4	2	0	0
2	1	0	0	0	0	1	0	0	1	0	0
3	1	1	1	0	2	1	0	1	0	0	2
4	0	1	0	0	0	1	0	0	0	1	0
5	1	0	2	0	0	0	3	0	0	0	3

Table 100. Inclusion, infiltration, cracking intensities (0-3) and associations with OHI scores. N=18

OHI SCORE	STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)	MICROCRACKING & SURFACE EROSION	MICROCRACKING & WEATHERING (STAGE 1/4)
OHI 0	2	0	0
OHI 1	4	1	0
OHI 2	1	1	0
OHI 3	1	0	1 (STAGE 1)
OHI 4	0	1	0
OHI 5	3	2	1 (STAGE 4)

Table 101. Stained samples (surface and microstructural staining), eroded, weathered (surface) with evidence of microcracking. Total N=18.

7. Case studies

7.2. Spurge Hole

Frequency of skeletal elements

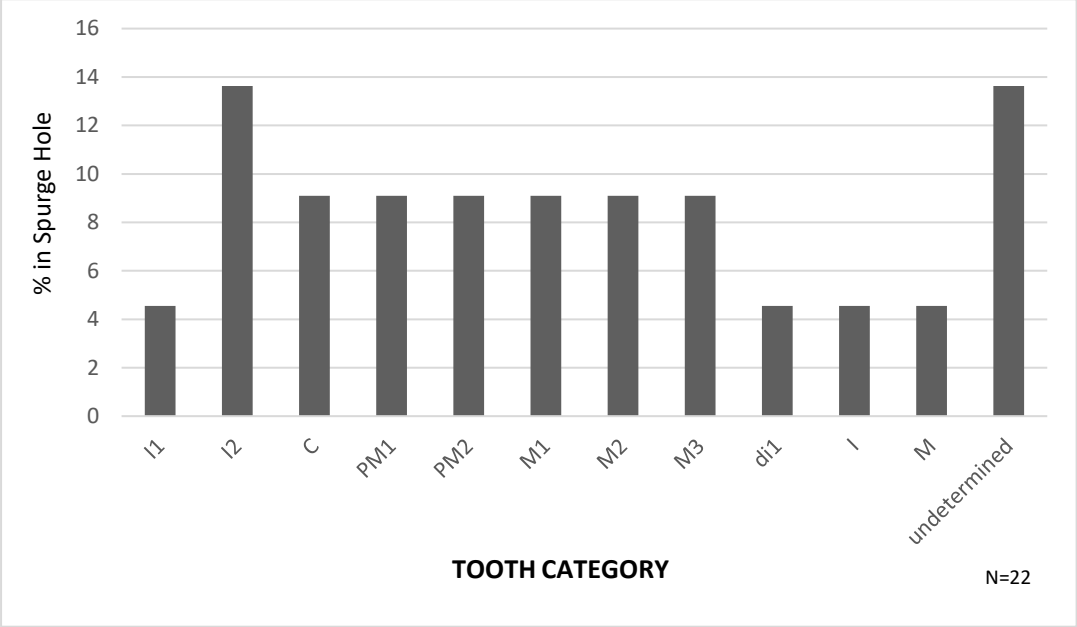


Figure 176. Teeth distributions in Spurge Hole. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dm1= deciduous 1st molar, I= incisor, M= molar. I (N=1) and M (N=2): no identification of exact tooth.

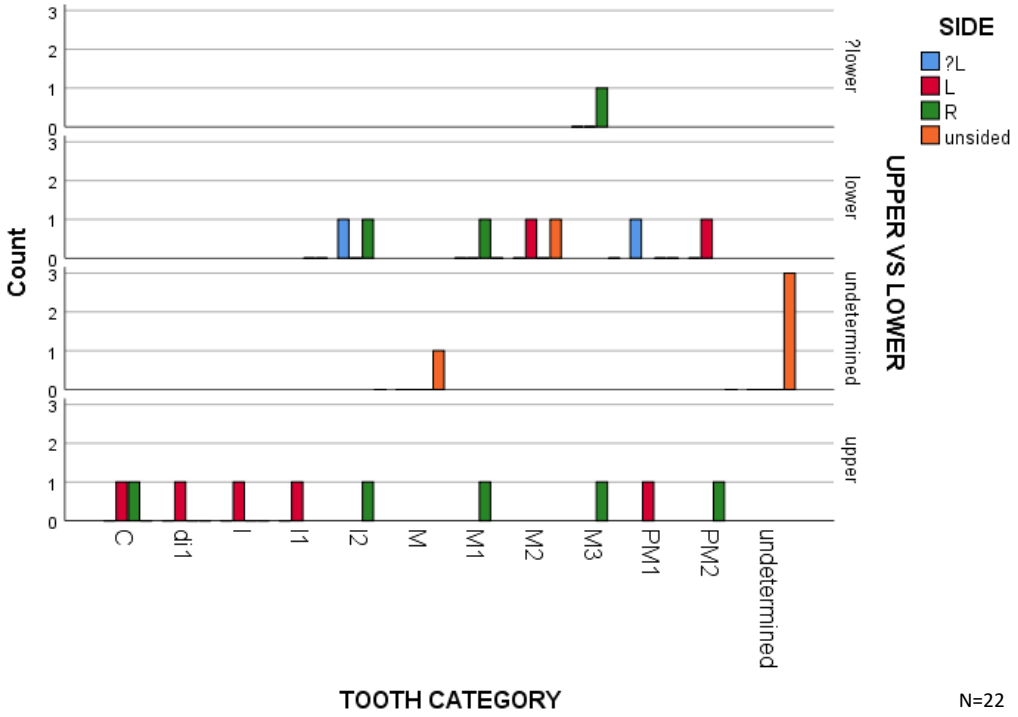


Figure 177. Frequencies of teeth distributions in Spurge Hole. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dm1= deciduous 1st molar, I= incisor, M= molar. I (N=1) and M (N=2): no identification of exact tooth Side:?L= probable left, L= left, R= right and unsided (not determined). Upper vs Lower: ?lower= probable lower tooth.

- Long bones SNOs 177-8, SNO 307 and SNOs 314-5 were further sampled for microscopic analysis and revealed differentiation in treatment with weathered long bones demonstrating very good histological preservation (OHI score: 5) and humeri displaying high bacterial attack (OHI scores: 2 and 1).

LONG BONE		EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
	HUMERUS	2	0	0	2
	RADIUS	2	0	0	2
	ULNA	1	0	0	1
	FEMUR	1	2	1	2

Table 104. Presence/ absence of epiphysis and shafts based on long bone representation in Spurge Hole. N=8.

Element completeness

- Femur head 179 (SNO) must derive from right femur shaft 178 (SNO) which possibly articulates with the surviving proximal end of femur head 179.
- Erosion was the primary cause of this result and was recorded on all flat/irregular bones and the vast majority of cranial/skull and vertebrae remains (N=25 respectively). Other causes of poor surface preservation were signs of prolonged weathering which was however solely recorded on three long bones. Soil acidity and extensive root etching therefore severely impacted the surviving assemblage, possibly masking other modification such as gnawing, fresh fractures and/or evidence of trauma on the bones.

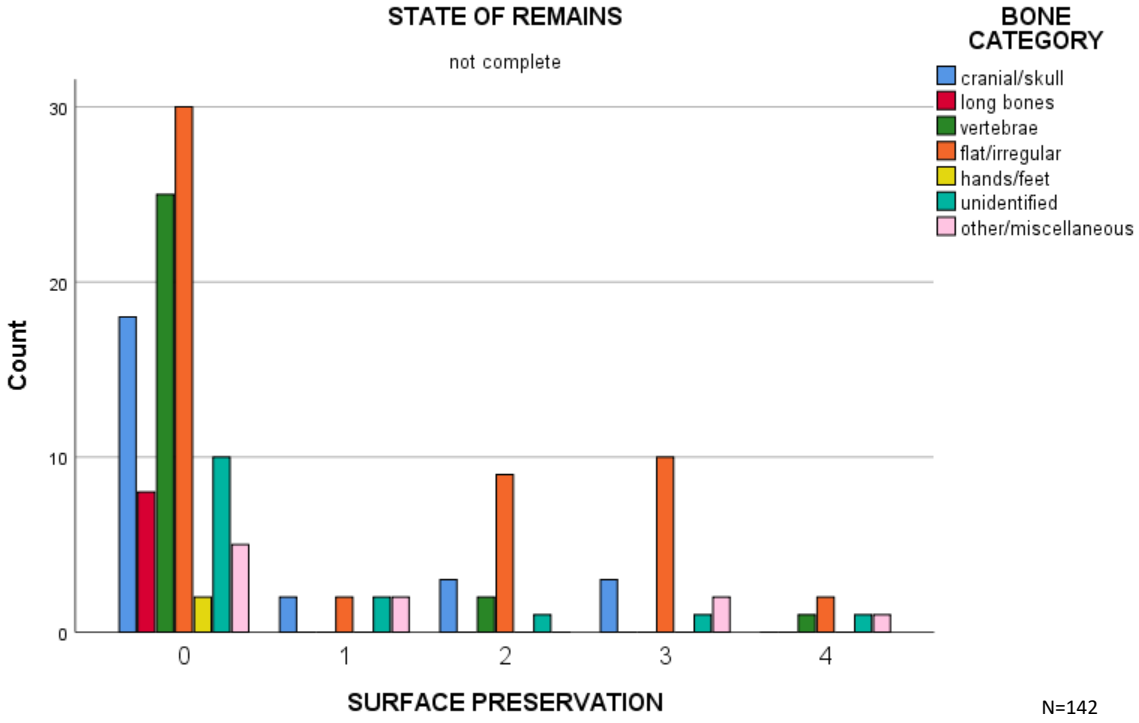


Figure 178. State or remains in Spurge Hole based on bone category and surface preservation scores (0-5/poor-good). N=excluding loose teeth.

BONE CATEGORY		STAIN	EROS	GN	AB	WTH (STAGE 3)	SURFACE PRES				
							0	1	2	3	4
	CRANIAL/SKULL	0	25	0	0	0	18	2	3	3	0
	LONG BONES	0	8	0	0	3	8	0	0	0	0
	VERTEBRAE	0	25	0	0	0	25	0	2	0	1
	FLAT/IRREGULAR	0	53	0	0	0	30	2	9	10	2
	HANDS/FEET	0	2	0	0	0	2	0	0	0	0
	UNIDENTIFIED	0	4	0	0	0	10	2	1	1	1
	BURNT	0	0	0	0	0	0	0	0	0	0
	OTHER/ MISCELLANEOUS	0	3	0	0	0	5	2	0	2	1

Table 105. Taphonomic modifications (STAIN= staining, EROS= erosion, GN= gnawing, AB= abrasion, WTH= weathering) and surface preservation scores (SURFACE PRES) recorded in Spurge Hole based on bone category. N= 142.

Taphonomy – Macroscopic results

Weathering

- Femur SNO 178 exhibited dry fractures on both proximal and distal ends whilst the cortical bone of femur SNO 177 and shaft SNO 397 was thinned out and therefore their fracture morphology could not be determined.

Erosion

- Surface preservation scores amongst eroded and non-eroded remains were primarily low (score 0) suggesting erosion/root etching ultimately affected the elements and possibly obscuring other taphonomic agents.
- Erosion was further recorded on five loose teeth with most showing severe signs of digestion (sometimes combined with root etching). Digestion might have occurred whilst remains were deposited in the cave and subsequently disturbed by burrowing animals however signs of gnawing were not apparent amongst remains.

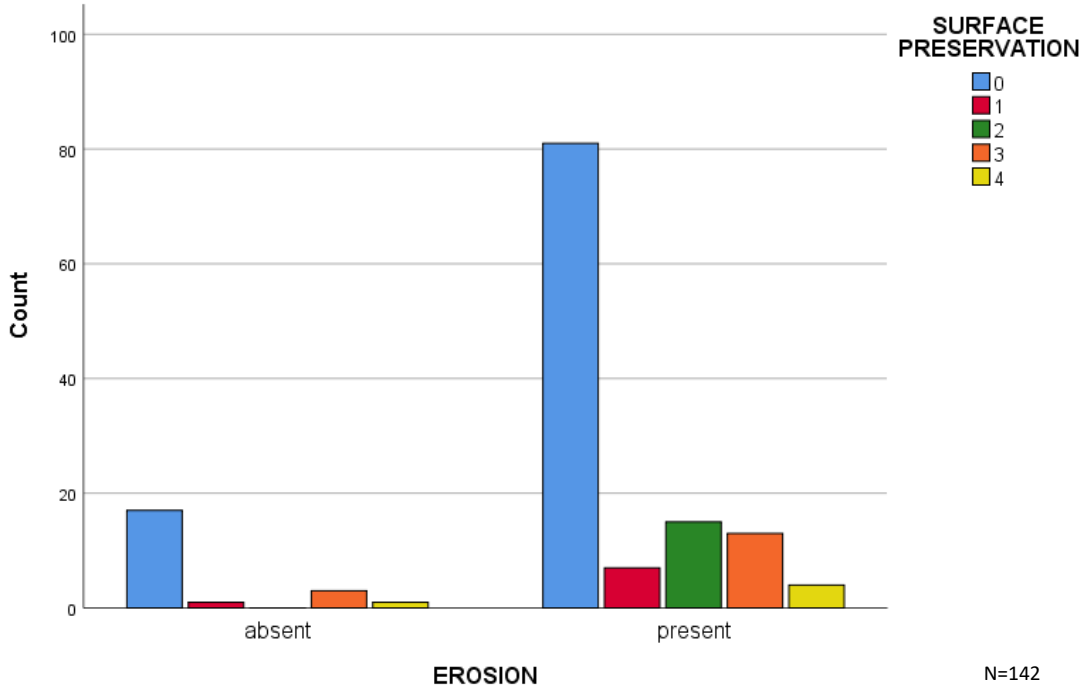


Figure 184. Surface preservation scores on eroded and non-eroded remains in Spurge Hole (0-5/poor-good).

Surface preservation

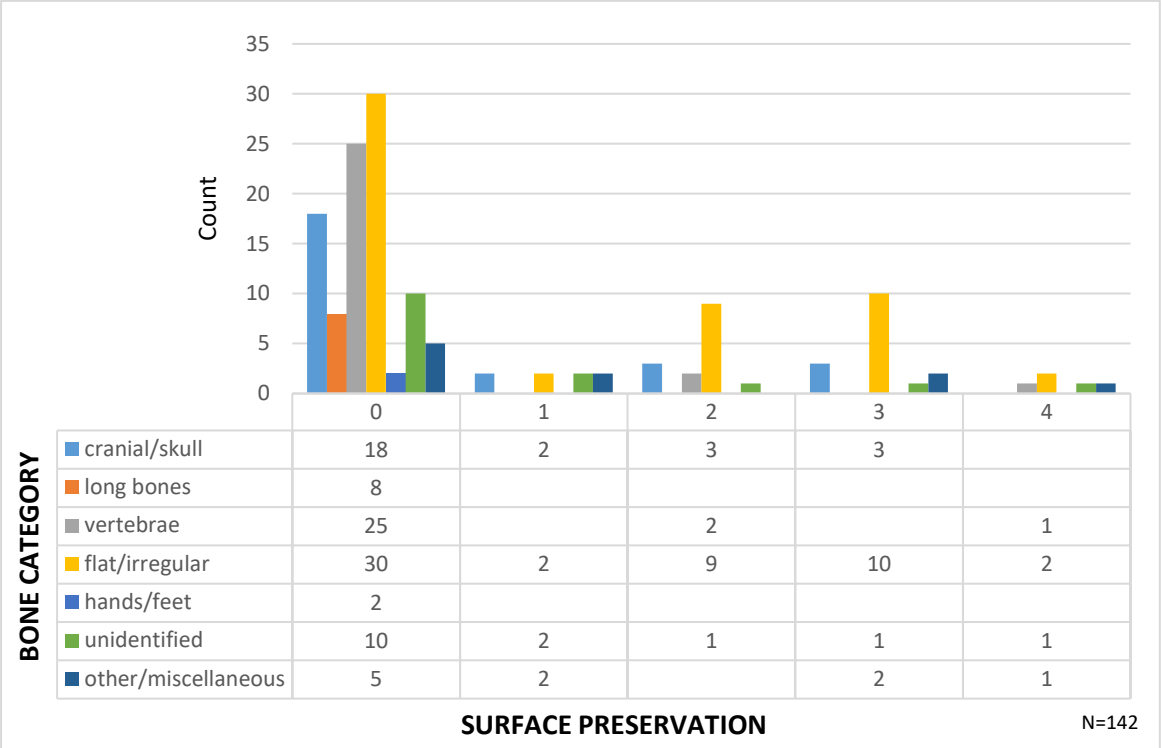


Figure 185. Frequencies of surface preservation scores in Spurge Hole divided by bone type. Colour-coded with the order they are listed in the table (bone category) (0-5/poor-good).

Microscopic results

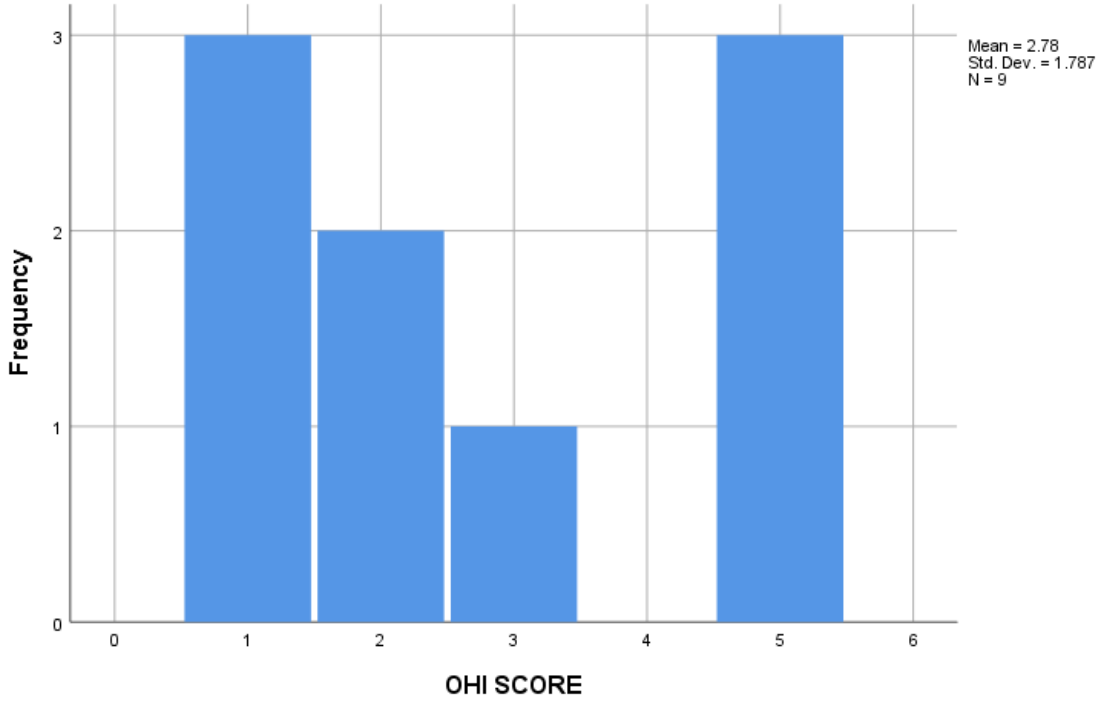


Figure 186. Histogram indicating OHI scores from Spurge Hole.

ELEMENT		OHI SCORE			
		1	**2**	**3**	**5**
	CF	2	1	1	0
	LB	1	1	0	3

Table 106. Table demonstrating OHI score distribution amongst cranial fragments (CF) and long bones (LB) sampled from Spurge Hole. N=9.

- Long bone SNO 27: brown (dark/fair) and black inclusions and infiltrations, orange, brown (fair) and red microstructural staining (not frequent). Loss of collagen was apparent which scored medium (2) on the Birefringence Index.
- Long bones SNOs 29-30: high levels of bacterial attack (OHI scores 2 and 1 respectively) with brown (dark, fair) inclusions. Brown (fair, dark) infiltrations were present in long bone SNO 29 whilst brown microstructural staining (fair/under polar light) was apparent in long bone 30. Neither long bone (SNOs 29-30) exhibited signs of microcracking however extensive bacterial attack could have obscured any evidence of microfissures or cracking.

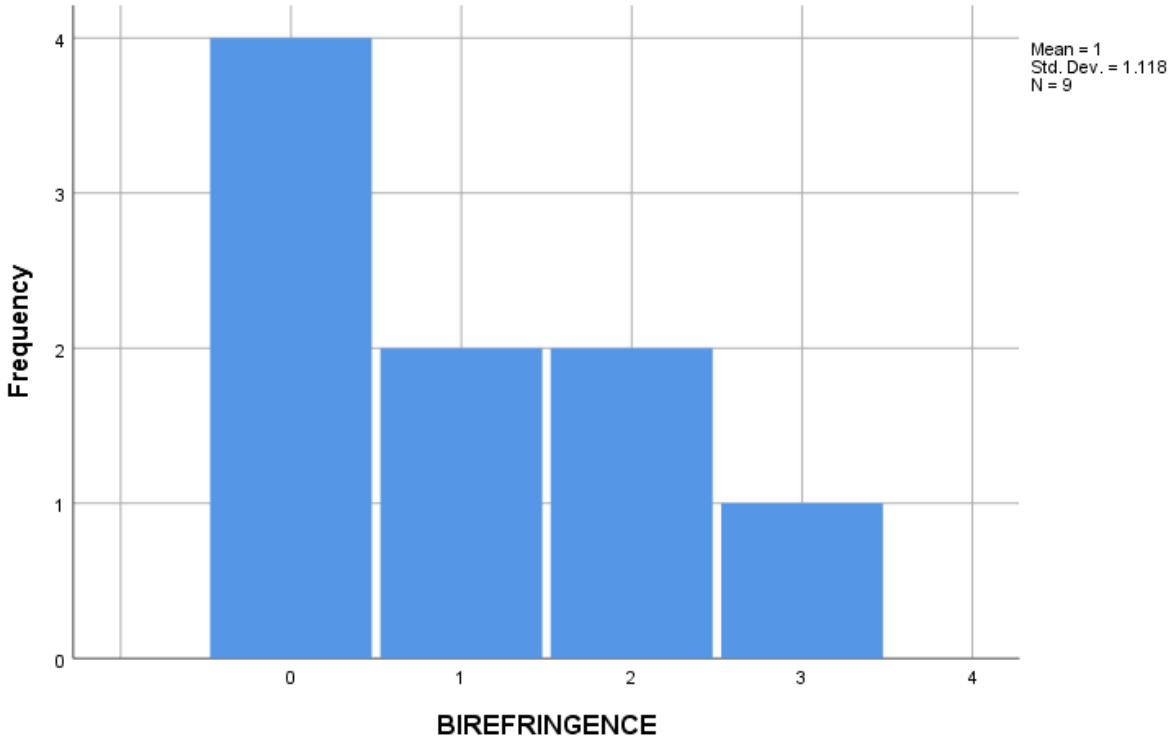


Figure 188. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from Spurge Hole.

- Extraneous material were identified in the majority of the samples whilst birefringence levels were either absent to low (OHI scores 1-3) or medium/high on samples indicating very good histological preservation (OHI score: 5). Extensive cracking and demineralization of the bone could have resulted in collagen loss in the bone cortex, further demonstrating medium birefringence scores (2) in two out of the three long bones with high OHI scores. Radius SNO 28 (Appendix 1/Sheet 3/Histology) demonstrated slight bacterial attack (linear longitudinal) however was given a high OHI score (5) as the overall microstructure was unaffected and original features had survived.

OHI SCORE		**BIREFRINGENCE INDEX**			
		NONE (0)	**LOW (1)**	**MEDIUM (2)**	**HIGH (3)**
	1	3	0	0	0
	2	1	1	0	0
	3	0	1	0	0
	5	0	0	2	1

Table 107. Birefringence scores from samples from Spurge Hole cross-referenced with OHI scores. N=9

.

DATE	SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
	26	LB	5	brown - dark, fair	brown - dark, fair	brown - brown/ red (under polar)	3
	27	LB	5	brown - dark, fair	brown- dark; black/brown	orange, brown - fair; red	2
	28	LB	5	brown - dark, fair; red	brown - dark; black/brown	orange/brown - fair	2
EARLY/ MIDDLE NEOLITHIC	29	LB	2	brown - fair, dark	brown - fair/dark	no staining identified	1
	30	LB	1	brown - fair, dark	no infiltrations identified	brown - fair (polar)	0
	31	CF	3	brown - dark, fair; black	brown - dark; brown/black	orange - fair; brown dark; red (polar); green?	1
	32	CF	2	brown - dark; black	brown- dark; black/brown	dark brown; fair/light brown	0
MIDDLE/ LATE NEOLITHIC	33	CF	1	brown - dark	brown- dark; black/brown	brown - fair	0

	34	CF	1	brown - dark	brown/black	brown - dark; petrol green (polar); green stain	0

Table 108. Samples (N=9) from Spurge Hole. Indication of available radiocarbon date (DATE), element (ELEM) – cranial fragment (CF) and long bone (LB), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high).

- Inclusion and infiltration colour was primarily brown (dark and/or fair) whilst microstructural staining ranged from brown (fair), brown/red (under polar light) to brown (dark) and petrol green (under polar light/SNO: 34). Cranial fragment SNO 34 (OHI score 1) did not exhibit any signs of surface staining and other taphonomy and was the single sample with medium surface preservation (3). Remaining samples were all poorly preserved (surface preservation score: 0).

	OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICRO-FISSURES
	1	3	2	3	2
	2	2	2	1	1
	3	1	1	1	1
	5	3	3	3	3

Table 109. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI scores. N=9.

- Lower OHI scores demonstrating both lower (1) and higher infiltration/inclusion intensities

OHI SCORE		INCLUSION INTENSITY			INFILTRATION INTENSITY				CRACKING INTENSITY		
		1	**2**	**3**	**0**	**1**	**2**	**3**	**0**	**1**	**3**
		LOW	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**HIGH**
	1	2	0	1	1	1	0	1	1	2	0
	2	0	1	1	0	0	1	1	1	1	0
	3	0	1	0	0	0	1	0	0	0	1
	5	0	0	3	0	0	0	3	0	1	2

Table 110. Inclusion, infiltration and cracking intensities (0-3) and associations with OHI scores. N=9.

7.3. George Rock Shelter

Frequency of skeletal elements

- One 3rd lower molar (3%), one deciduous upper 1st incisor (3%), one deciduous lower canine (3%) and two deciduous lower 1st molars (9%) were further recorded in the assemblage (Figure 151).

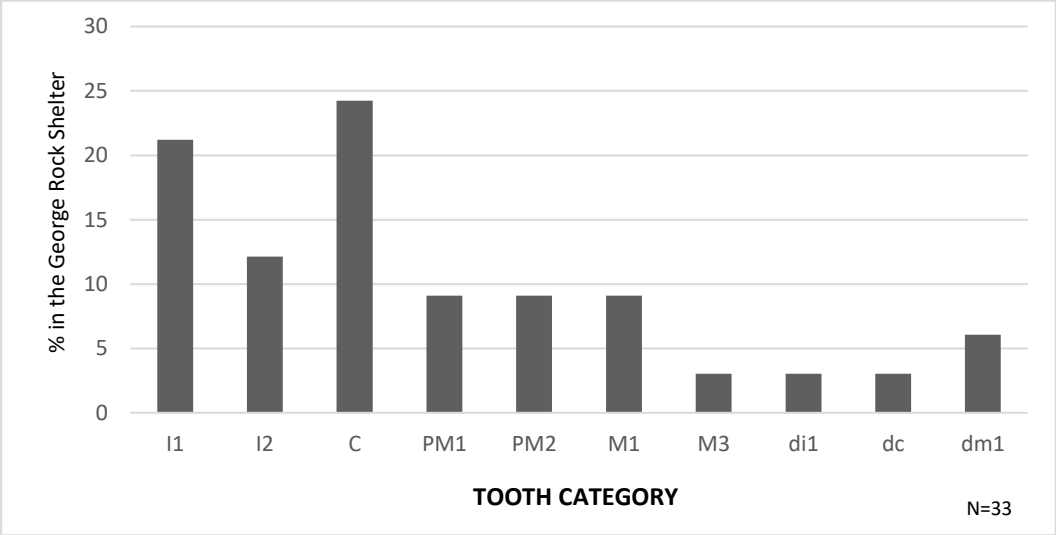


Figure 192. Teeth distributions in the George Rock Shelter. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M3= 3rd molar, di1= deciduous 1st incisor, dc= deciduous canine, dm1= deciduous 1st molar.

- Weathering (stage 1) was recorded on a single right ulna (SNO: 1039) that had further been impacted by erosion, abrasion and staining. Erosion was further recorded amongst 11 long bones whilst staining (N=7) and abrasion (N=4) were identified on fewer elements. Surface preservation scores amongst long bones were low (0-3) demonstrating how impactful the macroscopic agents were. The majority of limbs demonstrated very low surface preservation scale (score 2/N=7; score 0/N=5; score 1/N=2) whilst only a single radius (SNO: 851) had been preserved relatively better (score 3).

LONG BONE	EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
HUMERUS	1	1	2	0
RADIUS	1	1	2	0
ULNA	1	1	1	1
FEMUR	0	0	0	0
TIBIA	0	0	0	0
FIBULA	1	1	1	1
SHAFT/EPIPHYSIS UN	7	0	7	0

Table 112. Presence/ absence of epiphysis and shafts based on long bone representation in the George rock Shelter. SHAFT/EPIPHYSIS UN= shaft/epiphysis unidentified. N=15.

Element completeness

- Fragmented elements indicated poor surface preservation (most frequencies between 2 and 3). Score frequencies amongst complete elements were similarly medium/poor (3-2) (Figure 152). Similar to Spurge Hole, erosion was the primary cause of low surface preservation recorded on most hands/feet, cranial/skull fragments and flat/irregular bones (Table 114). Staining was identified on a lower proportion of the assemblage primarily amongst the abovementioned element frequencies whilst the low presence of abrasion, gnawing and weathering must have had a minor impact in overall surface preservation scores (Table 114). Erosion and root etching were therefore the main cause of low surface preservation scores and could have potentially masked other taphonomic modifications including more evidence of gnawing, fractures on long bones and/or evidence of trauma on the bones (e.g. cutmarks).

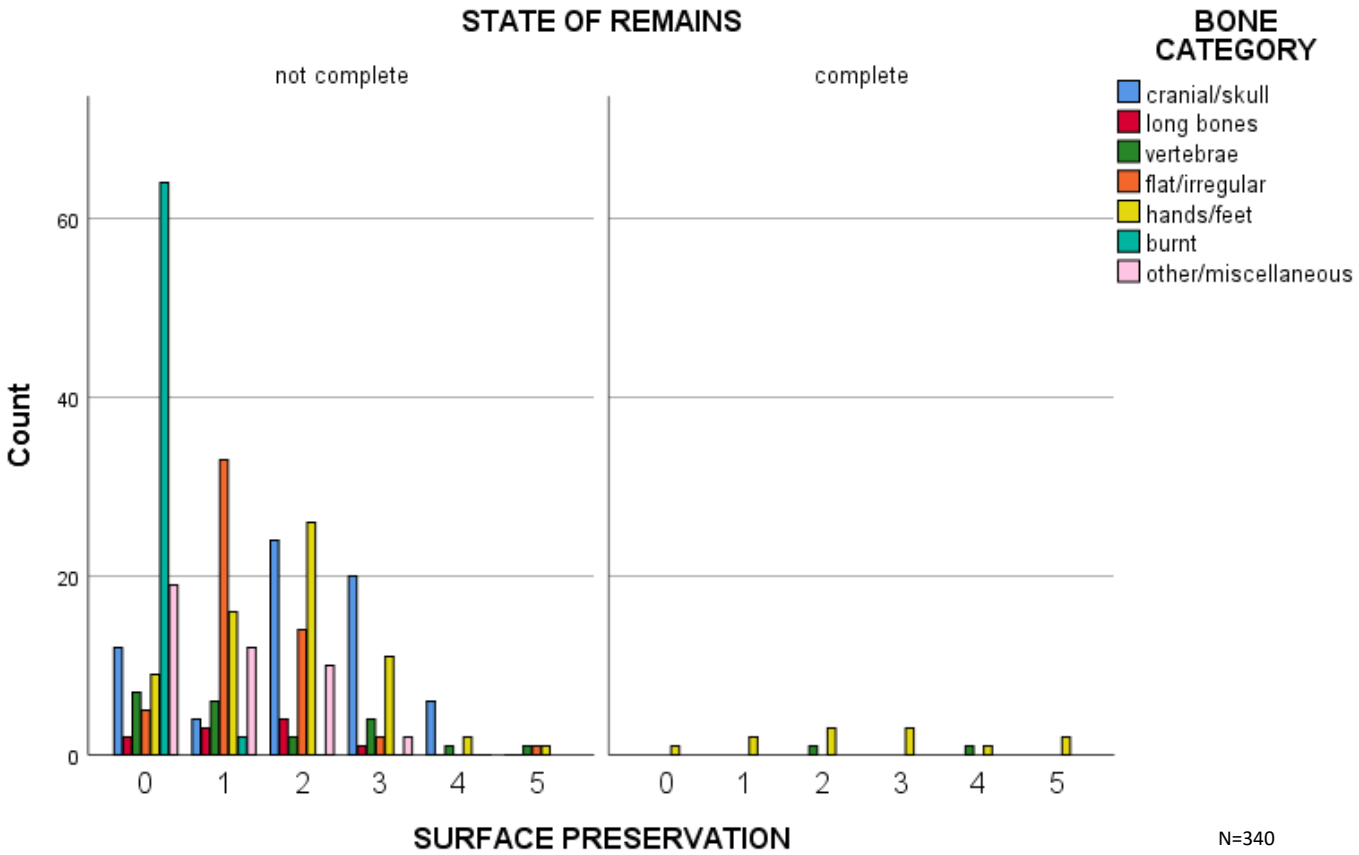


Figure 193. State or remains in the George Rock Shelter based on bone category and surface preservation scores (0-5/poor-good). N=excluding loose teeth.

BONE CATEGORY		STAIN	EROS	GN	AB	WTH	SURFACE PRES					
						(STAGE 1)	0	1	2	3	4	5
	CRANIAL/SKULL	31	57	0	10	0	12	4	24	20	6	0
	LONG BONES	4	6	0	2	1	2	3	4	1	0	0
	VERTEBRAE	8	17	0	0	0	7	6	3	4	2	1
	FLAT/IRREGULAR	32	54	0	8	0	5	33	14	2	0	1
	HANDS/FEET	53	66	2	12	0	10	18	29	14	3	3
	UNIDENTIFIED	0	0	0	0	0	0	0	0	0	0	0
	BURNT	0	4	0	2	0	64	2	0	0	0	0
	OTHER/MISCELLANEOUS	26	30	1	3	1	19	12	10	2	0	0

Table 113. Taphonomic modifications (STAIN= staining, EROS= erosion, GN= gnawing, AB= abrasion, WTH= weathering) and surface preservation scores (SURFACE PRES) recorded in the George Rock Shelter based on bone category. N=340.

MNI, demography and pathology

- Four Early Neolithic radiocarbon dates derived from horizons 1002/1007 and 1004 whilst a single post-Medieval metatarsal was unearthed from context 1009. Surviving cremated fragments suggested that the cremation accompanied the Early Neolithic burials from the George Rock Shelter.
- Dental pathologies included caries (N=1), and calculus (N=4) whilst remaining loose teeth either did not exhibited any signs of dental pathologies or erosion and/or digestion impacted the remaining surface. Degenerative pathologies were not identified on any elements. Surviving remains were fragmented and impacted by erosion therefore any signs of pathology might have been masked.

Taphonomy

Weathering

- Elements were further impacted be erosion, abrasion and staining whilst their surface preservation score was very low (1 for possible MT and 2 for ulna). Weathered human remains were recovered from context 1009 meaning, human remains were probably deposited at a later stage as verified by the radiocarbon dated element from this fill. Disturbances close to the surface of the site and short sub-aerial exposure in the rock shelter could have easily been the cause of this modification.

Gnawing

- All elements were eroded and staining was present on the metacarpal and long bone fragment. Surface preservation scores were medium (score 3/intermediate hand phalanx) to poor (score 1/MC and long bone fragment). Depositions in the Early Neolithic (layers 1002/1004) were subsequently disturbed by slight scavenger activity whilst later depositions (post-Medieval layer 1009) must have been similarly disturbed.

Erosion

- Erosion ultimately affected the majority of elements similar to recovered elements from Spurge Hole. The level of fragmentation and surface preservation between the two sites was very similar suggesting that environmental conditions ultimately dictated the survival of the remains and/or contributed to further degradation as in the case of several severely weathered elements from Spurge Hole.

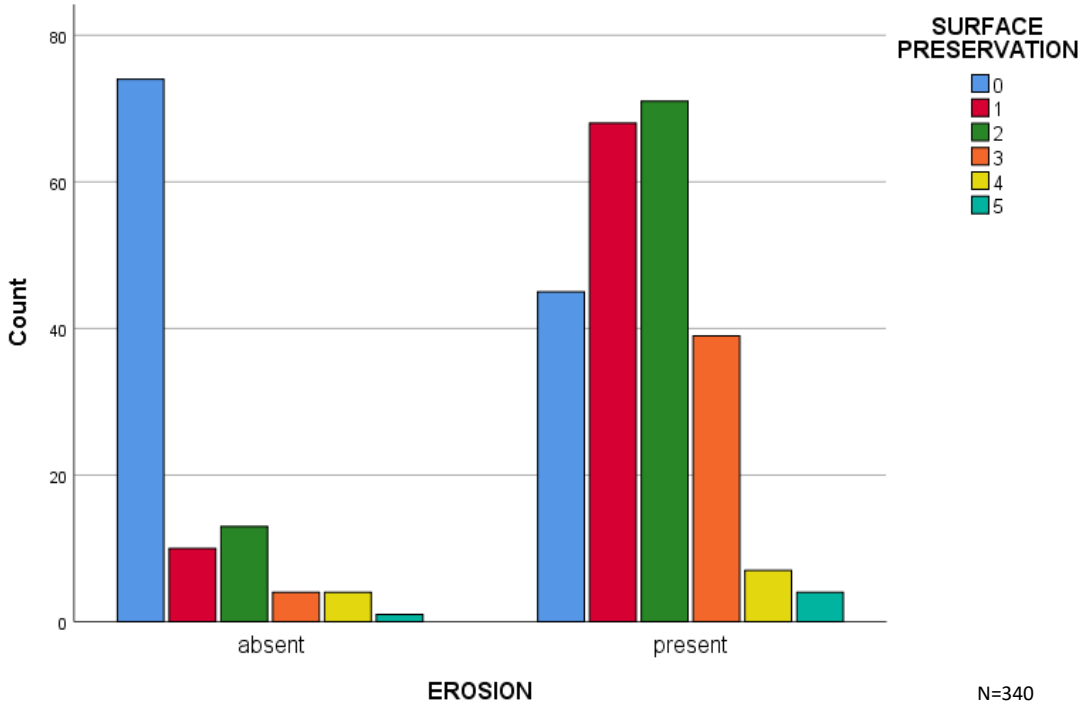


Figure 196. Surface preservation scores on eroded and non-eroded remains in the George Rock Shelter (0-5/poor-good).

Abrasion

- Surface preservation scores amongst abraded elements were primarily poor to medium (scores 2 to 3) whilst non-abraded elements were more severely impacted and demonstrated very poor surface preservation (score 0).

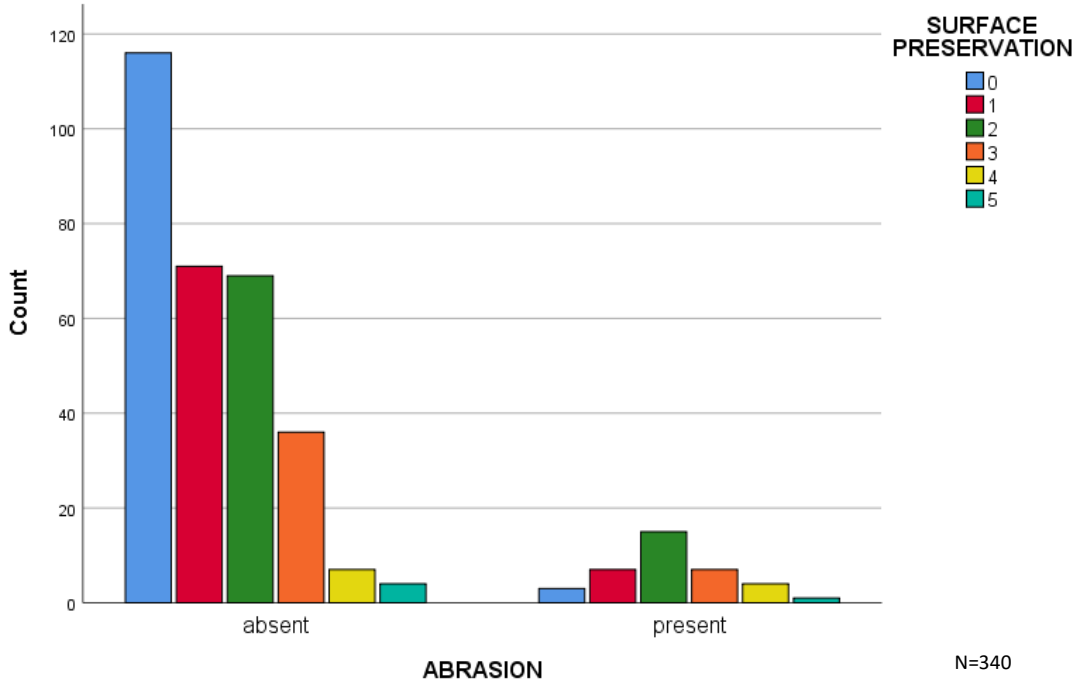


Figure 198. Surface preservation scores of abraded/non-abraded remains across sites in the George Rock Shelter (0-5/poor-good).

- Abraded elements were often eroded (N=27) and stained (N= 26) (Table 115 below) suggesting that these were possibly impacted by the same taphonomic modifications.

	EROSION ABSENT	**EROSION PRESENT**	**STAINING ABSENT**	**STAINING PRESENT**
ABRASION ABSENT	100	203	175	128
ABRASION PRESENT	6	31	11	26

Table 114. Abraded and non-abraded remains from the George Rock Shelter correlated with other taphonomic modifications (erosion and staining). N=340.

Staining

- Surface preservation scores on stained elements were primarily low (2-1) whilst most unstained elements were very poorly preserved (0).

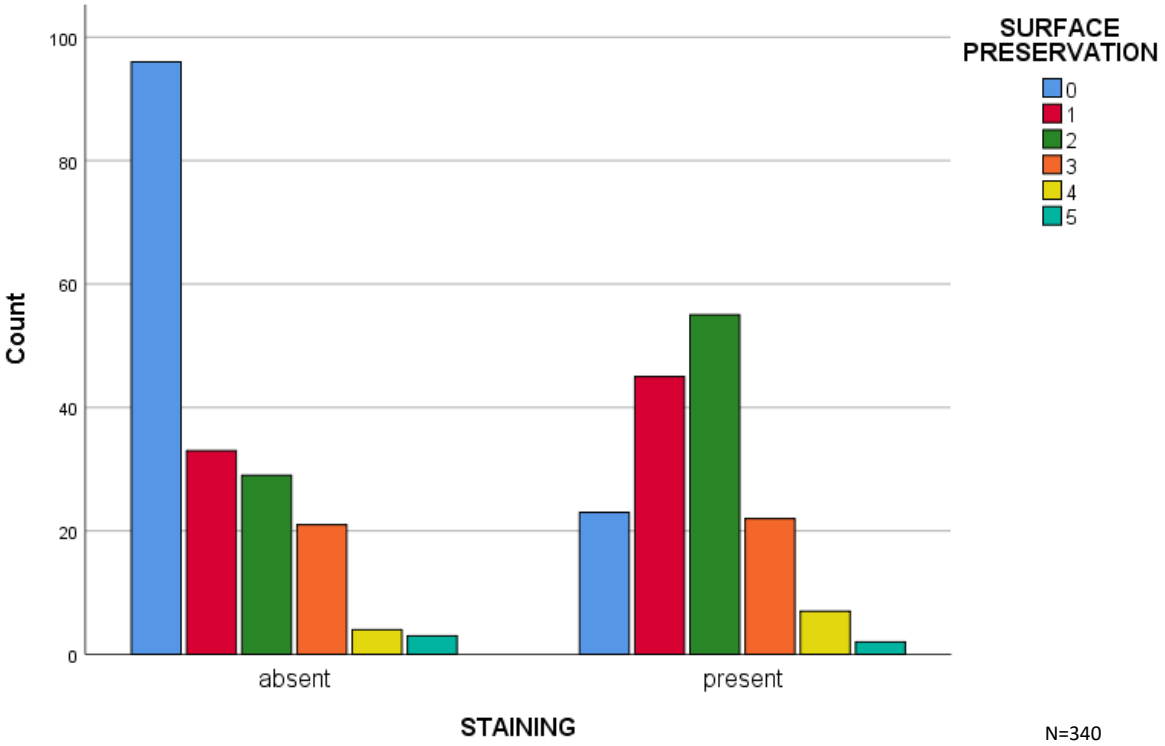


Figure 200. Surface preservation scores of stained/unstained-abraded remains across sites in the George Rock Shelter (0-5/poor-good).

- Stained elements were often accompanied by erosion (N=138) and abrasion (N=26). Analogous discolorations and black stain patches were extensively recorded on elements recovered from Ifton Quarry whilst larger and more intense black patches were recorded on elements from Little Hoyle Cave.
- Two out of the three gnawed elements (contexts 1002 and 1009) and two weathered bones (context 1009) demonstrated signs of staining.

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1
STAINING ABSENT	90	96	175	11	185	1	186	0
STAINING PRESENT	16	138	128	26	152	2	152	2

Table 115. Staining absence/presence correlated with other taphonomic modifications (WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=340.

Trauma/burning

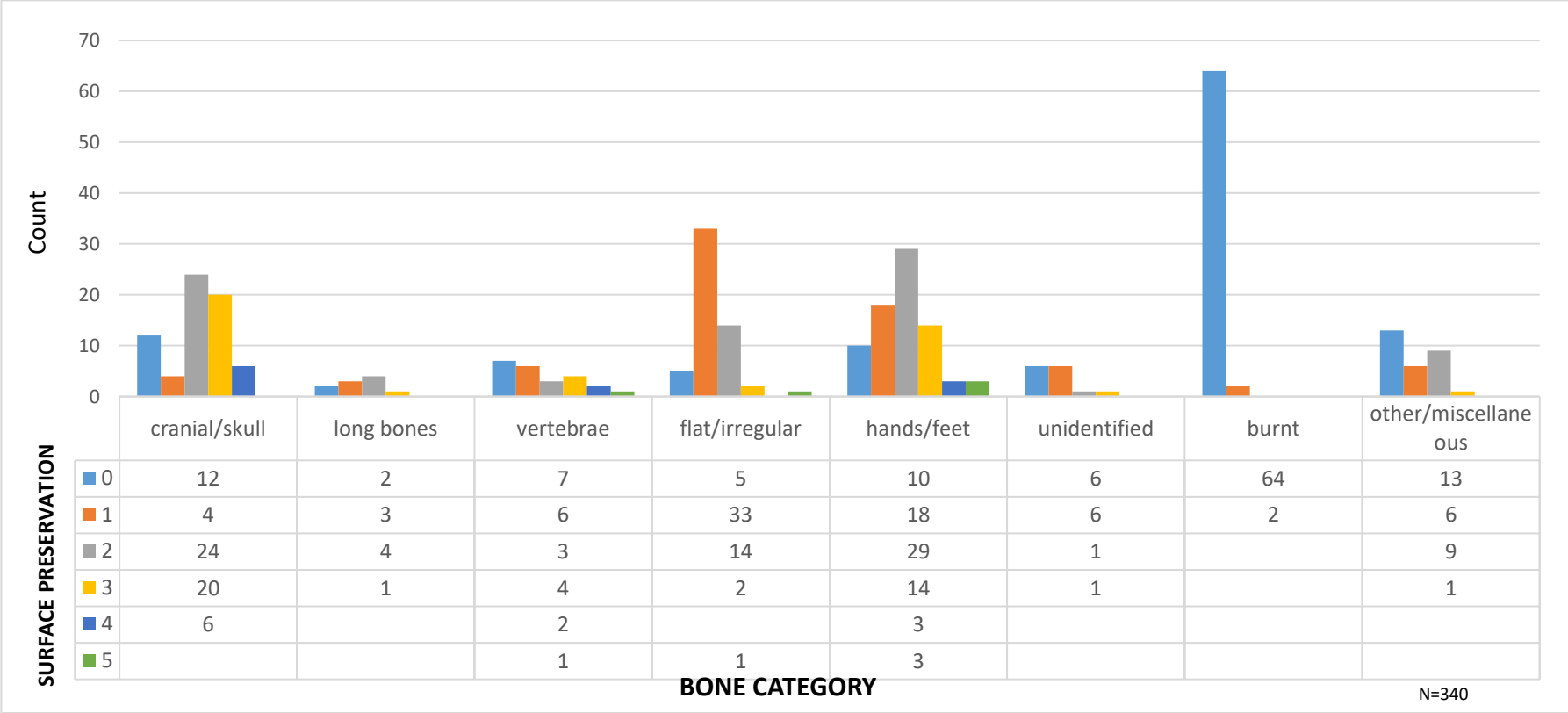
- Distinct burning stages can result from exposure and duration with the fire flames (higher intensities) and stage 0 can even appear from post-fire breakage (e.g. protected internal surface).

BURNING													
	NO BU SEQ (TOTAL)	BU SEQ –MIN AND MAX STAGE										BU SEQ TOTAL	TOTAL (BURNT)
MAX BU		0-2	0-3	0-4	1-4	1-5	2 -3	2-5	3-4	3-5	4-5		
1	3												3
2		1										1	1
3	4		3				4					7	11
4	13			3	1				11			15	28
5	8					1		2		4	9	16	24
TOTAL (BURNT)	28	1	3	3	1	1	4	2	11	4	9	37	BU N=67

Table 116. Evidence of burning – MAX BU= maximum burning stage; NO BU SEQ= no burning sequence (fragments reached their maximum burning stage); BU SEQ Min to Max= fragments exhibiting different burning stages. Minimum and maximum stages indicated here. BU SEQ Total=total of burned elements with different burning stages. N=67.

Surface preservation

- Several elements demonstrated medium (N=43, 12.6%) to good surface preservation (score 4/N=11, 3.2%; score 5/N=5, 1.5%).



SURFACE PRESERVATION	cranial/skull	long bones	vertebrae	flat/irregular	hands/feet	unidentified	burnt	other/miscellaneous
0	12	2	7	5	10	6	64	13
1	4	3	6	33	18	6	2	6
2	24	4	3	14	29	1		9
3	20	1	4	2	14	1		1
4	6		2		3			
5			1	1	3			

Figure 201. Frequencies of surface preservation scores in the George Rock Shelter divided by bone type (0-5/poor-good).

Microscopic results

- One cranial fragment (SNO: 54/see Appendix 1/Sheet 3/Histology) sampled from layer 1007 (post-Medieval) but not used in this analysis, demonstrated similar histological preservation (OHI score: 1), no irregularities in identifiable MFD (budded and linear longitudinal), however birefringence levels appeared higher (score 2/medium). Microcracking was also present and surface erosion had severely impacted its surface (surface preservation score: 0). Extensive bacterial attack similarly suggests primary deposition in the site, however, higher collagen preservation suggests that loss of birefringence on the cranial fragments examined (SNOs: 46-52/Neolithic horizons) must have resulted from prolonged exposure in the acidic environment with erosive process demineralising the fragments more extensively compared to later deposits. Loss of birefringence therefore could relate to the duration of exposure to agents that demineralise the bone.
- Inclusions, infiltrations and/or microcracking were not observed amongst samples whereas microstructural staining, ranging from brown (fair, dark) to brown/red, was present amongst all samples.

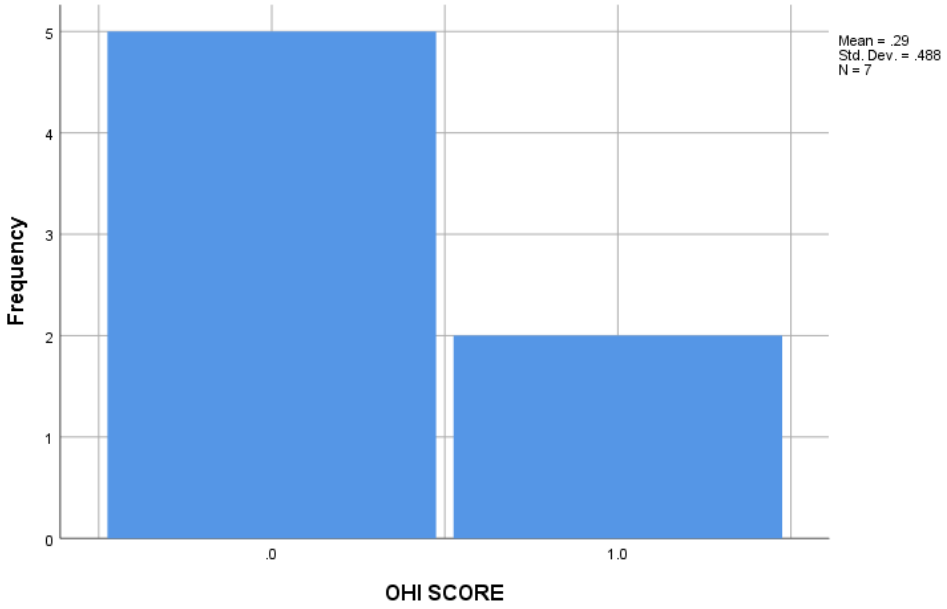


Figure 202. Histogram indicating OHI scores from the George Rock Shelter.

- Correlations between OHI and the Birefringence Index were apparent with cranial fragments (OHI score: 0) exhibiting slight collagen preservation in places (score 1/low) (Table 118).
- Other microscopic observations (inclusions, infiltrations, microcracking and microstructural staining) did not show any patterns between samples with low or absent collagen preservation and therefore no pattern can be highlighted.

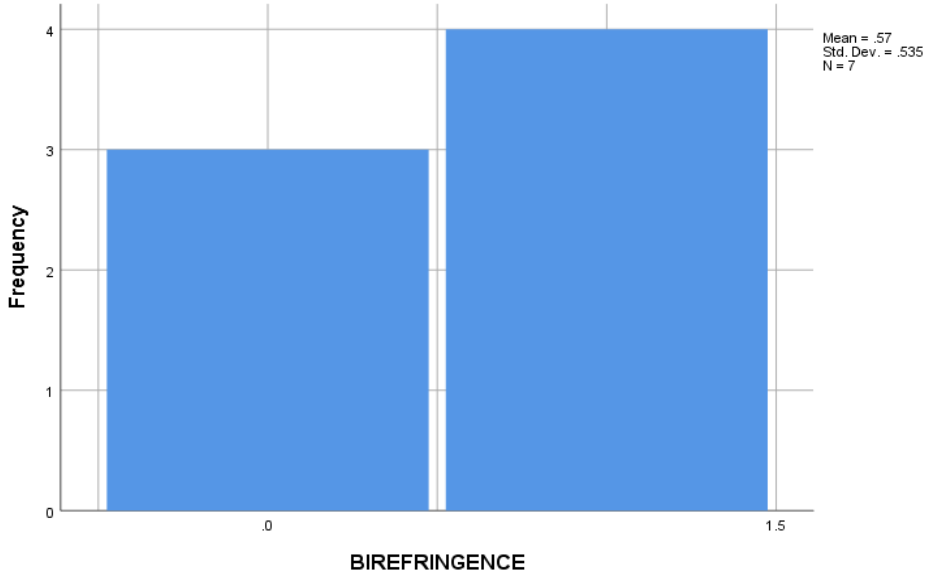


Figure 204. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from the George Rock Shelter.

OHI SCORE		BIREFRINGENCE INDEX	
		NONE (0)	LOW (1)
	0	2	3
	1	1	1

Table 117. Birefringence scores from the George Rock Shelter cross-referenced with OHI scores. N=7.

- Inclusion and infiltration colour was primarily brown (dark and/or fair) or black whilst microstructural staining ranged from brown (fair, dark) to brown/red (observed in six samples). No correlations between surface staining and microstructural staining were apparent.

SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
46	CF	0	brown - fair	black/brown	brown - fair, dark; brown/red	1
47	CF	0	black	no infiltrations identified	brown/red - fair; red - fair	1
48	CF	1	black	no infiltrations identified	brown/red - fair	0
49	CF	0	brown - dark	no infiltrations identified	brown/red	0
50	CF	1	no inclusions identified	black	brown/red - dark	1
51	CF	0	no inclusions identified	brown - fair	brown - fair	1
52	CF	0	no inclusions identified	brown - dark; fair (polar)	brown/red - dark	0
53	CF	1	red - dark	no infiltrations identified	red - fair; brown - fair	2

Table 118. Samples (N=7) from the George Rock Shelter. Indication of element (ELEM) – cranial fragment (CF), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium).

OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK
0	3	3	5	1
1	1	1	2	0

Table 119. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI scores. N=7.

- Intensity patterns were normally distributed amongst samples with OHI scores zero to one demonstrating low concentrations of both inclusions and infiltrations in the microstructure.

OHI SCORE	INCLUSION INTENSITY		INFILTRATION INTENSITY			CRACKING INTENSITY	
	0	**1**	**0**	**1**	**2**	**0**	**1**
	ABSENT	**LOW**	**ABSENT**	**LOW**	**MEDIUM**	**ABSENT**	**LOW**
0	2	3	2	2	1	4	1
1	1	1	1	1	0	2	0

Table 120. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=7.

7.4. Little Hoyle Cave

Frequency of skeletal remains

- Adult teeth included four 1st molars (N=4, 28%), one second molar (7%), two 3rd molars (14%) and one first upper premolar (7%). A lower number of adult loose teeth included three canines (21%) and one (7%) unidentified premolar (possibly lower).

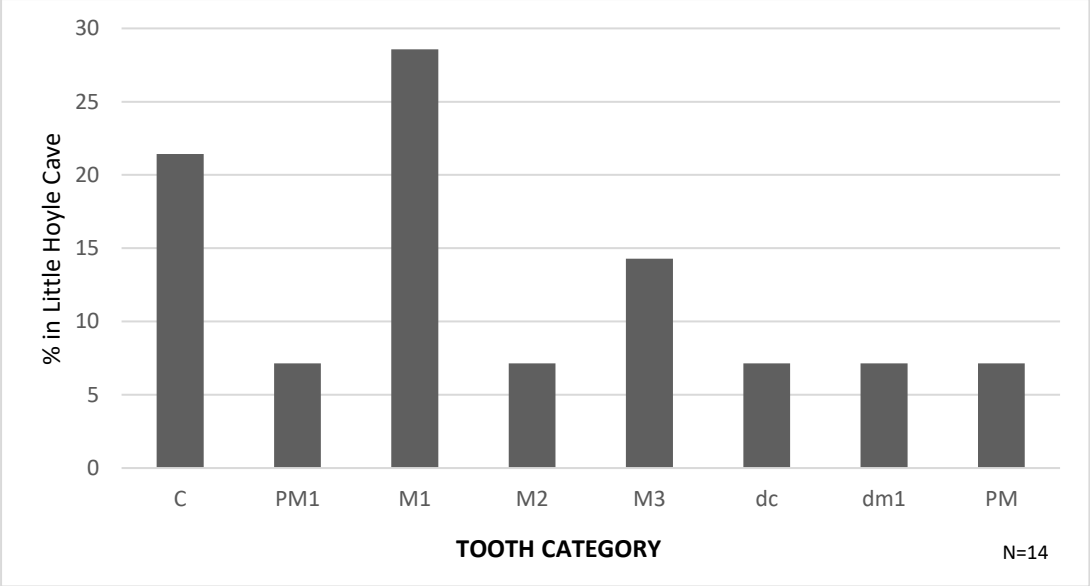


Figure 208. Teeth distributions in Little Hoyle Cave. C= canine, PM1= 1st premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dc= deciduous canine, dc= deciduous canine, dm1= deciduous 1st molar, PM= premolar (no identification of exact tooth).

- Staining was present on six long bones, a modification largely recorded amongst all elements recovered from this site. Erosion was further identified on four limbs with evidence of gnawing on one femur (SNO: 82) and signs of weathering (stage one) and abrasion on one ulna (SNO: 108).
- Surface preservation scores amongst all limbs was overall low (scores 0-2) whilst a single ulna 108 (SNO) had been impacted by more taphonomic modifications (weathering, erosion, staining, signs of abrasion) and survived relatively better compared to other limbs (surface preservation score 3).
- All limbs were fragmented whilst surviving epiphyses primarily included proximal ends (N=5). Three long bones (SNOs: 83, 95, 107) exhibited fractures including fresh breaks on femur 83 and humerus 107 and a dry break on femur 95. No other signs of processing (e.g. sharp force trauma) or handling were identified amongst fresh breaks.

LONG BONE		EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
	HUMERUS	0	1	1	0
	RADIUS	0	0	0	0
	ULNA	0	2	0	2
	FEMUR	1	3	3	1

Table 122. Presence/ absence of epiphysis and shafts based on long bone representation in Little Hoyle Cave. N=7.

Element completeness

- Surface preservation scores amongst fragmented remains fluctuated with cranial/skull remains demonstrating low surface preservation (scores 2-1), however, overall scores indicated contrasting patterns amongst higher (3-5) and lower preservation (0)
- Complete hands/feet demonstrated normal distribution scores with scores rising from poor surface preservation to high (2-5).

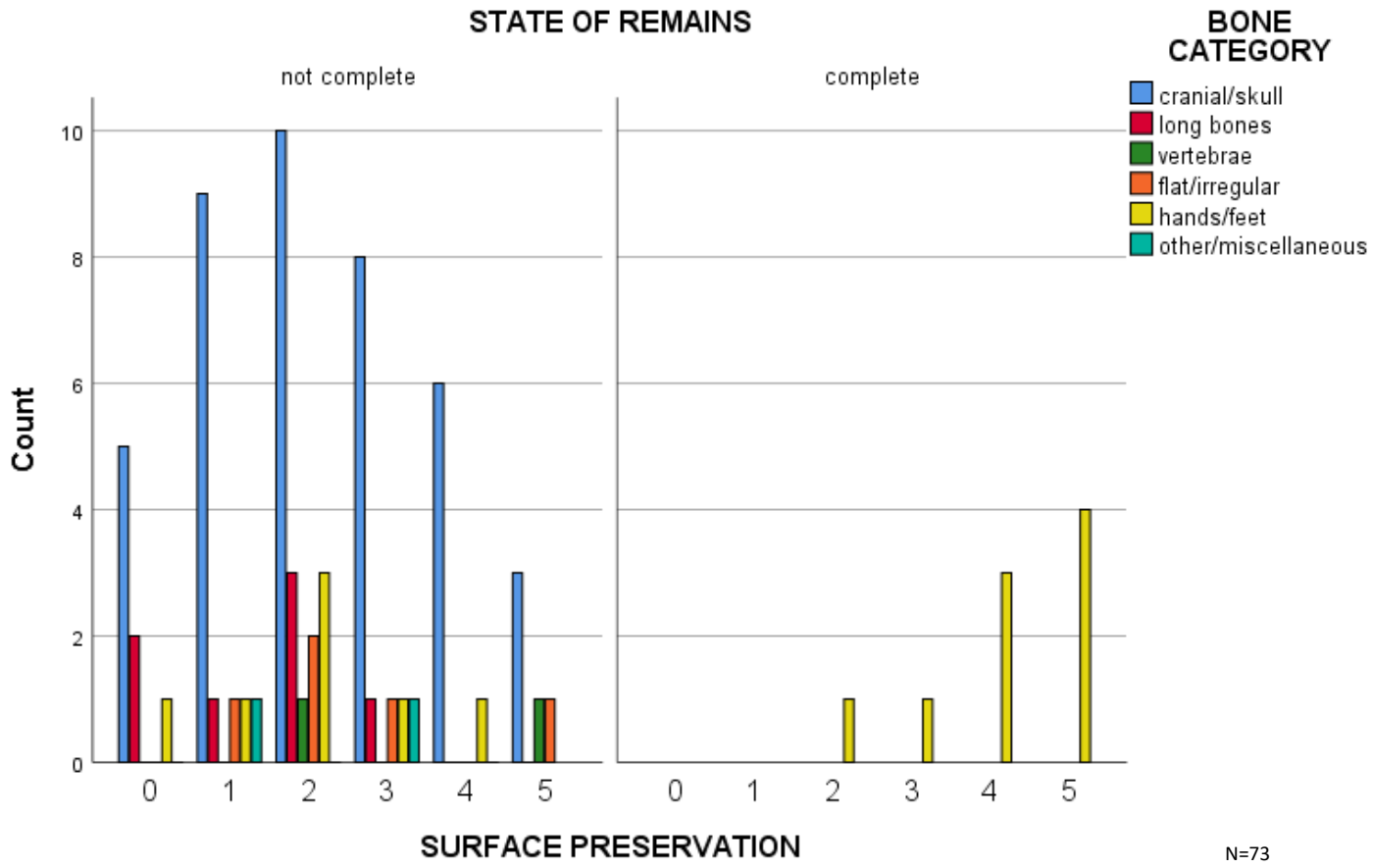


Figure 209. State or remains in Little Hoyle Cave based on bone category and surface preservation scores (0-5/poor-good). N=excluding loose teeth.

MNI, demography and pathology

- Signs of calculus and abscesses were noted (N=3 respectively) with one mandible (SNO: 84) demonstrating an abscess and possible ante-mortem tooth loss. Dental pathologies on four loose teeth included calculus with one lower first molar exhibiting possible signs of caries. Four endocranial lesions were recorded on loose cranial fragments that resembled unusual meningeal grooves on their surface (SNOs: 119, 128, 132 and 136).

Taphonomy – Macroscopic results

Weathering

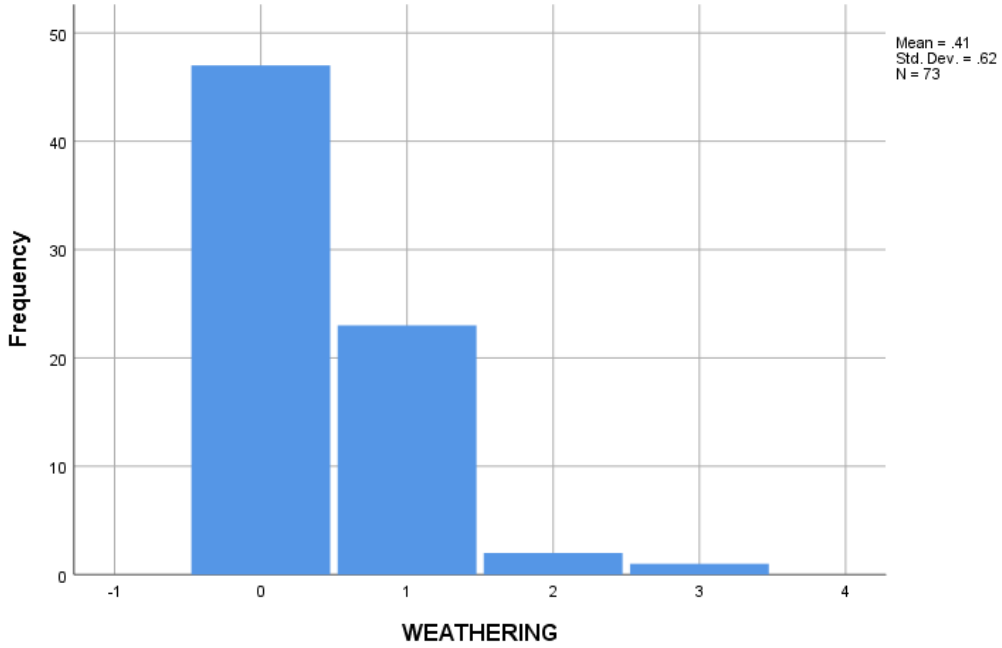


Figure 212. Weathering frequencies (0/no weathering and stages 1-3) from Little Hoyle Cave.

- Similar to non-weathered bones, surface preservation scores amongst all weathered elements (stages 1-3) were primarily low (2-0) with five elements (weathering stage 1) demonstrating higher surface preservation scores (proximal hand phalanx and atlas/ score 5; two mandibulae and one temporal fragment/ score 4. Proximal hand phalanx 72 (SNO) in particular was recovered from trench number 4, outside entrance two, suggesting that depositions were made in separate parts of the cave as mentioned in Rolleston's *et al.* report (1878) (see Appendix 5/ Site Backgrounds).

- Correlations between weathered elements and other taphonomic modifications demonstrated weathering was accompanied by staining and erosion, although the latter modification was not present on all weathered elements (Table 125/Appendices).

WTH STAGE	EROSION		STAINING		ABRASION	
	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
1	6	17	1	22	13	10
2	0	2	0	2	2	0
3	1	0	0	1	1	0

Table 123. Weathering stages 1-4 correlated with other taphonomic modifications. N=26 (only weathered bones).

Gnawing

- No signs of weathering were identified on gnawed elements and all surface preservation scores were medium/poor (score 2). Evidence of erosion was recorded on metatarsal SNO 73 and femur SNO 82 with abrasion and possible insect damage present on metacarpal SNO 102. Staining was further recorded on all gnawed elements with no particular pattern identified. Metatarsal SNO 73 in particular was discovered in Trench four, outside entrance two whilst context information was absent for femur SNO 82 and metacarpal SNO 106.

Erosion

- Signs of erosion, cave concretion and digestion were noted on four loose teeth however no context information is available to verify whether these were found amongst eroded human remains or from other parts of the cave.

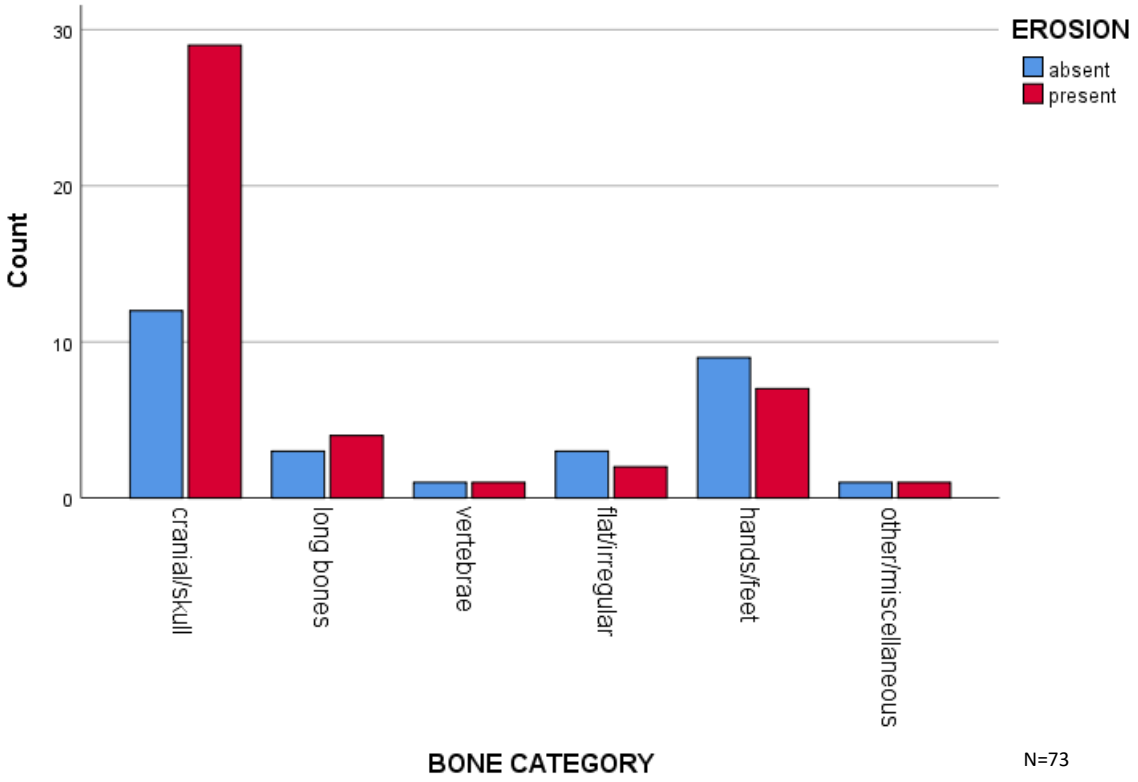


Figure 213. Frequency of erosion absence/presence based on bone category in Little Hoyle Cave.

- Surface preservation scores amongst eroded remains were primarily poor to medium (2/1-3) with non-eroded remains demonstrating ranging surfaced preservation scores (most low scores 0-2). Whilst erosion was present on most elements, it appears that the deviation amongst non-eroded and eroded remains was not major, suggesting erosive forces did not severely impact surviving elements.

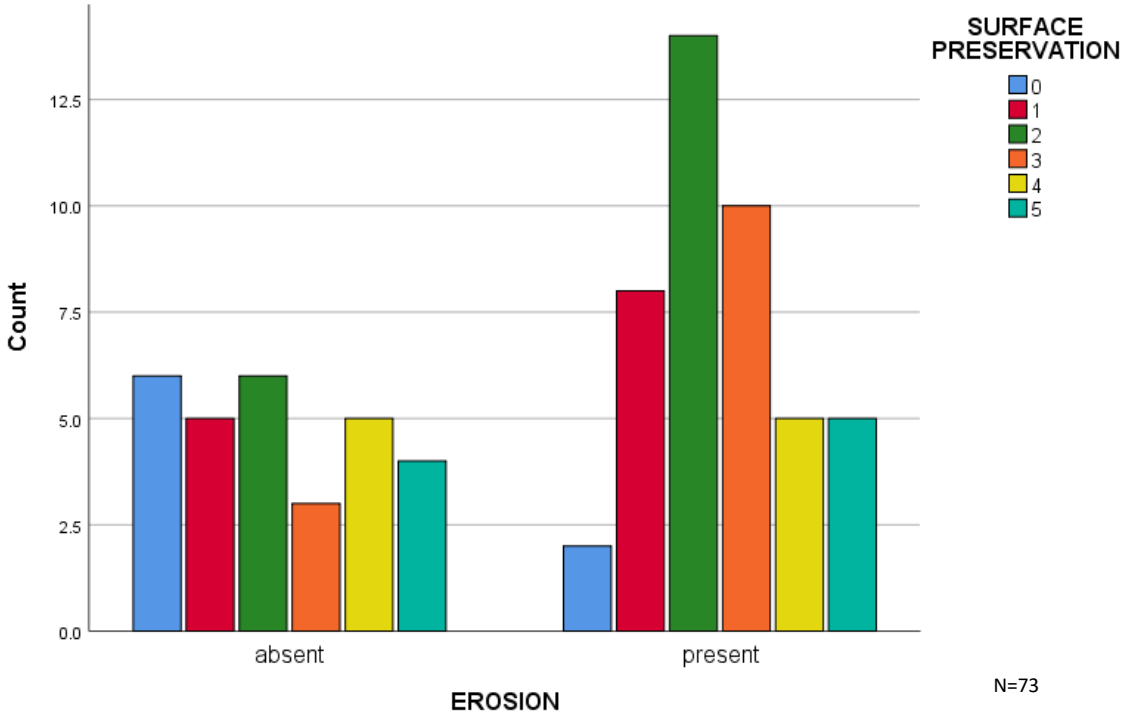


Figure 214. Surface preservation scores on eroded and non-eroded remains in Little Hoyle Cave (0-5/poor-good).

Abrasion

- Non-abraded elements were less well-preserved (scores 1-0) compared to abraded elements (scores 3-4) with equal distributions between scores one and five.

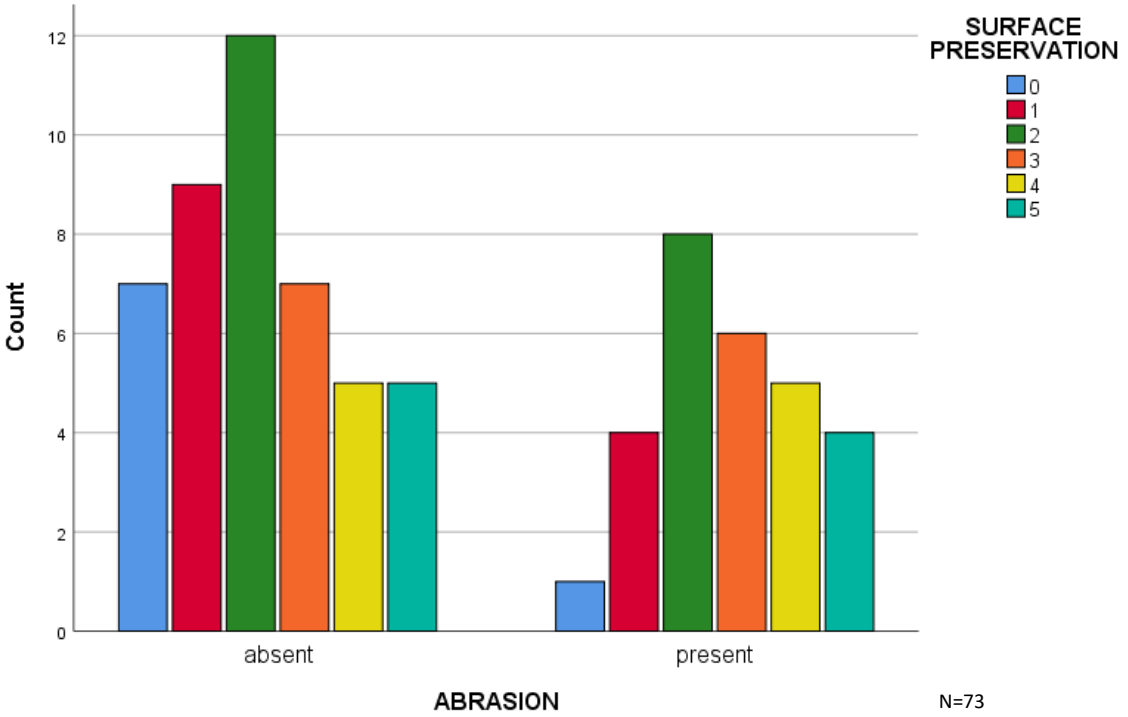


Figure 216. Surface preservation scores of abraded/non-abraded remains across sites in Little Hoyle Cave (0-5/poor-good).

	EROS ABSENT	EROS PRESENT	STAIN ABSENT	STAIN PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
ABRASION ABSENT	18	27	9	36	29	13	2	1
ABRASION PRESENT	11	17	7	21	18	10	0	0

Table 124. Abraded and non-abraded remains from Little Hoyle Cave correlated with other taphonomic modifications (EROS=erosion, STAIN= staining, WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=73.

Staining

- The vast majority of stained human remains showed low (score 2/N=18; score 1/N=11) to medium surface preservation scores (score 3/N=11) which reflects the severity of this modification.
- Staining was often accompanied by erosion (N=35).

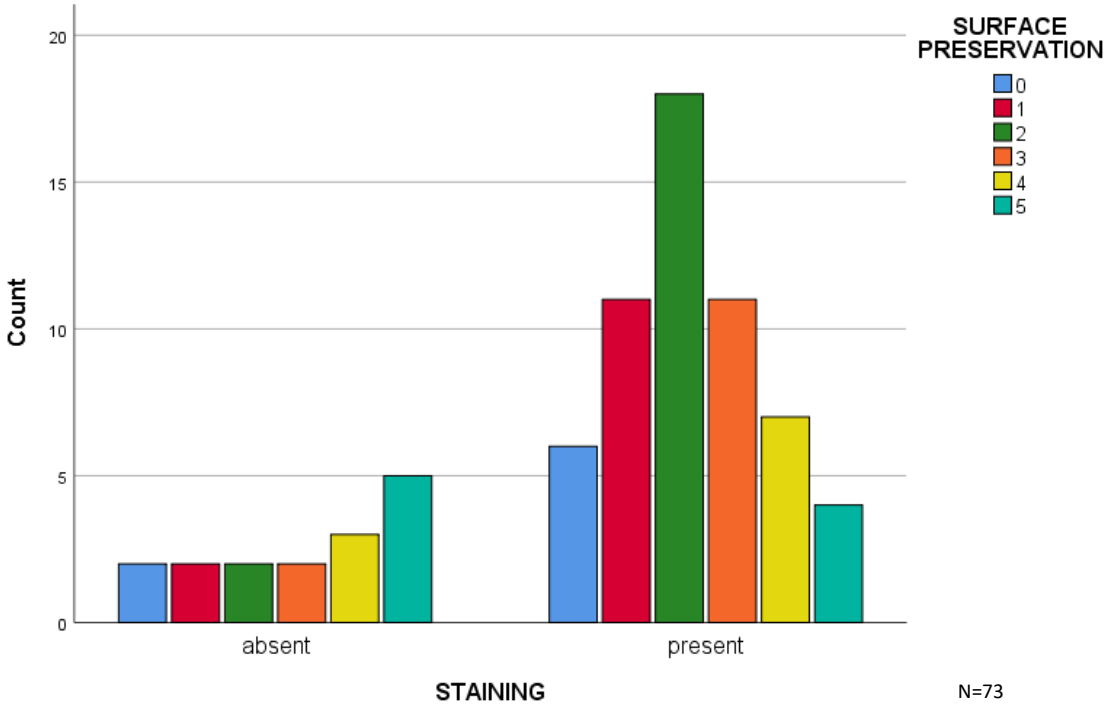


Figure 218. Surface preservation scores of stained/unstained remains across sites in Little Hoyle Cave (0-5/poor-good).

	EROS ABSENT	**EROS PRESENT**	**AB ABSENT**	**AB PRESENT**	**NO WTH**	**WTH STAGE 1**	**WTH STAGE 2**	**WTH STAGE 3**
STAINING ABSENT	7	9	9	7	15	1	0	0
STAINING PRESENT	22	35	36	21	32	22	2	1

Table 125. Stained and non-stained remains from Little Hoyle Cave correlated with other taphonomic modifications (EROS=erosion, STAIN= staining, AB= abrasion, WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=73.

Surface preservation

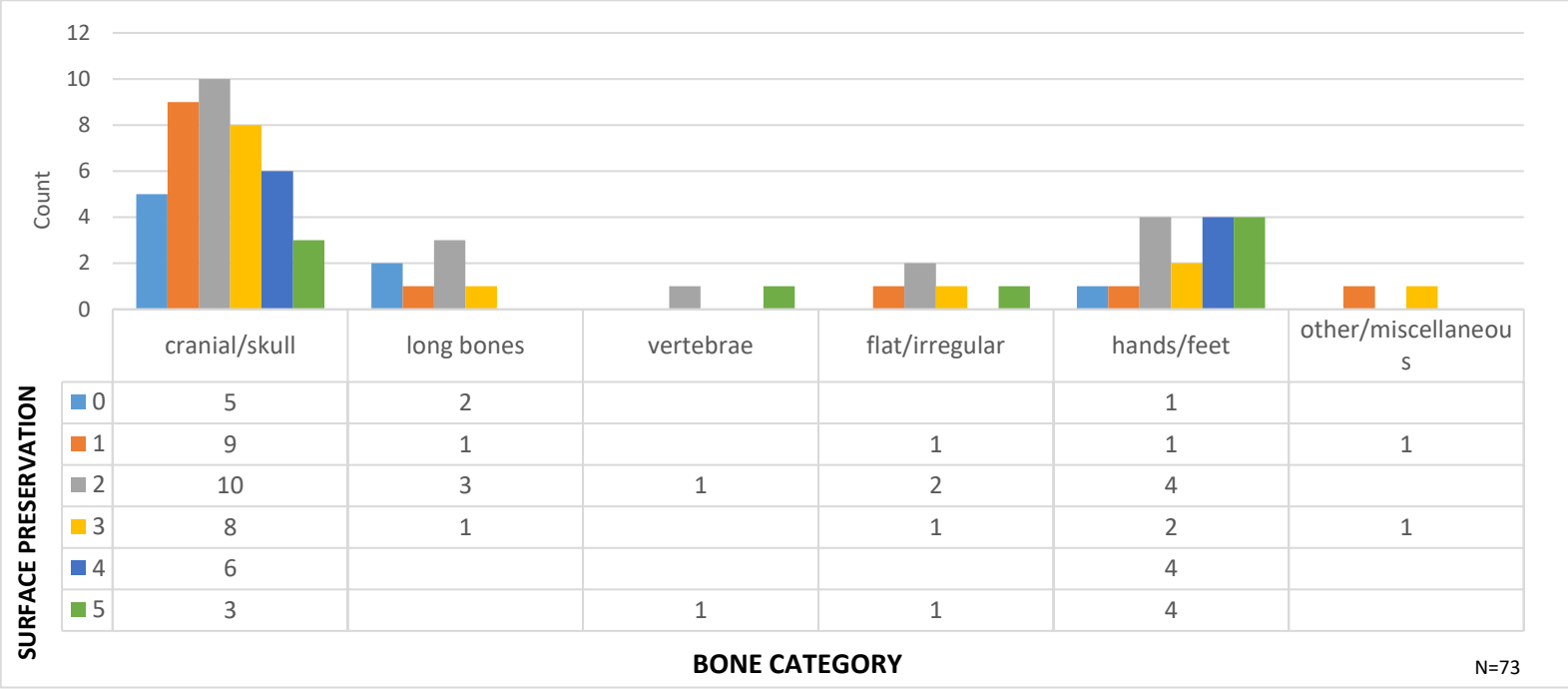


Figure 220. Frequencies of surface preservation scores in Little Hoyle Cave divided by bone type (0-5/poor-good).

Microscopic results

- Three cranial fragments scored low (1) on the OHI scale whilst one weathered fragment indicated better histological preservation (3). Weathered mandibulae (N=3) showed different levels of bacterial attack (1-3) whereas only one long bone had been affected by weathering (score 2). No particular pattern was therefore identified amongst weathering presence and OHI scores

- Inclusions and infiltrations (black/brown, brown fair, dark) were observed in the microstructure of all samples similarly to microstructural staining (ranging from black fair/dark to orange/brown and red/orange under polar), however, no particular pattern was identified amongst these samples.
- Cracking was not present in all samples. OHI scores primarily ranged one to three with a few exceptions altering the microstructural trajectory of the assemblage. Surface preservation scores amongst samples were primarily low to medium (0-3) with a single mandible (SNO: 2) demonstrating high OHI score (5) and high surface preservation (5). Overall OHI scores correlated with surface preservation scores excluding a mandible (SNO: 5) that showed extensive bacterial attack (score 1) nonetheless, good surface preservation (score 4) despite the presence of weathering, erosion, staining and abrasion.

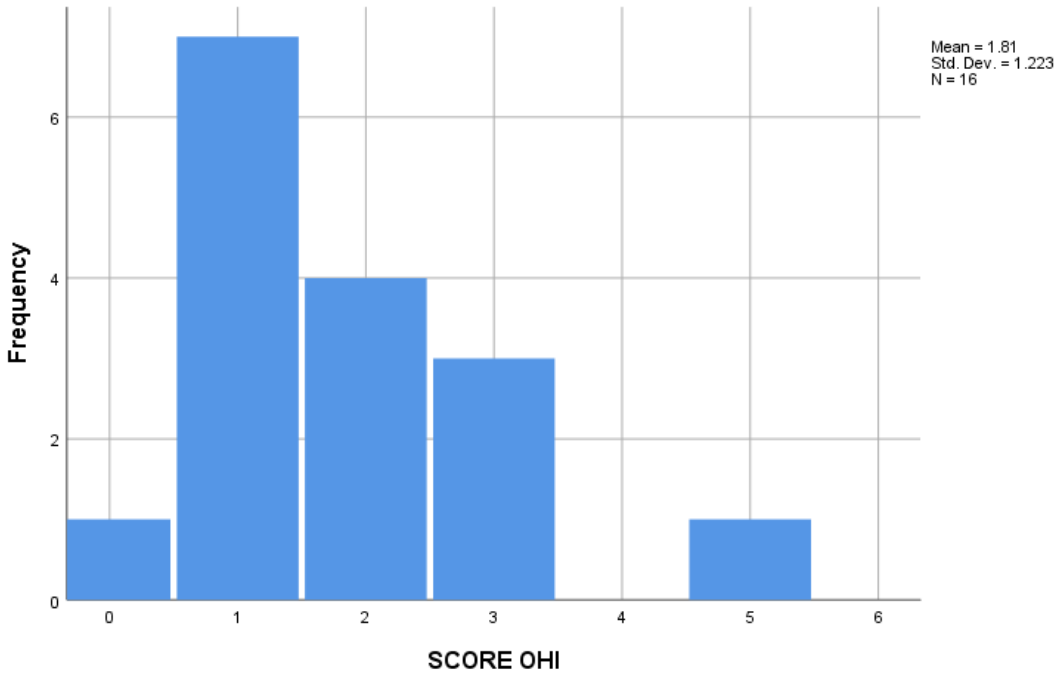


Figure 221. Histogram indicating OHI scores from Little Hoyle Cave.

- A single mandible (SNO: 2/OHI score: 5) nonetheless, showed slight collagen loss along with medium inclusion intensity, microcracking and a high level of infiltrations that might have been responsible for the medium birefringence score (infiltration of extraneous material might have caused loss of collagen).

- Surface erosion was further detected on the aforementioned mandible, however it did not impact the element (surface preservation score: 5). Birefringence scores primarily ranged low to medium (1-2) with collagen loss possibly resulting from demineralisation, cracking, erosion (N=11 samples) and weathering of the surface of the bones (N=8 samples). No other pattern was detected amongst birefringence scores, other diagenetic parameters and/or surface taphonomy.

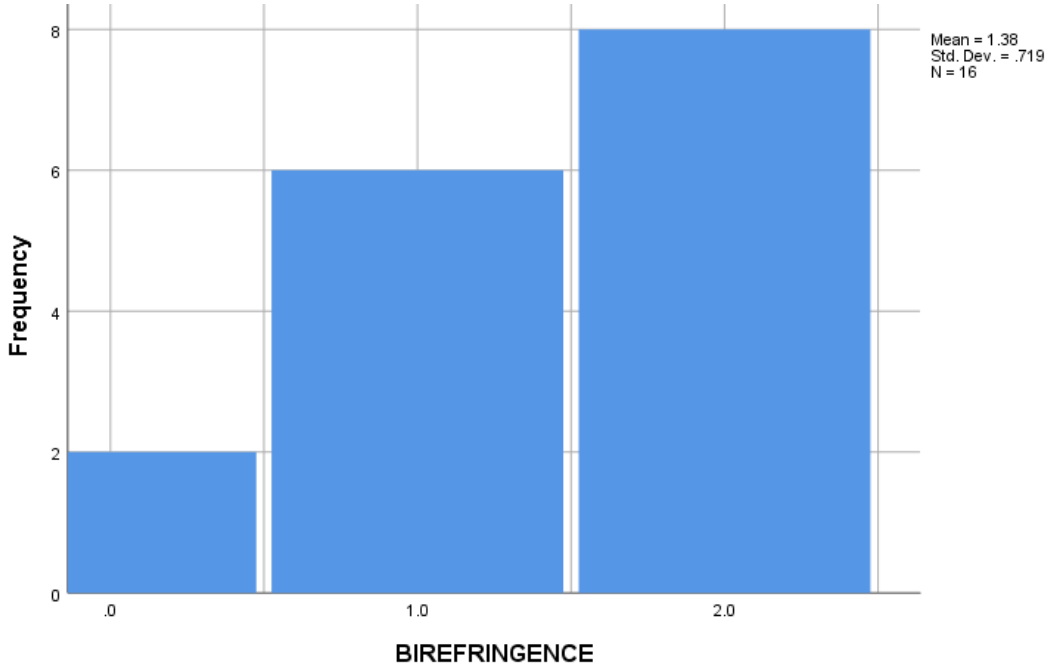


Figure 225. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium) from Little Hoyle Cave.

OHI SCORE		BIREFRINGENCE INDEX		
		NONE (0)	LOW (1)	MEDIUM (2)
	0	0	1	0
	1	2	4	1
	2	0	1	3
	3	0	0	3
	5	0	0	1

Table 127. Birefringence scores from samples from Little Hoyle Cave cross-referenced with OHI scores. N=16.

- Intensity patterns amongst infiltrations and inclusions were primarily low to medium (1-2) whilst cracking intensity scores ranged zero to one (N=5 respectively) to 3 (N=5) (Table 131). No pattern was identified amongst intensity patterns and OHI scores as both low and higher scores were correlated with various intensity patterns.
- Infiltration and inclusion colours ranged from black/brown, brown (fair, dark), grey (SNO: 7) and red or orange/brown (Table 133). Microstructural staining discolouration was mainly brown (fair, dark) however indications of orange/brown (either under normal or polarised light), with one case of red/orange discolouration under polarised light (SNO: 11), were observed on a notable number of samples (N=8) (see Table 130 below). Collagen loss was therefore not associated with presence of microstructural staining as discolourations were identified amongst all samples (SNO: 4 demonstrated absence of birefringence).

OHI SCORE		INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICRO-FISSURES
	0	1	1	1	0
	1	7	7	7	3
	2	4	4	4	4
	3	3	3	3	3
	5	1	1	1	1

Table 128. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=16.

OHI SCORE		INCLUSION INTENSITY			INFILTRATION INTENSITY			CRACK INTENSITY			
		1	**2**	**3**	**1**	**2**	**3**	**0**	**1**	**2**	**3**
		LOW	**MEDIUM**	**HIGH**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**MEDIUM**	**HIGH**
	0	1	0	0	1	0	0	1	0	0	0
	1	5	2	0	3	3	1	4	2	0	1
	2	3	0	1	2	1	1	0	1	0	3
	3	1	1	1	2	1	0	0	1	1	1
	5	0	1	0	0	0	1	0	1	0	0

Table 129. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=16.

DATE	SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
	1	CF	3	black/brown	brown - dark	brown - fair, dark; orange/brown	2
	2	M	5	black/brown	brown - fair, dark	brown - orange	2
MIDDLE NEOLITHIC	3	M	2	brown - dark	brown - dark	brown - fair, dark; orange/brown - fair, dark	2
	4	M	1	brown - dark	brown - dark	brown - dark	0
	5	M	1	brown - dark	orange/brown	brown/orange- dark, fair	1
EARLY NEOLITHIC	6	M	3	brown - dark, fair	brown - dark; black	brown/orange	2
	7	M	1	brown - dark, fair; grey - fair	black; brown - dark	brown- fair, dark	1
	8	M	2	brown - dark	brown/black	fair brown	2
	9	CF	1	brown - fair	brown - dark	brown, dark; faded orange-brown, intense orange/red	2
	10	CF	2	brown - fair	brown - dark	intense orange, orange/brown fair; brown - fair; dark brown in areas where collagen is preserved under polar light	1
	11	CF	1	brown - dark	brown/black; brown - dark	orange/brown fair; red/orange under polar	1

	12	CF	1	brown - fair; red	brown - dark; black/brown	brown	1
	13	LB	1	brown - fair	brown	orange/brown - fair; brown - fair	0
	14	LB	3	brown - dark; brown/grey - fair	black/brown	brown - fair, dark	2
EARLY NEOLITHIC	15	LB	0	brown - fair	black/brown	brown/red - dark; brown - fair	1
	16	LB	2	brown - fair	black	brown - dark, fair	2

Table 130. Samples (N=16) from Little Hoyle Cave. Indication of element (ELEM) – cranial fragment (CF), mandible (M) and long bone (LB), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high).

- Microstructural staining was very often accompanied by surface staining, particularly in lower OHI scores (1).
- Surface erosion was further detected amongst skull samples (N=11) and was accompanied by microstructural staining, infiltrations, inclusions and several cases of microcracking amongst samples with low to medium OHI scores (1-2).

OHI SCORE	**STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)**	**MICROCRACKING & SURFACE EROSION**	**MICROCRACKING & WEATHERING (STAGE 1)**
OHI 0	1	0	0
OHI 1	6	3	3

OHI 2	3	2	2
OHI 3	3	2	2
OHI 5	0	1	0

Table 131. Stained samples (surface and microstructural staining), eroded, weathered (surface) with evidence of microcracking.

7.5. Priory Farm Cave

Frequency of skeletal elements

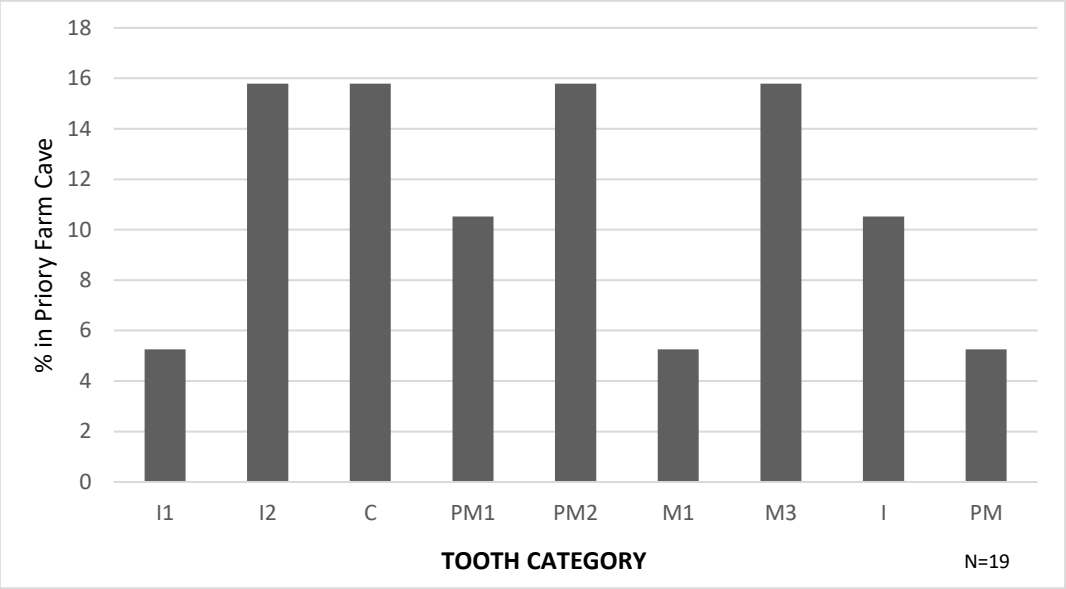


Figure 228. Teeth distributions in Priory Farm Cave. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M3= 3rd molar, I= incisor and PM= premolar (no identification of exact teeth).

- Ulna SNO 23 demonstrated signs of weathering (stage 2), abrasion and staining whilst humerus SNO 20 exhibited a fresh fracture (FFI: 3), abrasion and staining. Both limbs showed very good surface preservation (score 4). Ulna SNO 23 had an unfused distal epiphysis (no zone completion) and must have derived from the c. nine to ten years juvenile discovered amongst the assemblage (based on teeth eruption/maxilla SNO: 60). Other taphonomy identified on the long bones included signs of erosion (N=4), abrasion (N=6) and staining (N=5) whilst weathering was recorded on five limbs. Radii SNOs 24-25 showed signs of weathering stage one and three (24 and 25 respectively) and fresh fractures resulting shortly after death. Weathering suggests sub-aerial exposure prior deposition, however, some limbs might have been deposited near the entrance of the cave resulting in flaking and cracking.
- Only two long bones had been gnawed (SNOs: humerus 20, ulna 23) despite remains being discovered amongst animal bones.

Element completeness

- Surface preservation scores amongst fragmented/not complete human remains fluctuated from very good (4-5) (N=8, respectively) to very poor surface preservation (0) (N=7), possibly resulting from the multi-period depositions (Middle Neolithic, Late Bronze Age and Middle/Late Iron Age). Cranial/skull remains demonstrated the best preservation despite signs of staining, erosion and weathering on some fragments whilst vertebrae remains showed poor (0) to medium (3) preservation, possibly resulting from erosive processes (Table 135/page 136 in Appendix 6). Surface preservation scores of hands/feet were poor (0-1) to medium (33) whilst only three elements demonstrated very good preservation (5).

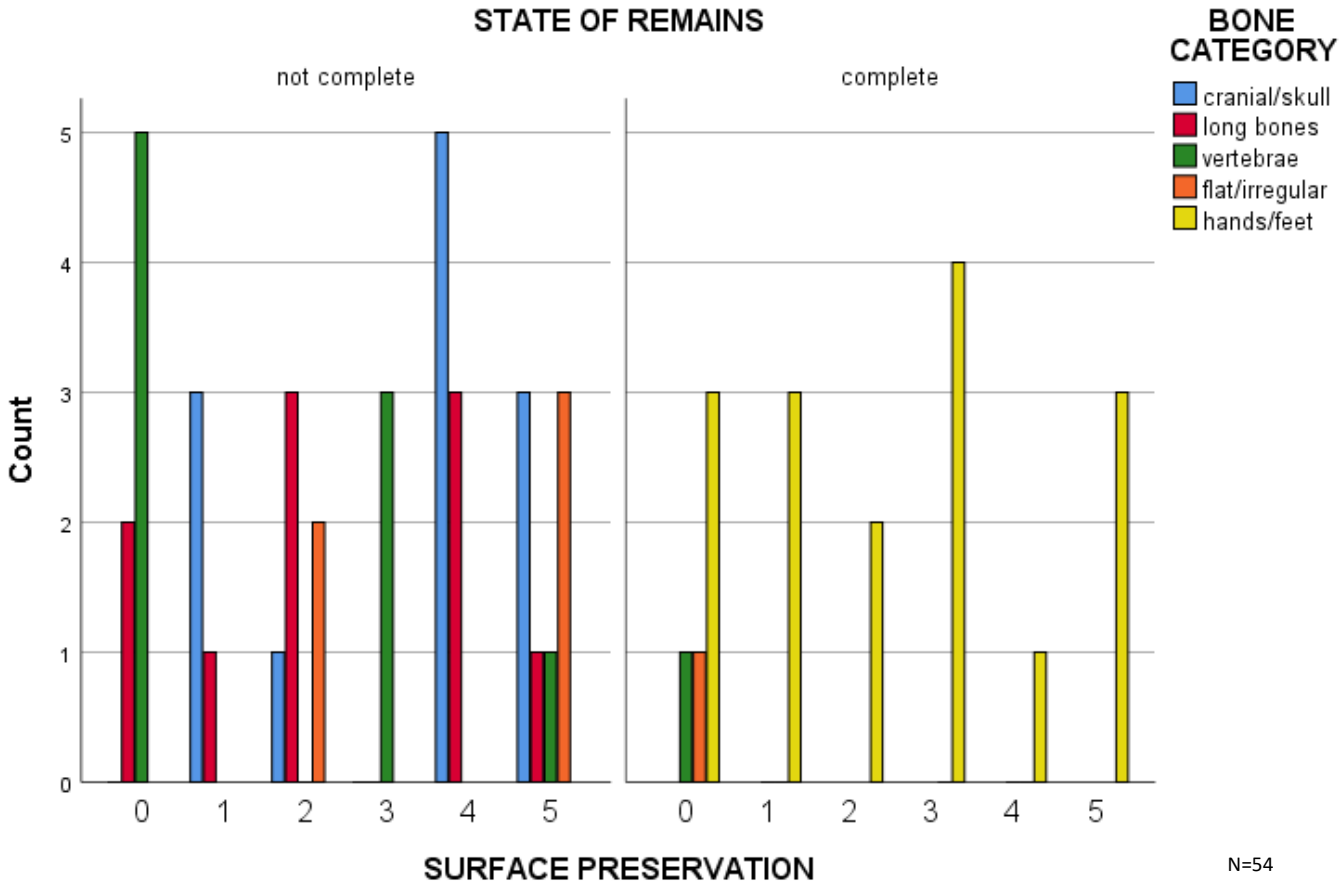


Figure 230. State or remains in Priory Farm Cave based on bone category and surface preservation scores (0-5/poor-good). N=excluding loose teeth.

BONE CATEGORY	STAIN	EROS	GN	AB	WTH			SURFACE PRES					
					(STAGE 1)	(STAGE 2)	(STAGE 3)	0	1	2	3	4	5
CRANIAL/SKULL	5	11	0	5	2	0	0	0	3	1	0	5	3
LONG BONES	4	4	2	6	1	3	1	2	1	3	0	3	1
VERTEBRAE	0	4	0	2	0	0	0	6	0	0	3	0	1
FLAT/IRREGULAR	0	3	0	3	1	1	0	1	0	2	0	0	3
HANDS/FEET	1	5	1	9	1	0	0	3	3	2	4	1	3

Table 133. Taphonomic modifications (STAIN= staining, EROS= erosion, GN= gnawing, AB= abrasion, WTH= weathering) and surface preservation scores (SURFACE PRES) (0-5/poor-good) recorded in Priory Farm Cave based on bone category. N=54.

MNI, demography and pathology

- The male cranium was incomplete and reconstructed with two fragments of left zygomatic bone and part of the right temporal not attached to the skull. Scores given for the mastoid processes (one attached to cranium, one fragmented) differed, however, detachment from the cranium and further fragmentation could have accelerated degradation.
- Caries was identified on teeth still attached in the mandibular (SNO: 58) and maxillary alveoli (SNO: 60) whilst calculus and periapical cavities were identified in the maxillary alveoli still attached on cranium SNO 66. Caries was further recorded on one loose 3rd molar.

Taphonomy

Weathering

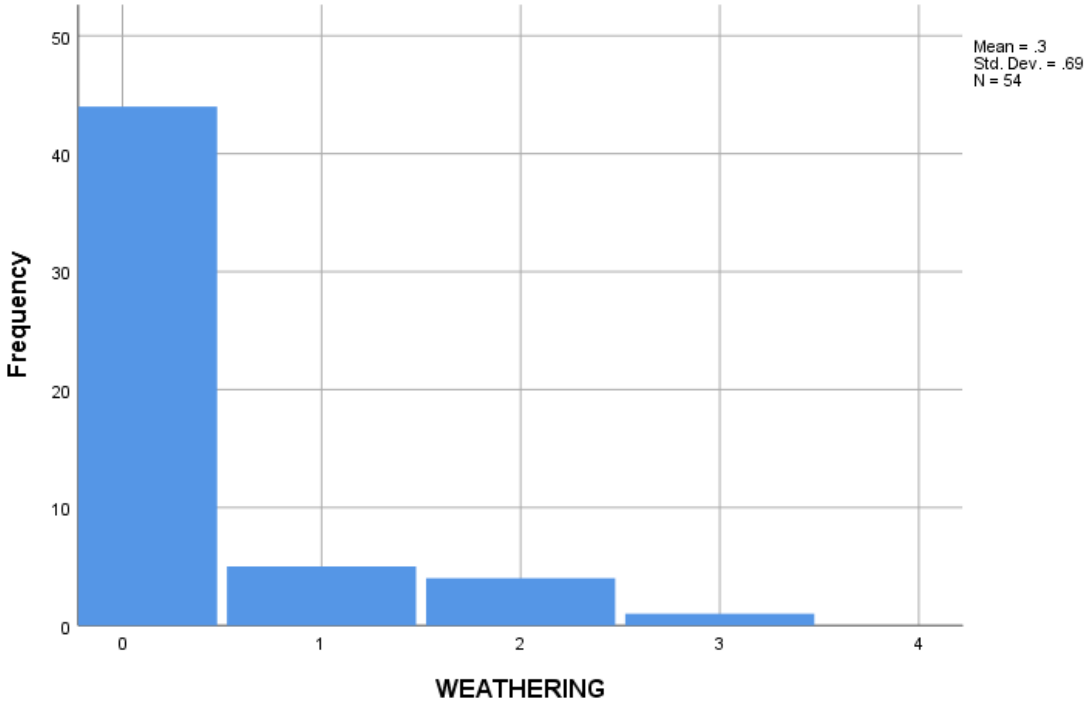


Figure 231. Weathering frequencies (0/no weathering and stages 1-3) from Priory Farm Cave.

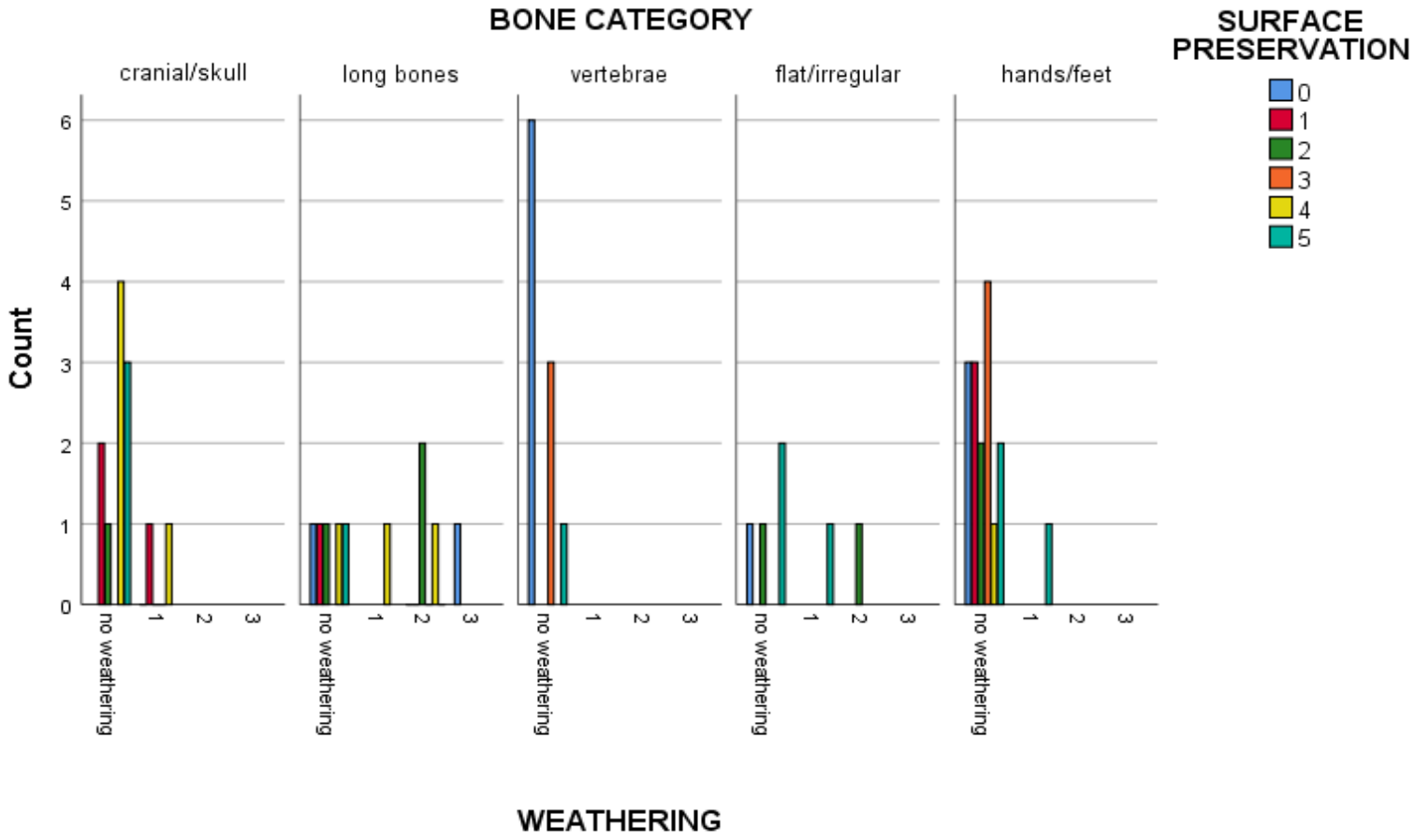


Figure 232. Weathering absence/presence (stages 1-3) based on surface preservation scores and bone category in Priory Farm Cave (0-5/poor-good).

- Weathering stage one was recorded on skull remains (maxilla and frontal fragment), one radius, one scapula and a single metacarpal.
- More advanced weathering was identified on long bones (stage 2/N=3; stage /N=1) and one clavicle (stage 2). Correlations between weathered elements and other taphonomic modifications demonstrated erosion was primarily associated with stage one weathering. Staining did not significantly impact weathered elements whilst abrasion was present on more elements.
- A single weathered ulna (SNO: 23, weathering stage 2) exhibited signs of gnawing and good surface preservation (score 4). Absence of gnawing potentially suggests that if remains were subjected to sub-aerial exposure, it might have been protected followed by deposition in the cave.
- A weathered ulna (stage 1) (SNO: 24) derived from a sub-adult (juvenile) which could represent the same sub-adult (juvenile maxilla) discovered close to the rock-wall entrance, a few meters away from an adult cranium (see Appendix 5/Site Backgrounds). Weathering might therefore reflect short protected exposure whilst advanced weathering (stage 3) on radius SNO 25 accompanied by a mixture of breaks (FFI score: 3), concretion and staining could suggest early manipulation followed by possible deposition in the inner part of the cave (stalagmite layer), disturbances and moving of interments. Sub-aerial exposure resulting in weathering could have either taken place from these later disturbances and moving of the elements closer to the entrance/outside of the cave (element exposed to elements) or from earlier handling and later deposition in the cave. Remains derive from multi-period deposits, suggesting possibly exposure to separate contexts prior to final burial which further explains contrasting weathering stages amongst elements.

WTH STAGE		EROSION		STAINING		ABRASION	
		ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
	1	1	4	4	1	2	3
	2	3	1	3	1	1	3
	3	1	0	0	1	0	1

Table 134. Weathering (WTH) stages 1-3 correlated with other taphonomic modifications. N=10 (only weathered bones).

Erosion

- Most eroded elements showed poor preservation (0) (N=7) followed by a higher scores (4) (N=6) (Figure 185). Non-eroded remains on the other hand, showed very good surface preservation (N=7) followed by medium to low scores (2 and 0/score 5 respectively).
- Erosion/root etching was further identified on the majority of loose teeth (N=11) whilst signs of concretion were present on two loose teeth.
- Four human teeth were found at the entrance of the cave, at the bottom of the shell-midden, along with a tooth (still attached on a mandible) that was further sampled for radiocarbon dating and gave a Late Bronze Age date. The exact location of remaining loose teeth is unknown/not provided in the site reports however four had not been eroded which could indicate these derived from the shell-midden at the entrance of the cave whilst remaining elements and loose teeth must have derived from the inner cave where the Middle Neolithic and L/M Iron Age mandibulae were discovered. Similarly, eroded remains (with evidence of weathering) could have derived from the same deposits in the inner cave, suggesting weathering (stage 1) resulted from prior sub-aerial exposure followed by collection and deposition in the cave.

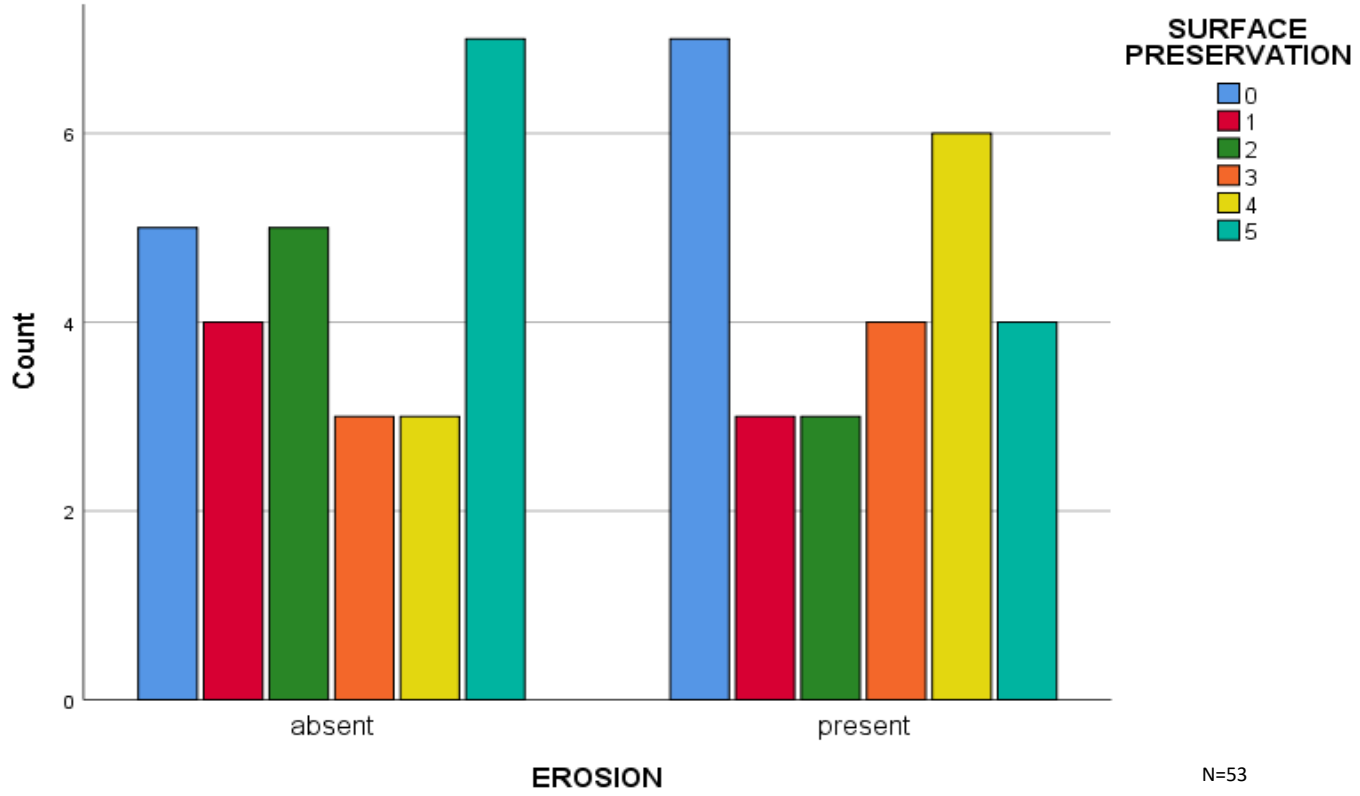


Figure 234. Surface preservation scores of abraded/non-abraded remains across sites in Priory Farm Cave (0-5/poor-good).

	AB ABSENT	AB PRESENT	STAIN ABSENT	STAIN PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
EROSION ABSENT	12	15	21	6	22	1	3	1
EROSION PRESENT	17	10	23	4	22	4	1	0

Table 135. Eroded and non-eroded remains from Priory Farm Cave correlated with other taphonomic modifications (AB-abrasion, STAIN= staining, WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=53.

Abrasion

- Surface preservation scores amongst abraded and non-abraded remains demonstrated contrasting patterns with most abraded elements showing very good surface preservation (scores 4-5) as opposed to non-abraded elements most of which displayed very poor preservation (score 0).

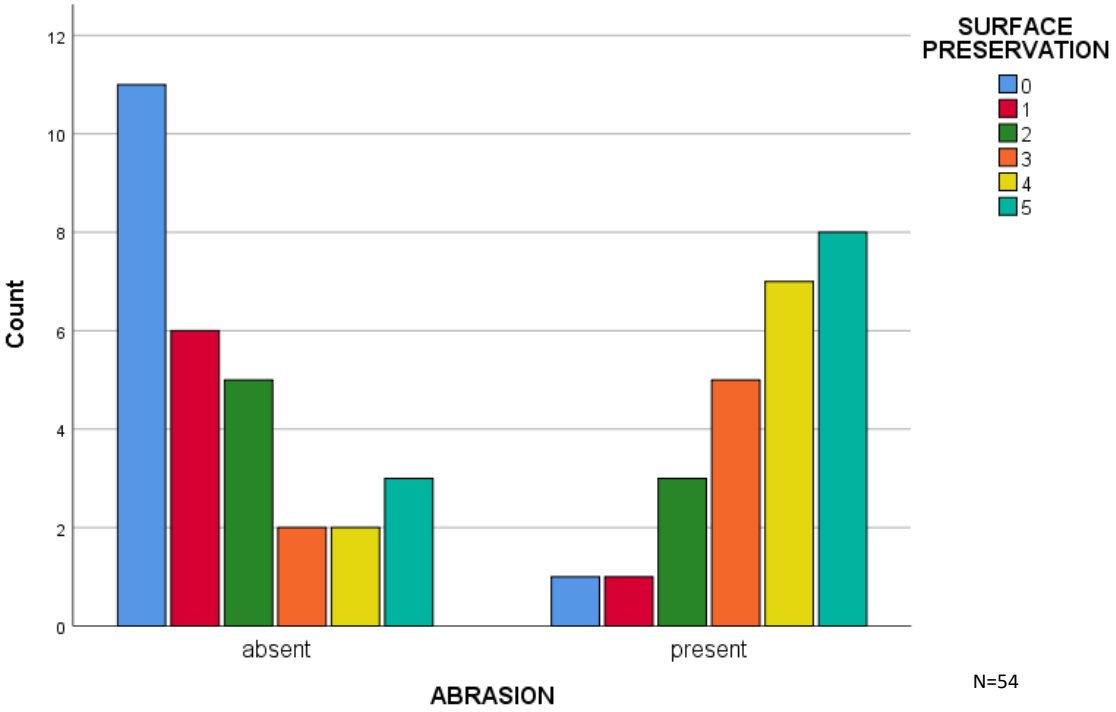


Figure 236. Surface preservation scores of abraded/non-abraded remains across sites in Priory Farm Cave (0-5/poor-good).

- Abrasion was recorded on most weathered elements (stages 1-3) the majority of which had high surface preservation scores (4 and 5) (N=4) with remaining elements (N=3) showing much lower surface preservation scores (0 and 2). Sub-aerial exposure might have been followed by water filtering in the cave/entrance of the cave or remains might have undergone sub-aerial exposure in separate contexts with collection and deposition in the cave as a final stage.

	EROS ABSENT	**EROS PRESENT**	**STAIN ABSENT**	**STAIN PRESENT**	**NO WTH**	**WTH STAGE 1**	**WTH STAGE 2**	**WTH STAGE 3**
ABRASION ABSENT	12	17	25	4	26	2	1	0
ABRASION PRESENT	15	10	19	6	18	3	3	1

Table 136. Abraded and non-abraded remains from Priory Farm Cave correlated with other taphonomic modifications (EROS=erosion, STAIN= staining, WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=54.

Staining

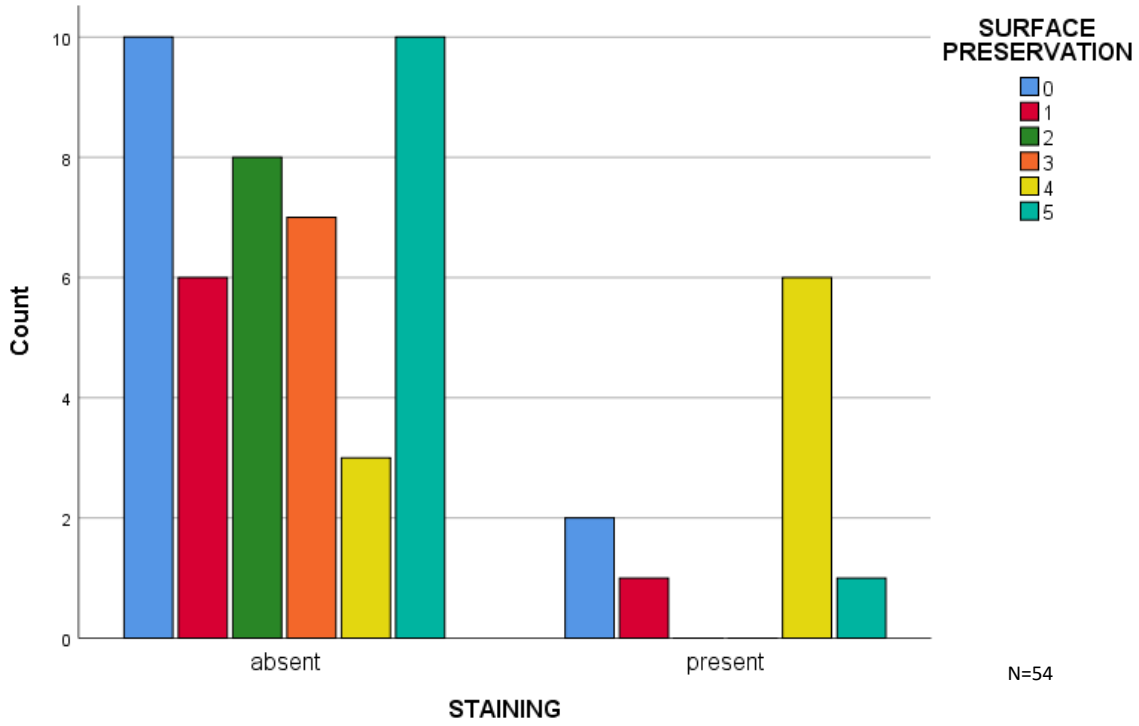


Figure 237. Surface preservation scores of stained/unstained remains across sites in Priory Farm Cave (0-5/poor-good).

- Associations amongst stained elements and other taphonomic modifications included erosion on four elements, abrasion (N=6), gnawing on two elements and weathering (stages 1-3).
- Staining was further identified on eight loose teeth.

	EROS ABSENT	EROS PRESENT	AB ABSENT	AB PRESENT	GN ABSENT	GN PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
STAINING ABSENT	21	23	25	19	43	1	37	4	3	0
STAINING PRESENT	6	4	4	6	8	2	7	1	1	1

Table 137. Stained and non-stained remains from Priory Farm Cave correlated with other taphonomic modifications (EROS=erosion, STAIN= staining, AB= abrasion, GN= gnawing, WTH=weathering absence (NO WTH)/ presence (stages 1-3). N=54.

Fractures

- Abrasion (N=3/SNOs: 20, 24-25), staining (N=2/SNOs: 20, 25) and weathering (stages 1 and 3/SNOs: 24-25) were noted on limbs with gnawing marks identified on a single long bone (SNO: 20). Radius SNO 25 (FFI: 3 with modern damage and mixture of breaks) exhibited weathering (stage 3), abrasion and staining, and demonstrated the lowest surface preservation whilst radius 24 (FFI: 1, unformed radial end/possible juvenile) had been impacted by weathering less severely (stage 1), showed signs of erosion, abrasion and a higher surface preservation (score 4). Fresh fractures suggest manipulation shortly after death whilst presence of advanced weathering suggests intentional sub-aerial exposure followed by deposition in the cave. Whilst depositions are multi-period, surviving elements and taphonomic modifications demonstrate similarities to Little Hoyle Cave.

Surface preservation

- Cranial/skull remains primarily showed good surface preservation (score 4/N=5) whilst vertebrae (N=6) had been impacted more severely and represented the bone category with the lowest surface preservation score (0). Long bone surface preservation survival showed fluctuations in patterns (scores 2 and 4/N=3 respectively; score 2/ N=3) similar to complete bones of the hands/feet (score 3/N=4; scores 0-1 and 5/N=3 respectively).

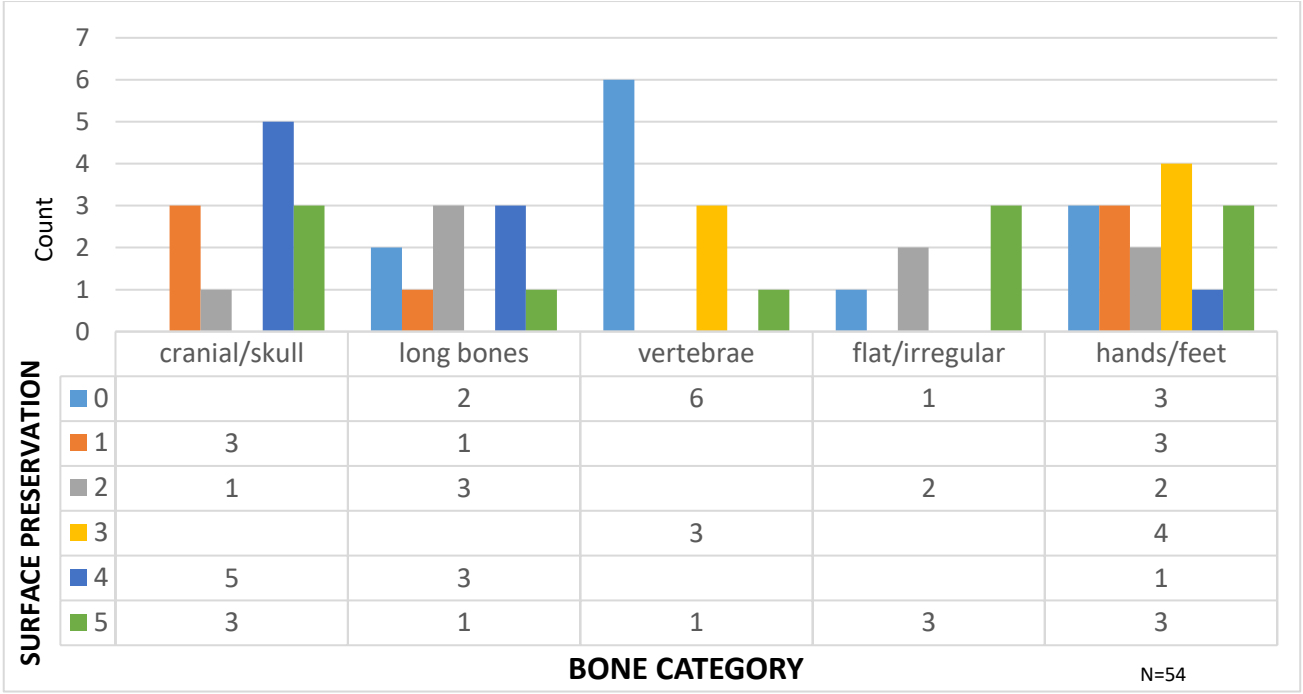


Figure 238. Frequencies of surface preservation scores in Priory Farm Cave divided by bone type (0-5/poor-good).

Microscopic results

DATE	SNO	ELEM	OHI SCORE	AT	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	MICROCRACK	BIREFR
MIDDLE NEOLITHIC (SNO: 45)	45	M	1	NW	brown/black	black/dark brown	brown dark; fair	present	1

Table 138. Mandible 45 sampled from Priory Farm Cave. Indication of available radiocarbon date (DATE), element (ELEM) – mandible (M), OHI score, attack (AT) – non-Wedl (NW), inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) score (1=low).

7.6. Ogof Garreg Hir

Element completeness

- According to the excavation report, the surviving assemblage, along with a range of faunal remains, artefacts and a kitchen midden discovered (no stratigraphy) (see Appendix 5/Site Backgrounds), suggests occupation in a part of the cave/passage that disappeared due to coastal erosion. Access to the cave is now only possible via a rope, therefore access must have been accomplished via a scree slope formed after the Last Glaciation and the sea must have not been in such close proximity. Evidence of abrasion that could indicate water wear was not identified on the bones, however cave concretion could have masked previous modifications such as polishing the surface of the bones. Sub-adult remains do not have the same bone density as adult remains and therefore lower bone density could have affected their preservation making them more susceptible to fragmentation (Symes *et al.* 2014b).

Microscopic results

DATE	SNO	ELEM	OHI SCORE	AT	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	MICROCRACK	BIREFR
EARLY NEOLITHIC	54	LB	4	NW	black/brown; brown – dark	brown/black	brown - dark	present	3

Table 140. Ogof Garreg Hir 54 sampled from Early Neolithic. Indication of available radiocarbon date (DATE), element (ELEM) – long bone (LB), OHI score, attack (AT) – non-Wedl (NW), inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) score (3=high).

7.7 Ogof Colomendy

Frequency of skeletal elements

- A single cranium was fragmented (N=58 fragments) and had not been reconstructed (recorded as one entry).Three burnt cranial fragments (1.5%) were included in the same bag as the cranium. Two unidentified shafts (1%) and eight other/miscellaneous remains (including fragments of postcranial remains) were further recorded for taphonomy purposes (3.9%).
- Loose teeth included 1st (N=2, 5.9%), 2nd (N=3, 8.8%) and unidentified (N=8, 23.5%) incisors, seven canines (20.6%), upper and lower 1st (N=4, 11.8%) and 2nd (N=6, 17.6%) premolars and 1st (N=2, 5.9%), 2nd (N=1, 2.9%) and a single unidentified (N2.9%) molars .

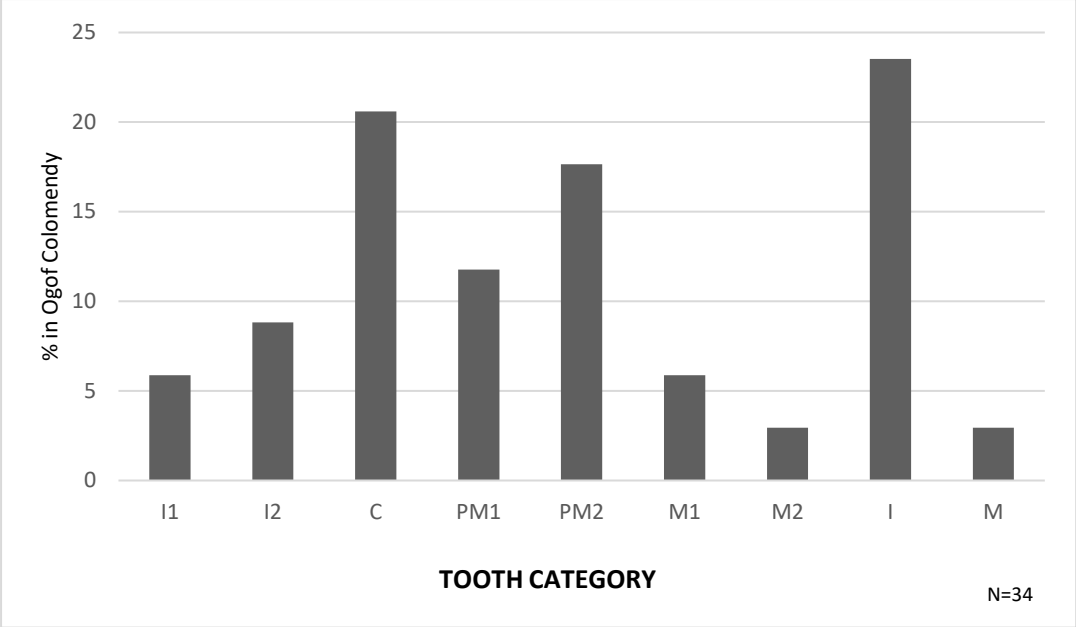


Figure 243. Teeth distributions in Ogof Colomendy. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, I= incisor, M= molar. I (N=8) and M (N=1): no identification of exact tooth.

LONG BONE	EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
HUMERUS	2	3	3	2
RADIUS	8	3	7	4
ULNA	16	3	3	16
FEMUR	2	12	7	7
TIBIA	4	5	1	8
FIBULA	1	3	2	2
SHAFT UN	4	0	4	0

Table 142. Presence/ absence of epiphysis and shafts based on long bone representation in Ogof Colomendy. SHAFT UN=shaft unidentified. N=66 (including four unidentified shafts).

- Ulnae showed almost equal distributions between scores one to five (scores 1-3, 4-5/N=3; score 2/N=2) with the majority of ulna (N=5) showing poor surface preservation (score 0). The majority of femora demonstrated low/medium to higher surface preservation (score 2/N=6; score 3/N=4).

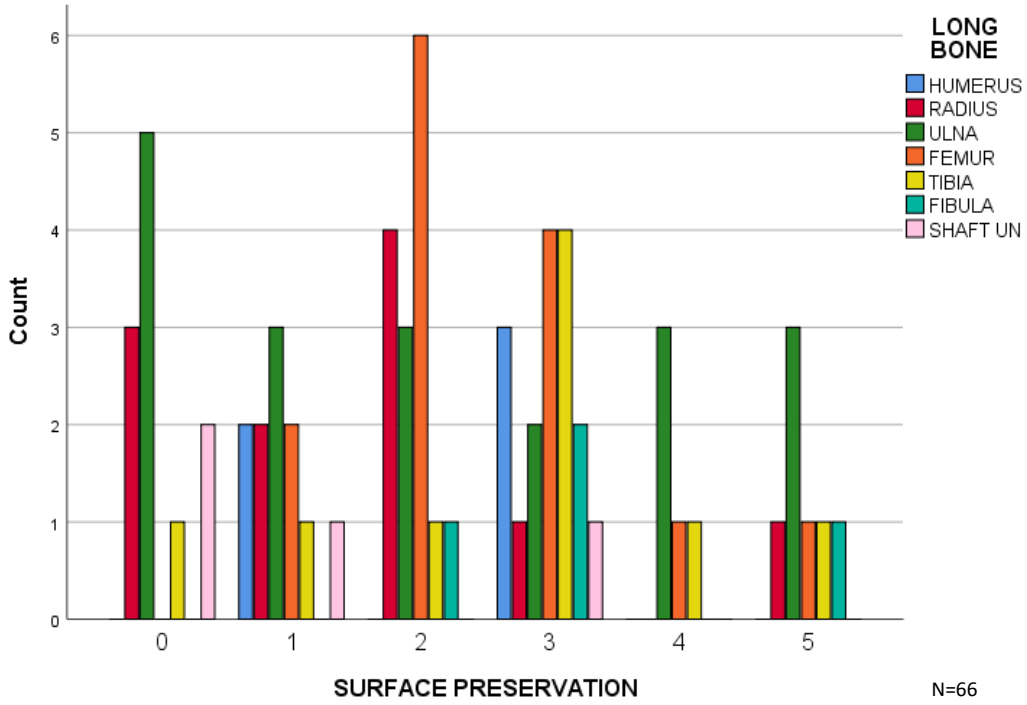


Figure 244. Surface preservation scores based on long bone representation from Ogof Colomendy (0-5/poor-good).

- Taphonomic modifications identified on either epiphyses and/or shafts included erosion (N=29), abrasion (N=21), staining (N=52), gnawing (N=35) (Table 145) and weathering (N=4). Weathering (stage 1) (SNOs: 653, 654, 679 and 823) was accompanied by erosion, staining, gnawing (SNOs: 653, 679, 823) and occasional abrasion (SNO: 654).
- Weathering might have resulted from sub-aerial exposure or deposition close to the cave entrance followed by scavenger disturbances. Weathered femur 679 (SNO) in particular exhibited a fresh fracture (FFI score: 5) and very good surface preservation (score 5) whereas weathered humerus 823 (SNO) exhibited a dry break (FFI score 5) and medium surface preservation (score 3) suggesting separate stages of processing and manipulation. Fractures were overall identified on 29 long bones with equal numbers of both fresh and dry breaks (N=11 respectively), including fractures on both proximal and distal epiphyses of shafts. Fresh and dry fractures on shafts further support the hypothesis of early manipulation of the bones with later disturbances caused by scavenger activity, re-visits of the site and/or disturbances during excavation.

EPIPHYSES & SHAFTS					
	EPIPHYSIS ABSENT		***EPIPHYSIS PRESENT***		**TOTAL**
LONG BONE	**SHAFT ABSENT**	**SHAFT PRESENT**	**SHAFT ABSENT**	**SHAFT PRESENT**	
HUMERUS	1	1	2	1	5
GN ABSENT			1	1	2
EROS ABSENT			1	1	2
STAIN PRESENT			1	1	2
GN PRESENT	1	1	1		3
EROS ABSENT	1				1
STAIN PRESENT	1				1
EROS PRESENT		1	1		2
STAIN PRESENT		1	1		2
RADIUS	5	3	2	1	11
GN ABSENT	5	2	1		8
EROS ABSENT	2	2	1		5
STAIN ABSENT			1		1
STAIN PRESENT	2	2			4
EROS PRESENT	3				3
STAIN PRESENT	3				3
GN PRESENT		1	1	1	3
EROS ABSENT		1	1	1	3

STAIN PRESENT		1	1	1	3
ULNA	2	14	1	2	19
GN ABSENT		8	1		9
EROS ABSENT		2			2
STAIN PRESENT		2			2
EROS PRESENT		6	1		7
STAIN ABSENT		2	1		3
STAIN PRESENT		4			4
GN PRESENT	2	6		2	10
EROS ABSENT	1	5		2	8
STAIN ABSENT		1			1
STAIN PRESENT	1	4		2	7
EROS PRESENT	1	1			2
STAIN PRESENT	1	1			2
FEMUR	2		5	7	14
GN ABSENT			1	1	2
EROS ABSENT				1	1
STAIN PRESENT				1	1
EROS PRESENT			1		1
STAIN PRESENT			1		1
GN PRESENT	2		4	6	12
EROS ABSENT			3	1	4
STAIN ABSENT			3		3

STAIN PRESENT				1	1
EROS PRESENT	2		1	5	8
STAIN PRESENT	2		1	5	8
TIBIA		4	1	4	9
GN ABSENT			1	2	3
EROS ABSENT			1	1	2
STAIN ABSENT			1		1
STAIN PRESENT				1	1
EROS PRESENT				1	1
STAIN PRESENT				1	1
GN PRESENT		4		2	6
EROS ABSENT		2			2
STAIN PRESENT		2			2
EROS PRESENT		2		2	4
STAIN PRESENT		2		2	4
FIBULA		1	2	1	4
GN ABSENT			2	1	3
EROS ABSENT			2	1	3
STAIN ABSENT			1	1	2
STAIN PRESENT			1		1
GN PRESENT		1			1
EROS ABSENT		1			1
STAIN ABSENT		1			1

UNIDENTIFIED SHAFT	4				4
GN ABSENT	4				4
EROS ABSENT	3				3
STAIN ABSENT	1				1
STAIN PRESENT	2				2
EROS PRESENT	1				1
STAIN ABSENT	1				1
TOTAL	14	23	13	16	66

Table 143. Preserved epiphyses and shafts divided by long bone, absence/presence of epiphysis, gnawing (GN), erosion (EROS) and staining (STAIN). Epiphysis and/or shaft absence= less than 50% of the zone was present however, these fragmented shafts were identifiable to element and were included in this analysis to underline the level of fragmentation and record taphonomic modifications identified on their surface.

Element completeness

- Complete hands/feet suggest that primary burials might have taken place on site followed by possible selective deposition of a large number of long bones (both fresh and dry fractures apparent) with smaller elements (extremities) buried deeper/further in the cave during disturbances and further depositions.
- Overall taphonomic modifications included staining and erosion with occasional abrasion across almost all bone categories. Weathering was further recorded on long bones, cranial/skull remains and flat/irregular bones whereas gnawing was primarily identified on long bones and a low number of flat/irregular bones, hands/feet and one vertebra.

- Surface preservation scores amongst fragmented/not complete human remains ranged score 2-3 in most bone categories with scores on fragmented hands/feet showing variation between very poor (score 0), medium/poor (score 2-3) and good preservation (score 5). Complete elements on the other hand were almost exclusively bones of the hands feet with medium surface preservation (3) and only one cervical vertebra demonstrating full zone completion.

MNI, demography and pathology

- Four radiocarbon dates determined the presence of individuals of different ages including one Early Bronze Age adult (SNO: 627 humerus), one Early to Middle Bronze Age adolescent (SNO: 628 humerus), one Late Neolithic adult (SNO: 699 femur) and a late Middle Neolithic adult/younger adult (or late adolescent) (unknown fragment). As the Middle Neolithic element is unknown (not present amongst the assemblage recorded) the exact age of the individual cannot be confirmed and was recorded as a younger adult.

Taphonomy – Macroscopic results

Weathering

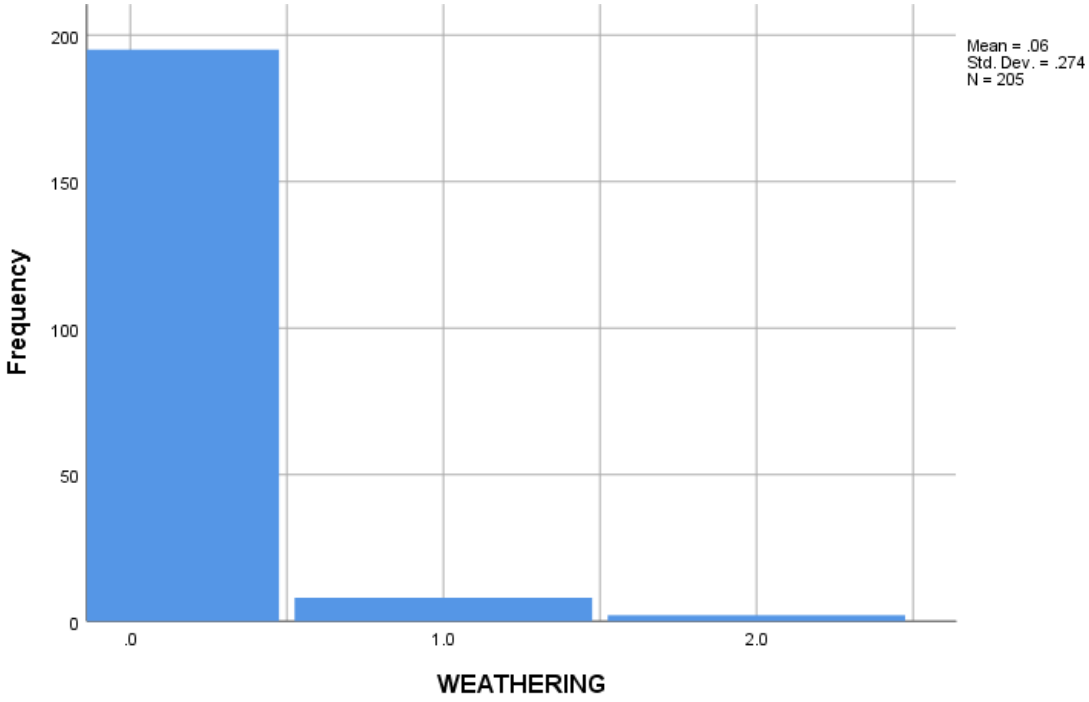


Figure 245. Weathering frequencies (0/no weathering and stages 1-2) from Ogof Colomendy.

- Two fragmented elements showing more advance weathering stage (2) were accompanied by staining that might have just been pushed around during disturbances. Weathered clavicle SNO 818 was further impacted by insect wear, also recorded on 11 elements (long bones, flat/irregular bones, hands/feet). No particular pattern was identified and presence of weathering and insect wear must have been circumstantial.
- Abrasion was associated with stage one weathering and was overall not identified on a large proportion of the assemblage from Ogof Colomendy. Trampling, on the other hand, often associated with abrasion (rounding of the bone from disturbances, tumbling and dragging of elements), was not present on any bones, therefore elements might have undergone short sub-aerial exposure and/or deposition close to the entrance of the cave, followed by water wear inside the cave resulting in polishing

- Ulna SNO 654 (weathering/abrasion/staining) was fractured from both proximal and distalbends (shafts) and cracking of the surface at the ends of the shafts might have resulted from radiating fractures.
- Two long bones, femur SNO 679 and humerus SNO 823 (SNO) exhibited fractures (fresh and dry respectively), weathering stage one, gnawing, erosion and abrasion. Femur SNO 679 showed high surface preservation whilst and medium on humerus SNO 823 was less well preserved. Both dry and fresh fractures were identified on a large portion of long bones from Ogof Colomendy which further supports that the site was used for early manipulation with some elements potentially been selected, or collected after exhumations/excarnations (resulting in weathering) and deposited in the cave. Multiple dates ranging from the Middle Neolithic to the Middle Bronze Age justify a re-use of the site which might have been used for discarding body parts, based on the fragile and processed state the both human and animal remains were discovered (see Appendices/Site Backgrounds).

WTH STAGE		EROSION		STAINING		ABRASION		GNAWING	
		ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
	1	2	6	0	8	4	4	4	4
	2	2	0	0	2	2	0	2	0

Table 144. Weathering (WTH) stages 1-2 correlated with other taphonomic modifications. N=10 (only weathered bones).

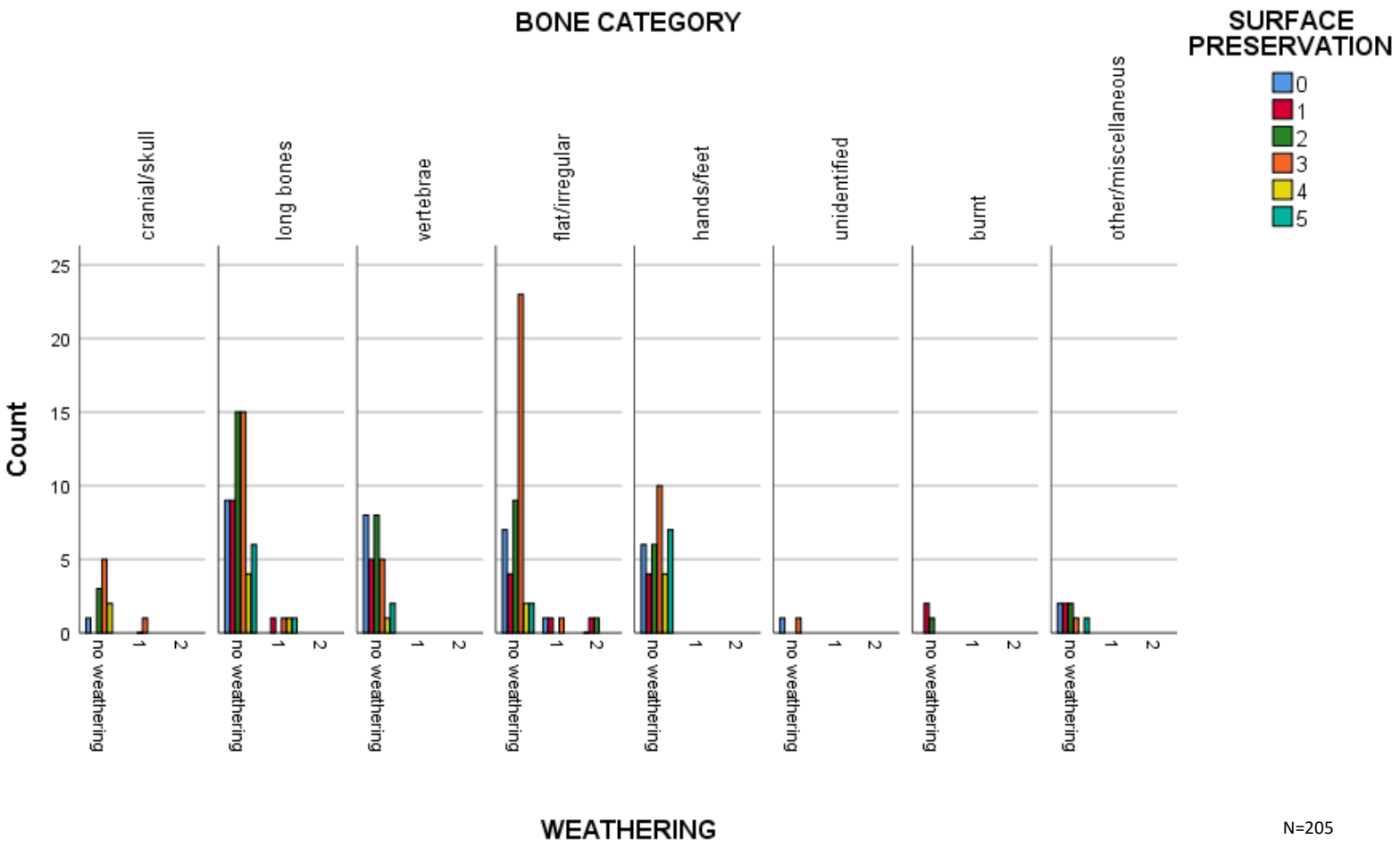


Figure 247. Weathering absence/presence (stages 1-2) based on surface preservation scores and bone category in Ogof Colomendy (0-5/poor-good).

Gnawing

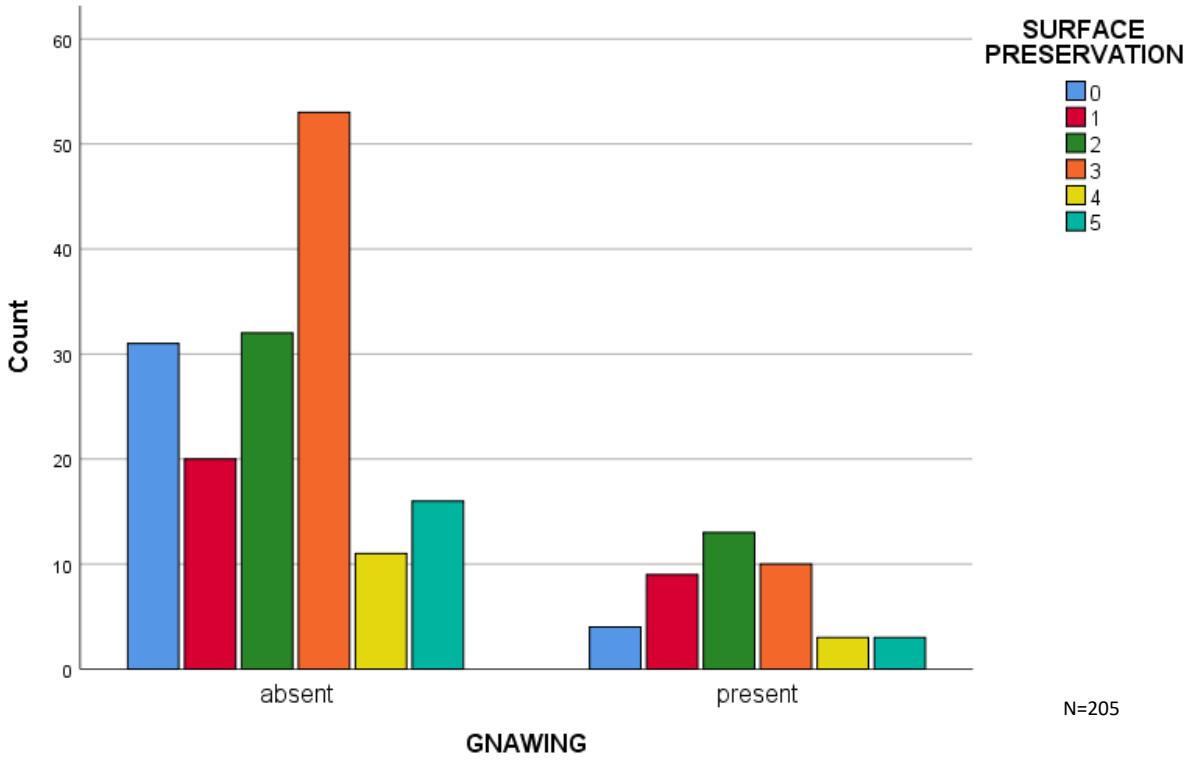


Figure 249. Gnawing presence/absence based on surface preservation scores from elements in Ogof Colomendy (0-5/poor-good).

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2
GNAWING ABSENT	101	62	60	103	124	39	157	4	2
GNAWING PRESENT	23	19	7	35	32	10	38	4	0

Table 145. Gnawing absence/presence cross-referenced with other taphonomic modifications. N=205

- Humerus SNO 686 demonstrated signs of sharp force trauma (peri-mortem cutmark) on the diaphysis close to the proximal end/humeral head. No other evidence of sharp force trauma was identified amongst the surviving assemblage.
- Erosion was further noted on the majority of aforementioned long bones (N=13) exhibiting either fresh or dry fractures and staining was recorded on all limbs. Overall gnawing patterns amongst the assemblage fit the interpretive trajectory already described in the original reports (see Appendix 5/Site Backgrounds) with remains heavily manipulated either shortly after death, suggesting handling prior to deposition, or due to subsequent disturbances resulting in further breakage (dry fractures).
- Gnawed and weathered (stage 1) humerus SNO 823 exhibited a dry fracture (FFI: 5) whereas gnawed and weathered (stage one) femur SNO 679 exhibited a fresh break. Four elements (SNOs: 630, 681, 784, 815) including a tibia, femur, a vertebra fragment and a clavicle demonstrated signs of gnawing and insect wear with the two long bones exhibiting sings of fresh and dry fractures which could have drawn insects to attack the bones (N=12 in total showing evidence of insect wear) when the bone was still fresh. Whilst the origin of these elements (either Neolithic or Bronze Age) cannot be confirmed without accurate radiocarbon dating, the site was used for different burial patterns

- (early/later manipulation, possible exposure to the elements or depositions in separate parts of the cave followed by scavenger disturbances).
- Gnawing marks were identified on 16 long bones exhibiting fresh and dry fractures on either proximal or distal epiphyses (N=6 respectively) followed by breaks on both proximal and distal epiphyses (fresh and dry/N=2; fresh/N=2).

FRACTURE FRESHNESS		
FFI	**GNAWING ABSENT**	**GNAWING PRESENT**
DRY	5	6
DRY (PROX&DISTAL)	2	0
DRY AND FRESH (PROX&DISTAL)	0	1
FRESH	5	6
FRESH (PROX&DISTAL)	0	2
FRESH AND DRY (PROX&DISTAL)	1	1

Table 146. Fracture Freshness Index (FFI) correlated with gnawing absence/presence from long bones in Ogof Colomendy. N= 29 long bones and N=16 gnawed long bones.

Erosion

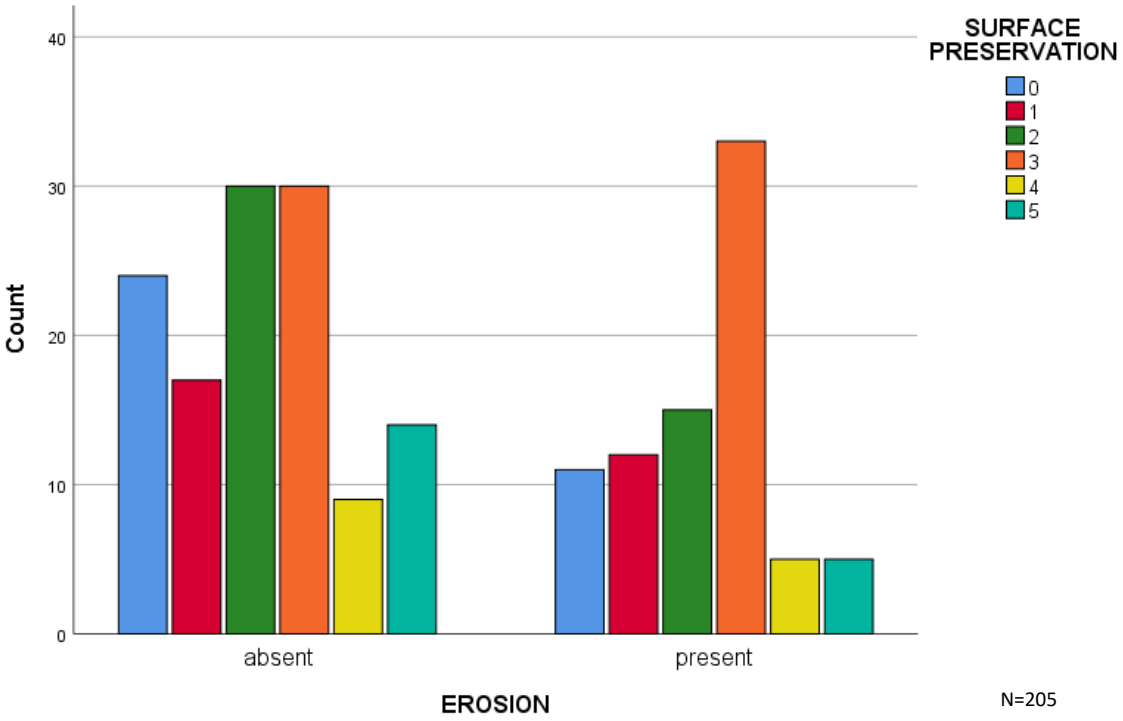


Figure 252. Surface preservation scores on eroded and non-eroded remains across sites in Ogof Colomendy (0-5/poor-good).

- Erosion was further noted on a single loose tooth and concretion residues recorded on three loose teeth.
- Absence of erosion on elements reaching weathering stage two might indicate depositions at different parts of the cave similar to a number of gnawed elements that survived impact by erosive forces (N=23). No particular pattern could be identified amongst eroded and non-eroded remains as other taphonomic modifications displayed similar distributions amongst remains. Depositions in different periods might have been responsible for these patterns with older deposits been more impacted, more fractured and more disturbed than later deposits. Stratigraphic information is not available and the cave has undergone a series of periodic disturbances (from scavenger activity to modern quarrying close to the cave, human disturbances from cavers and periodic excavations).

	NO WTH	WTH STAGE 1	WTH STAGE 2	GN ABSENT	GN PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT
EROSION ABSENT	120	2	2	101	23	47	77	96	28
EROSION PRESENT	75	6	0	62	19	20	61	60	21

Table 147. Eroded and non-eroded remains from Ogof Colomendy compared with other taphonomic modifications (WTH=weathering, GN=gnawing, staining and abrasion). N=205.

Abrasion

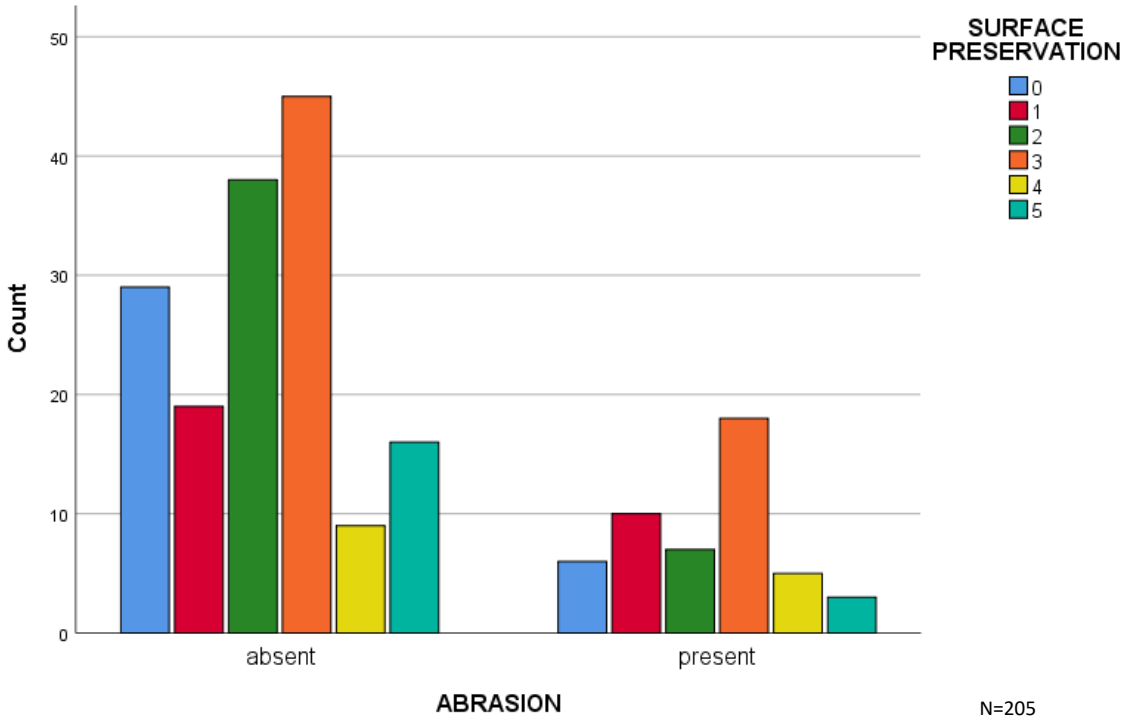


Figure 254. Surface preservation scores of abraded/non-abraded remains across sites in Ogof Colomendy (0-5/poor-good).

- Evidence of slight insect wear was also apparent on four flat/irregular bones (three ribs, one clavicle) which, based on the range of manipulated bones, may suggest transport of insects into the cave through organic materials. Insect damage from sub-aerial exposure could have also created the same patterns, however, no evidence of weathering was observed. Weathering (stage 2) was noted on a single clavicle (SNO: 818) exhibiting insect damage along with staining and absence of abrasion. This evidence could therefore suggest sub-aerial exposure prior to deposition with insects entering the cave (after circulation) and attacking more elements (N=12 in total).

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2
ABRASION ABSENT	96	60	61	95	124	32	150	4	2
ABRASION PRESENT	28	21	6	43	39	10	45	4	0

Table 148. Abraded and non-abraded remains from Ogof Colomendy correlated with other taphonomic modifications (erosion, staining, gnawing, and weathering – WTH). N=205.

Staining

- The majority of human remains displaying staining marks showed medium (score 3) to poor surface preservation (2-0) whereas elements not exhibiting staining indicated variation in surface preservation scores (scores 3, 0 to 5 and 1) (Figure 256 below).

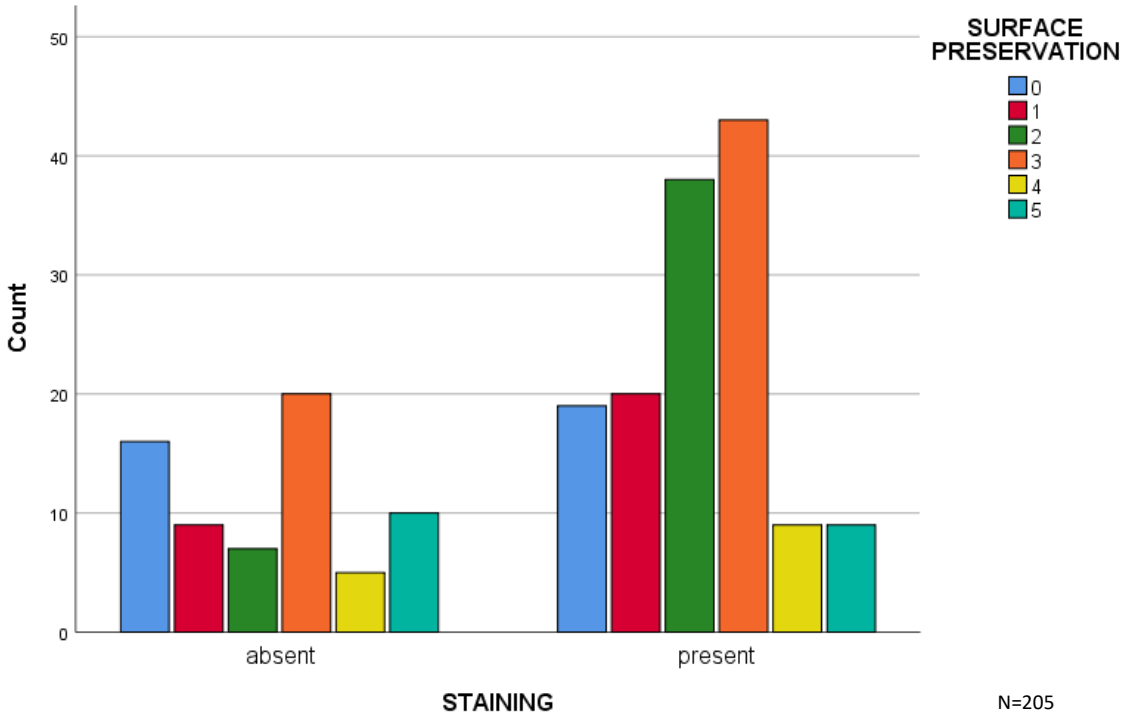


Figure 256. Surface preservation scores of stained/unstained remains across sites in Ogof Colomendy (0-5/poor-good).

- Staining was associated with erosion (N=61) and/or occasional abrasion (N=43) whilst gnawing marks (N=35) were almost always accompanied by staining. Discolorations were further reported on all weathered bones (N=10).
- Staining marks included black and black/brown discolorations resulting from exposure to humidity/mould and/or resulting from manganese and soil compounds. A single vertebra (SNO: 768) exhibited signs of green staining resulting from organic matter (plants, mosses and/or algae). Nine elements demonstrated staining resembling grey concretion residues on their surface whilst one patella and one distal hand phalanx (SNOs: 687 and 827) had single purple stains (faded) on their surface. Staining was further noted on ten loose teeth.

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2
STAINING ABSENT	47	20	61	6	60	7	67	0	
STAINING PRESENT	77	61	95	43	103	35	28	8	2

Table 149. Staining absence/presence correlated with other taphonomic modifications (erosion, abrasion, gnawing, WTH= weathering absence/presence stages 1-2). N=205.

Fractures (fresh vs dry)

- Surface preservation scores amongst dry breaks primarily showed medium preservation (score 3) and approximately equal distribution amongst scores (Figure 207). Fresh breaks showed medium surface preservation scores with the majority of long bones exhibiting fresh fractures displaying lower scores (2-0).

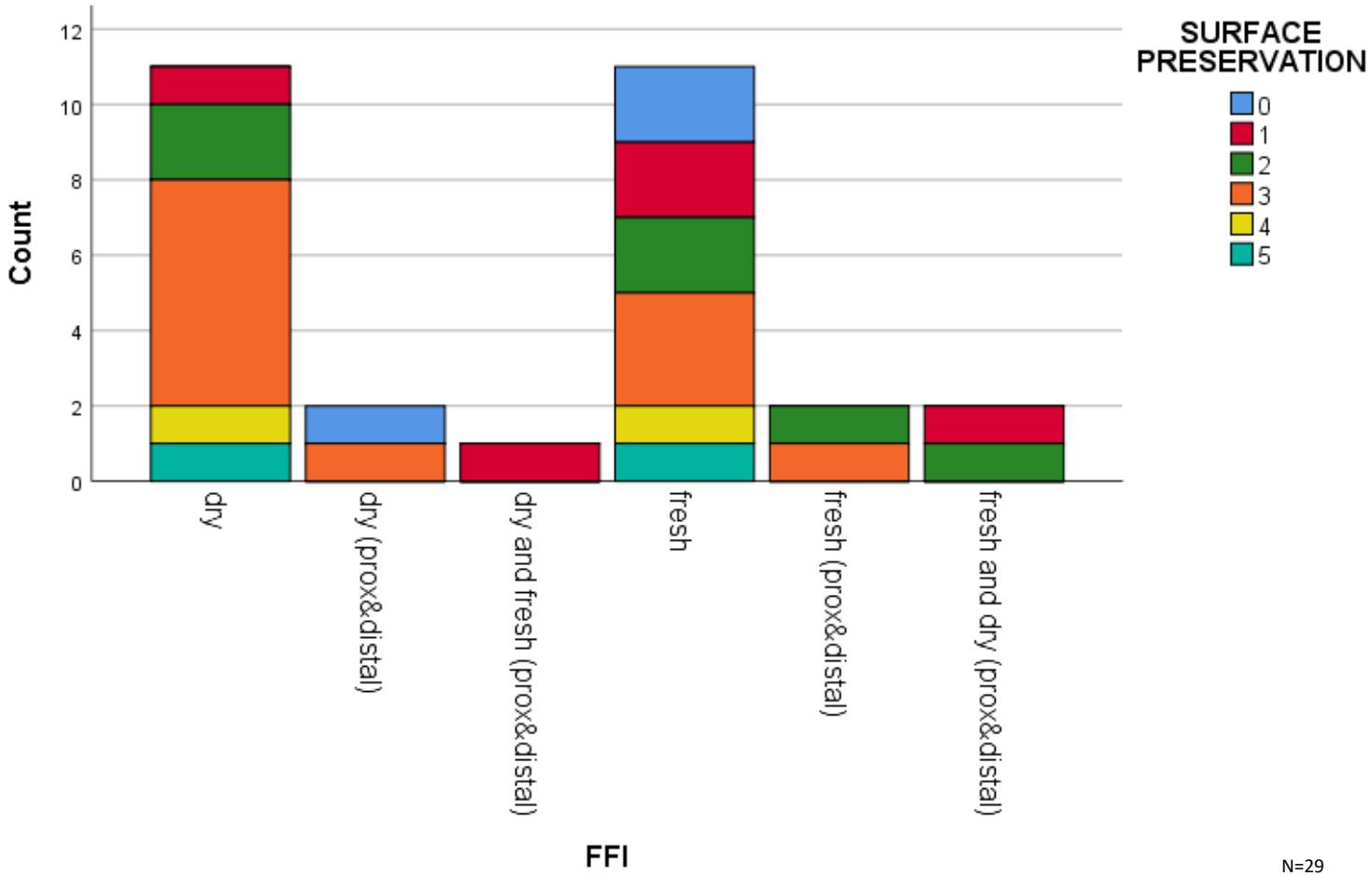


Figure 260. Fracture Freshness Index (FFI dry/fresh breaks) based on surface preservation scores in Ogof Colomendy (0-5/poor-good).

- Taphonomic patterns (Table 154) amongst fractured long bones demonstrated presence of weathering (stage 1) apparent on fractured femur SNO 679 and humerus SNO 823 showed signs of weathering (stage 1). Femur SNO 679 exhibited a fresh break (FFI score: 0) and very good surface preservation (score 5) and humerus 823 a dry fracture (FFI score: 5) and medium surface preservation (score 3). Gnawing, erosion and staining were apparent on both limbs which possibly suggests that these modifications resulted in-situ. Weathering was not present on other fractured long bones. Fresh fractures and good surface preservation supports manipulation shorty after death, followed by immediate deposition. Despite the range of modifications identified on femur SNO 678, the element survived very well and, therefore, weathering might have occurred as protected exposure (entrance cave) with the element either deposited or settling there after disturbances.
- Three radiocarbon dated long bones (Early BA humerus SNO 697, Early/Middle BA humerus SNO 98 and Late Neolithic femur SNO 699) displayed signs of abrasion and erosion with the adolescent humerus 698 (SNO) exhibiting a dry fracture (FFI score: 5) whilst adult humerus SNO 697 and femur SNO 699 exhibited fresh breaks (FFI scores: 2 and 3 respectively). All three long bones were sampled for microscopic analysis, however only the Late Neolithic femur was included in the analysis. The femur demonstrated extensive bacterial attack (OHI score: 0). The Bronze Age humeri demonstrated low OHI score (1) but were excluded from the analysis once the radiocarbon dates were confirmed. Both fresh and (one) dry fractures showed extensive bacterial attack (see Appendix 1/Sheet 3/Histology) which further supports that manipulation occurred over different phases, either peri- or post-mortem.

FFI	WEATHERING STAGE 1	EROSION	ABRASION	GNAWING	STAINING
DRY	1	7	6	6	11
DRY (PROX&DISTAL)	0	1	1	0	2
DRY AND FRESH (PROX&DISTAL)	0	1	0	1	1
FRESH	1	6	4	6	11
FRESH (PROX&DISTAL)	0	2	0	2	2
FRESH AND DRY (PROX&DISTAL)	0	1	0	1	2

Table 150. FFI (Freshness Fracture Index) correlated with taphonomic modifications in Ogof Colomendy. N=29.

Surface preservation

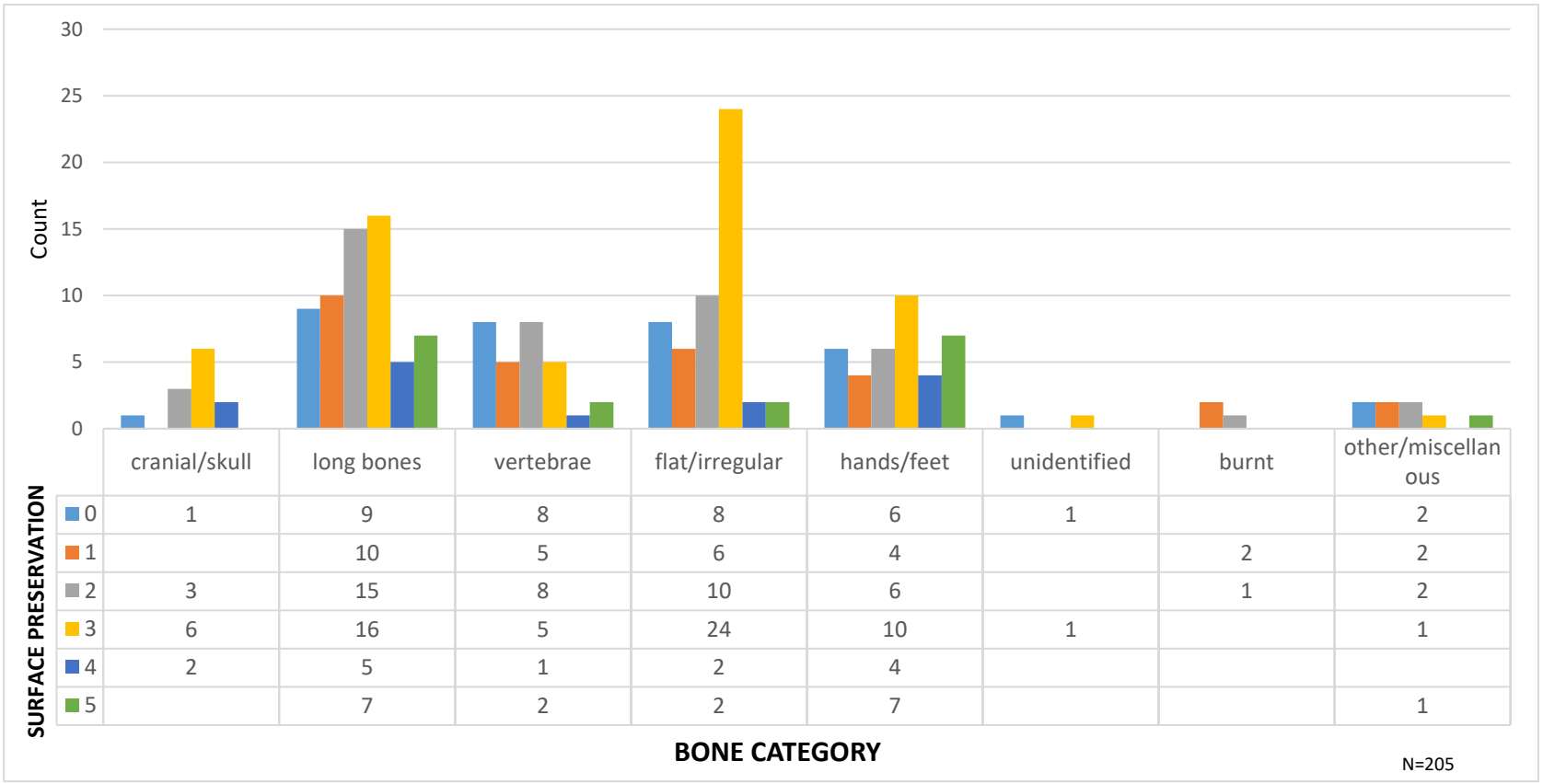


Figure 261. Frequencies of surface preservation scores in Ogof Colomendy divided by bone type (0-5/poor-good).

Microscopic results

DATE	SNO	ELEM	OHI SCORE	AT	INCL COLOUR	STAIN COLOUR	MICROCRACK	BIREFR
LATE NEOLITHIC	24	LB	0	NW	red/brown; red - intense; dark/brown	brown – fair; red - intense	present	

Table 151. Femur 24 sampled from Ogof Colomendy. Indication of available radiocarbon date (DATE), element (ELEM) – mandible (M), OHI score, attack (AT) – non-Wedl (NW), inclusion (INCL), microstructural staining (STAIN) colours and birefringence (BIREFR) score (1=low).

- Two Bronze Age humeri (SNOs: 24-5 in Appendix 1/Sheet 3/Histology) were further sampled (radiocarbon dating unknown when sampling took place), however, these were not included in the analysis. Three elements of different ages, possibly reflecting phases of different manipulation, were sampled for microscopic analysis. All three samples demonstrated high levels of bacterial attack (OHI scores: 0/Neolithic femur and 1/BA humeri), low collagen preservation (scores 1) with more microscopic agents identified in the microstructure (inclusions, infiltrations on BA humeri 24 and microstructural staining). Evidence of surface abrasion and staining were identified in all three samples with surface erosion only apparent on femur 23 (SNO Databse/Histology). The Late Neolithic femur (SNO: 699/23 in Database/Histology) and an Early Bronze Age humerus (SNO: 697/25 in Database/Histology) exhibited fresh fractures whilst an Early/Middle Bronze Age humerus (SNO: 698/24 in Database/Histology) exhibited a dry fracture suggesting bones were disturbed or manipulated at different phases during the process of decomposition. Disarticulation and circulation of bone is a practice often encountered

amongst Neolithic assemblages suggesting possible taphonomic re-elaboration (exhumations and re-burials) as exposure in different depositional environments produces an amalgam of distinct taphonomy and, in this case, distinct fracture morphologies.

7.8. Gop Cave

Frequency of skeletal element

- Upper and lower molars included 1st (N=3, 14.3%), 2nd (N=4, 19%) and 3rd molars (N=2, 9.5%) and one deciduous 1st molar (4.8%)

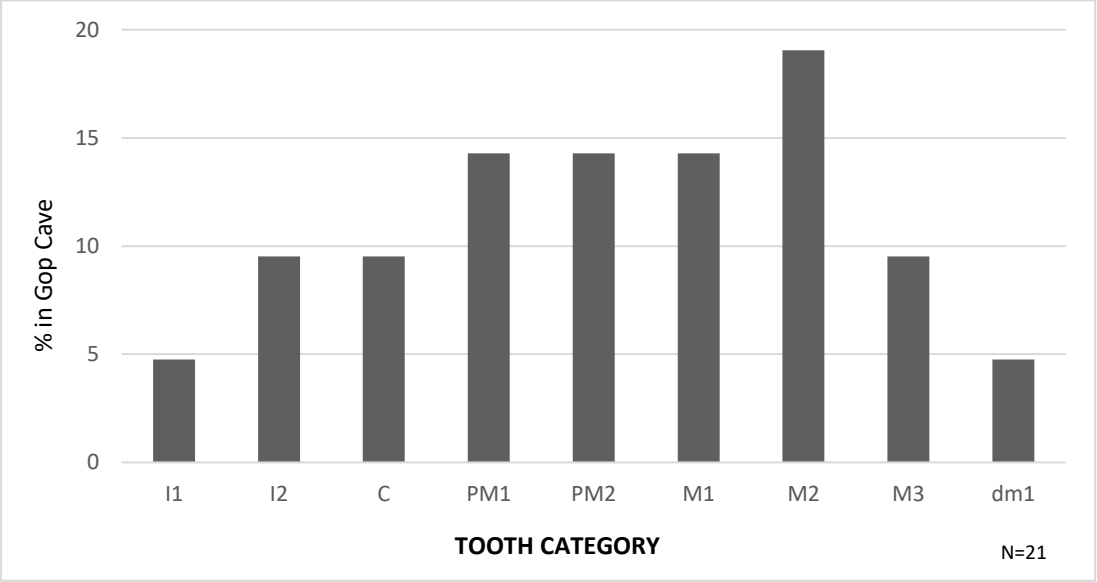


Figure 266. Teeth distributions in Gop Cave. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dm1= deciduous 1st molar.

- Four long bones (SNOs: 535, 537-8 and 541) demonstrated full zone completeness including two right tibiae, one left radius and one left ulna.
- Overall zone representation amongst long bones was good, however, presence of fresh fractures supports early manipulation that was possibly followed by moving, shifting of the bones and short (weathering stage 1) or prolonged (weathering stages 2/3) sub-aerial exposure.

LONG BONE	EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
HUMERUS	0	4	0	4
RADIUS	0	4	0	4
ULNA	0	2	0	2
FEMUR	1	1	0	2
TIBIA	0	3	0	3
FIBULA	1	0	0	1

Table 153. Presence/ absence of epiphysis and shafts based on long bone representation in Gop Cave. N=16.

- Surface preservation amongst limbs demonstrated variation in scores (Figure 267 below), with most showing medium preservation (score 3/N=8) and higher scores (score 4/N=3; score 5/N=3).

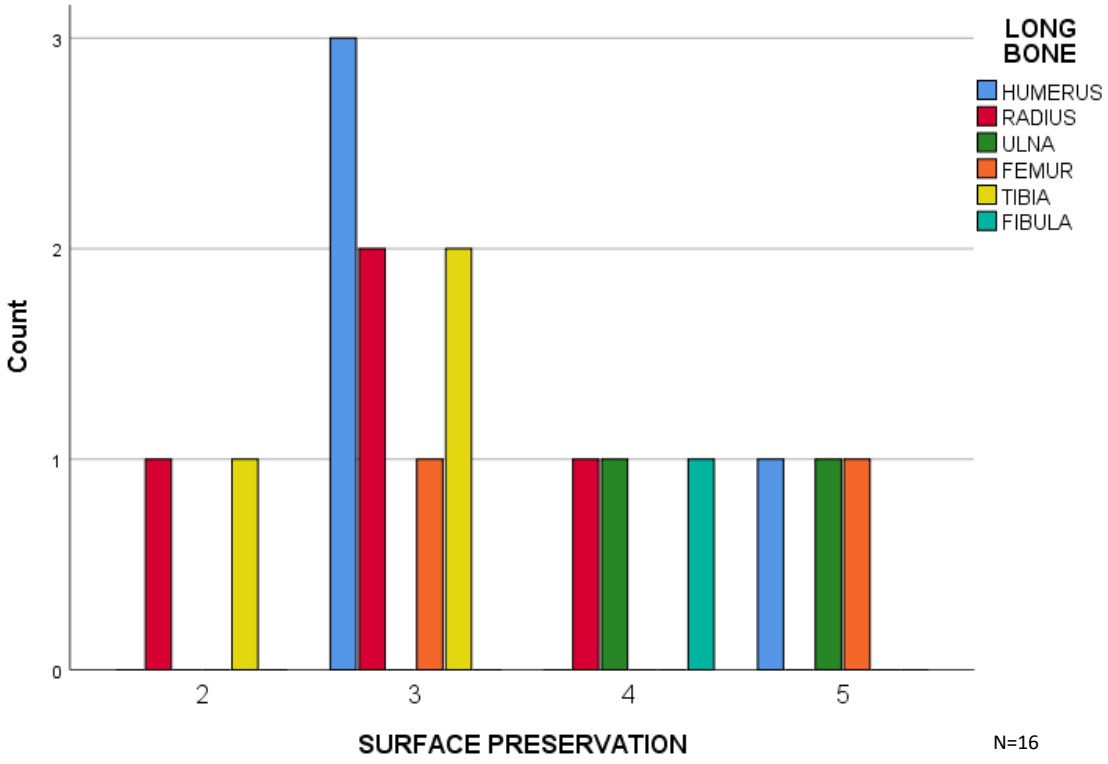


Figure 267. Surface preservation scores based on long bone representation from Gop Cave (0-5/poor-good).

- Taphonomic modifications included erosion and staining (N=12 respectively), abrasion (N=8) and signs of weathering (N=5) and gnawing (N=3) were present on a lower number of long bones. Presence of sharp force trauma was further noted on a single humerus (SNO: 543) resembling a percussion mark on the diaphysis interrupted by weathering (stage 1) and suggesting that the cut-mark

pre-dates weathering. A dry fracture (FFI score: 6) was further identified on humerus SNO 543 accompanied by erosion and staining and supporting short sub-aerial exposure resulting in weathering followed by the presence of a dry fracture either due to circulation or later disturbances. The humerus was further sampled for microscopic analysis and indicated extensive bacterial attack (OHI score: 0) suggesting primary inhumation with the body articulated (at some point) with enteric bacteria released in the body and attacking the microstructure of the bone.

- Eight more long bones exhibited fresh fractures on either proximal or distal ends (or both in the case of femur shaft 548) and overall medium (score 3) to very good surface preservation (score 5 on two long bones). Fracture morphology and microscopic observations on four of these long bones will be discussed later in this section to clarify whether manipulation of these elements followed similar or separate taphonomic trajectories in the cave.

Element completeness

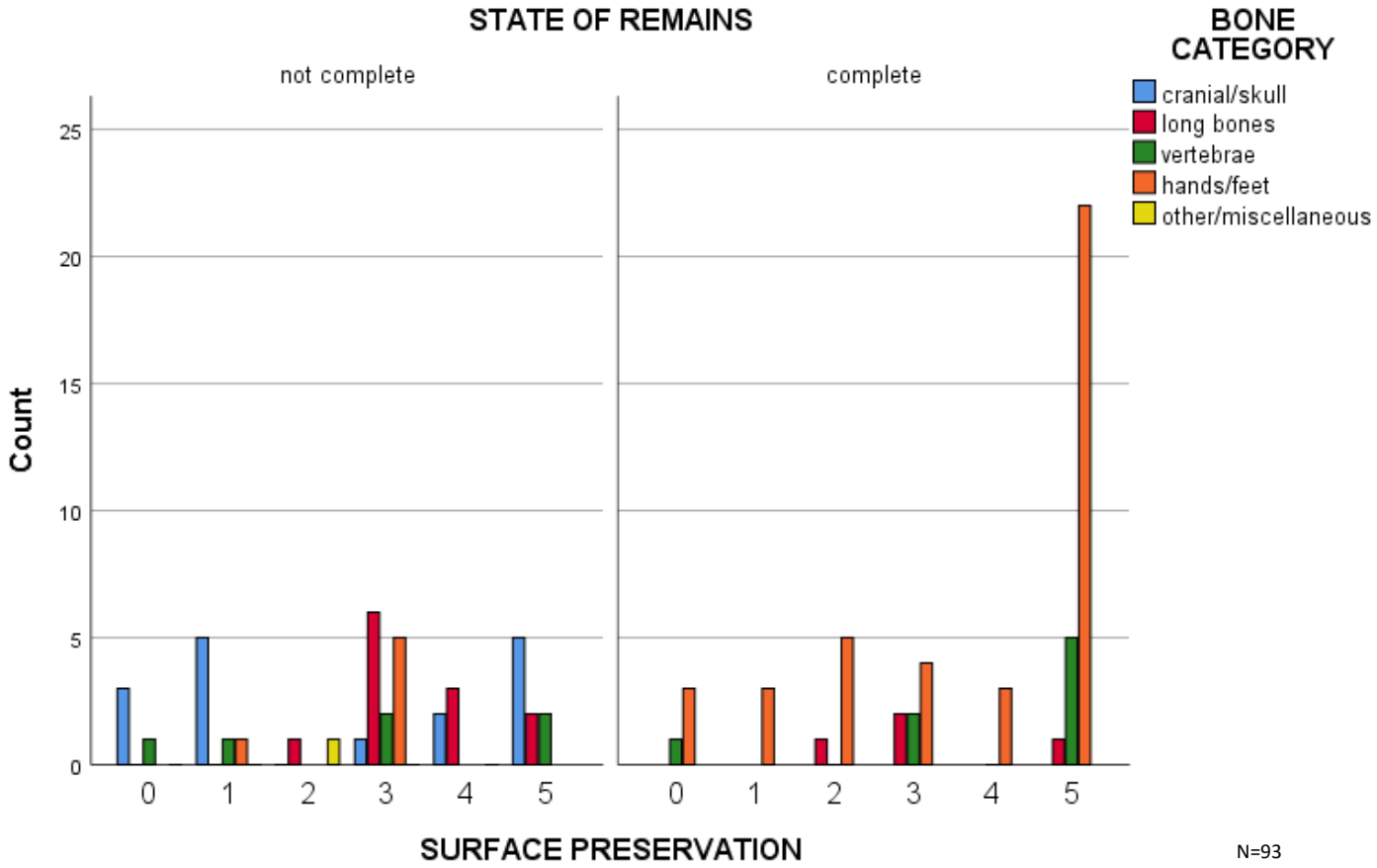


Figure 268. State or remains in Gop Cave based on bone category and surface preservation scores (0-5/poor-good). N=excluding loose teeth.

MNI, demography and pathology

- A single mandible (SNO: 622) demonstrated a probable large abscess in-between the 2nd incisor/canine and 1st premolar alveoli that had been covered with cave concretion. Caries was identified on a single loose molar (SNO: 107/see Appendix 1/Sheet 4/Dentition) with probable signs of digestion. Root etching was identified on a high number of loose teeth and therefore patterns could resemble root etching and not digestion.

Taphonomy

Weathering

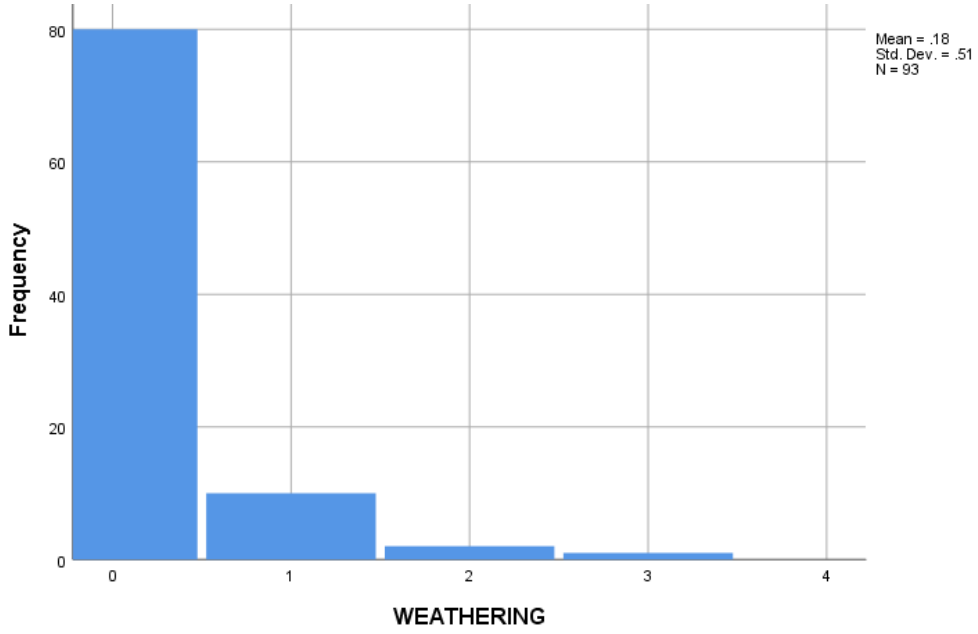


Figure 269. Weathering frequencies (0/no weathering and stages 1-2) from Gop Cave.

- Stage two weathering was accompanied by contrasting patterns (equal ratios of absence/presence of modifications) whilst stage three (tibia SNO 534) was followed by signs of slight root etching and a fresh fracture. Absence of other modifications on the surface of tibia 534 could reflect selection of body parts, early manipulation with alter circulation further supported by the medium OHI score (3) which suggests that decomposition was interrupted bacteria to destroy the microstructure of the bone completely.
- Surface preservation scores amongst weathered and non-weathered elements further support disturbances, manipulation, moving and/or arrangement of

- elements that impacted the surface of the bones with signs of weathering. The majority of non-weathered elements showed very good surface preservation (score 5), followed by medium scores (3) whilst weathered elements had been affected more intensely. Exceptions include metacarpals 553 and 594 that showed high surface preservation (scores 4 and 5).

WTH STAGE	EROSION		STAINING		ABRASION		GNAWING	
	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
1	4	6	2	8	2	8	8	2
2	1	1	1	1	1	1	1	1
3	0	1	1	0	1	0	1	0

Table 154. Weathering (WTH) stages 1-2 correlated with other taphonomic modifications. N=13 (only weathered bones).

Gnawing

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT	NO WEATHERING	WEATHRING STAGE 1	WEATHERING STAGE 2	WEATHERING STAGE 3
GNAWING ABSENT	38	45	37	46	6	77	73	8	1	1
GNAWING PRESENT	4	6	2	8	3	7	7	2	1	0

Table 155. Gnawing absence/presence cross-referenced with other taphonomic modifications. N=93

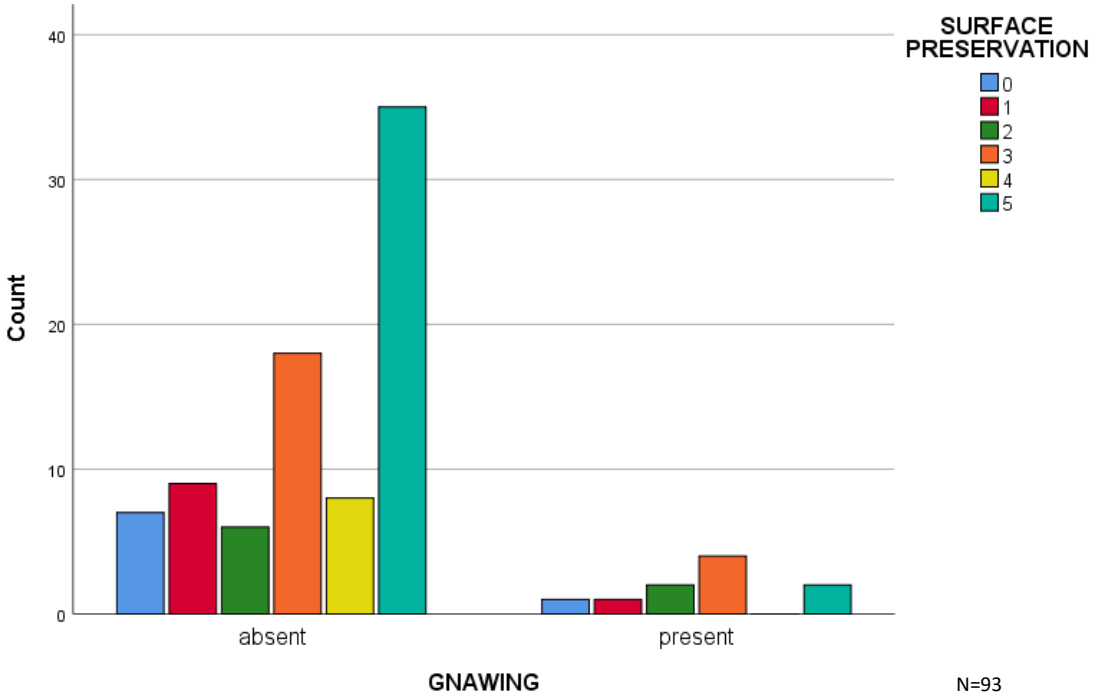


Figure 271. Gnawing presence/absence based on surface preservation scores from elements in Gop Cave (0-5/poor-good).

Erosion

- Signs of erosion (root etching) were further identified on the majority of loose teeth (N=14) and cave concretion residues also recorded on six eroded remains and six loose teeth.
- For example, humerus 544 (SNO) demonstrated signs of erosion, cave concretion, weathering (stage 2) and a fresh fracture which suggests possible selection of remains possibly prior to deposition in the cave.

	NO WTH	**WTH STAGE 1**	**WTH STAGE 2**	**WTH STAGE 3**	**GN ABSENT**	**GN PRESENT**	**STAINING ABSENT**	**STAINING PRESENT**	**ABRASION ABSENT**	**ABRASION PRESENT**
EROSION ABSENT	37	4	1	0	38	4	15	27	2	40
EROSION PRESENT	43	6	1	1	45	6	24	27	7	44

Table 156. Eroded and non-eroded remains from Gop Cave compared with other taphonomic modifications (WTH=weathering, GN=gnawing, staining and abrasion). N=93.

Abrasion

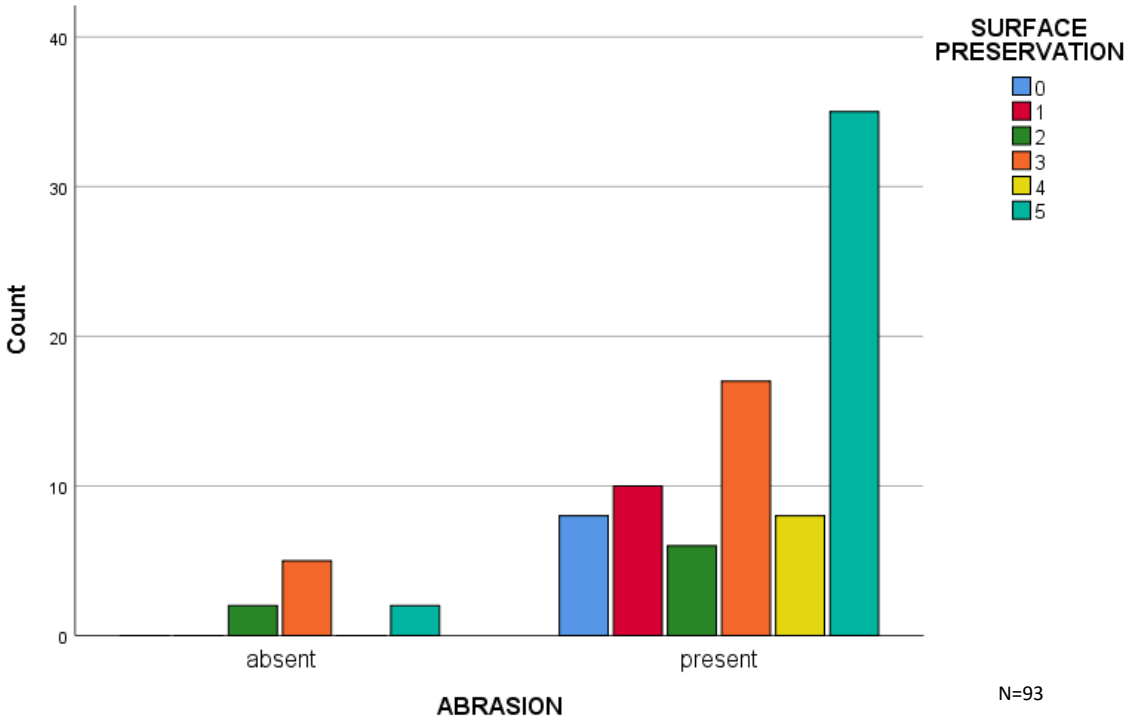


Figure 276. Surface preservation scores of abraded/non-abraded remains across sites in Gop Cave (0-5/poor-good).

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
ABRASION ABSENT	2	7	3	6	6	3	5	2	1	1
ABRASION PRESENT	40	44	36	48	77	7	75	8	1	0

Table 157. Abraded and non-abraded remains from Gop Cave correlated with other taphonomic modifications (erosion, gnawing, staining and weathering – WTH). N=93.

Staining

- A single talus (SNO: 591) exhibited pink/red marks on its plantar view along with evidence of trampling on that area with possible concretion residues solidified on the surface. White/grey stains and cave concretion residues were further identified on 11 elements including three mandibulae, three vertebrae, two ulnae and three hands/feet as well as six loose teeth.

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3
STAINING ABSENT	15	24	3	36	37	2	35	2	1	
STAINING PRESENT	27	27	6	48	46	8	5	8	1	0

Table 158. Staining absence/presence correlated with other taphonomic modifications (erosion, abrasion, gnawing, WTH= weathering absence/presence stages 1-3). N=93.

- Overall surface preservation scores demonstrated similar distributions amongst stained and unstained bones (Figure 278 below), however, the majority of elements not exhibiting staining marks showed very good surface preservation (score 5).

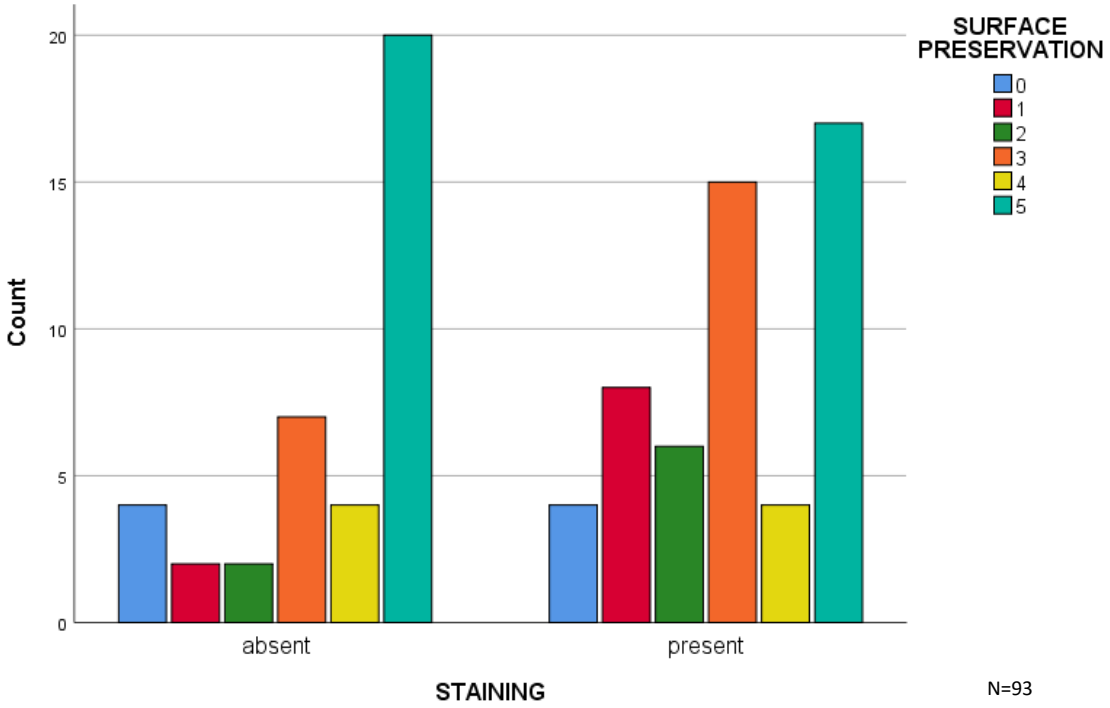


Figure 278. Surface preservation scores of stained/unstained remains across sites in Gop Cave (0-5/poor-good).

Fractures (fresh vs dry)

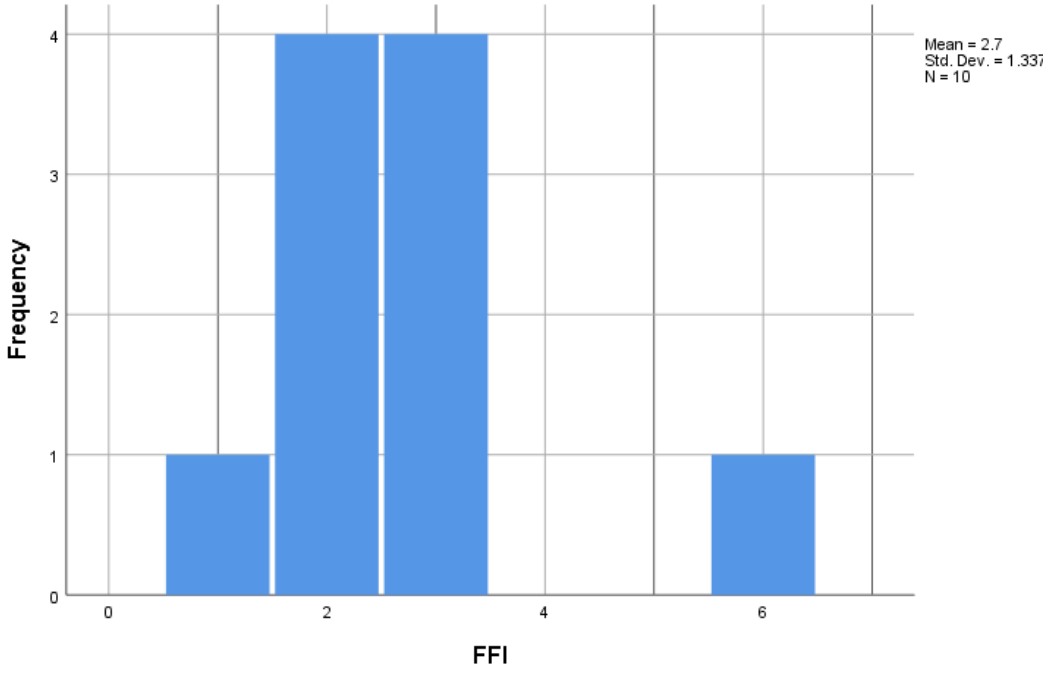


Figure 280. Total FFI (Fracture Freshness Index) scores in Gop Cave. N=double entries for fractures identified in both proximal and distal ends.

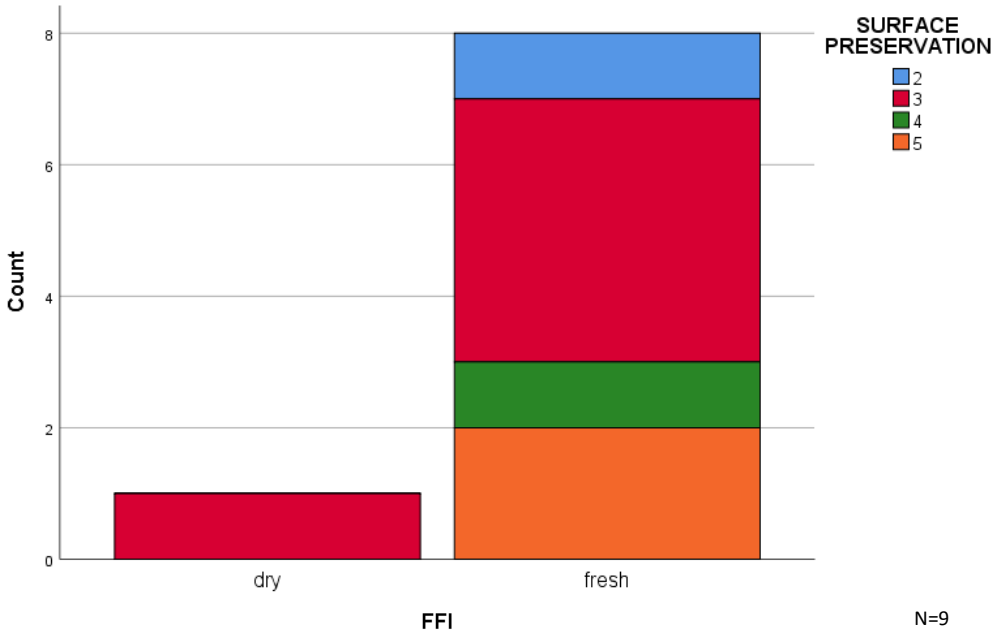


Figure 281. Fracture Freshness Index (FFI dry/fresh breaks) based on surface preservation scores in Gop Cave (0-5/poor-good).

Surface preservation

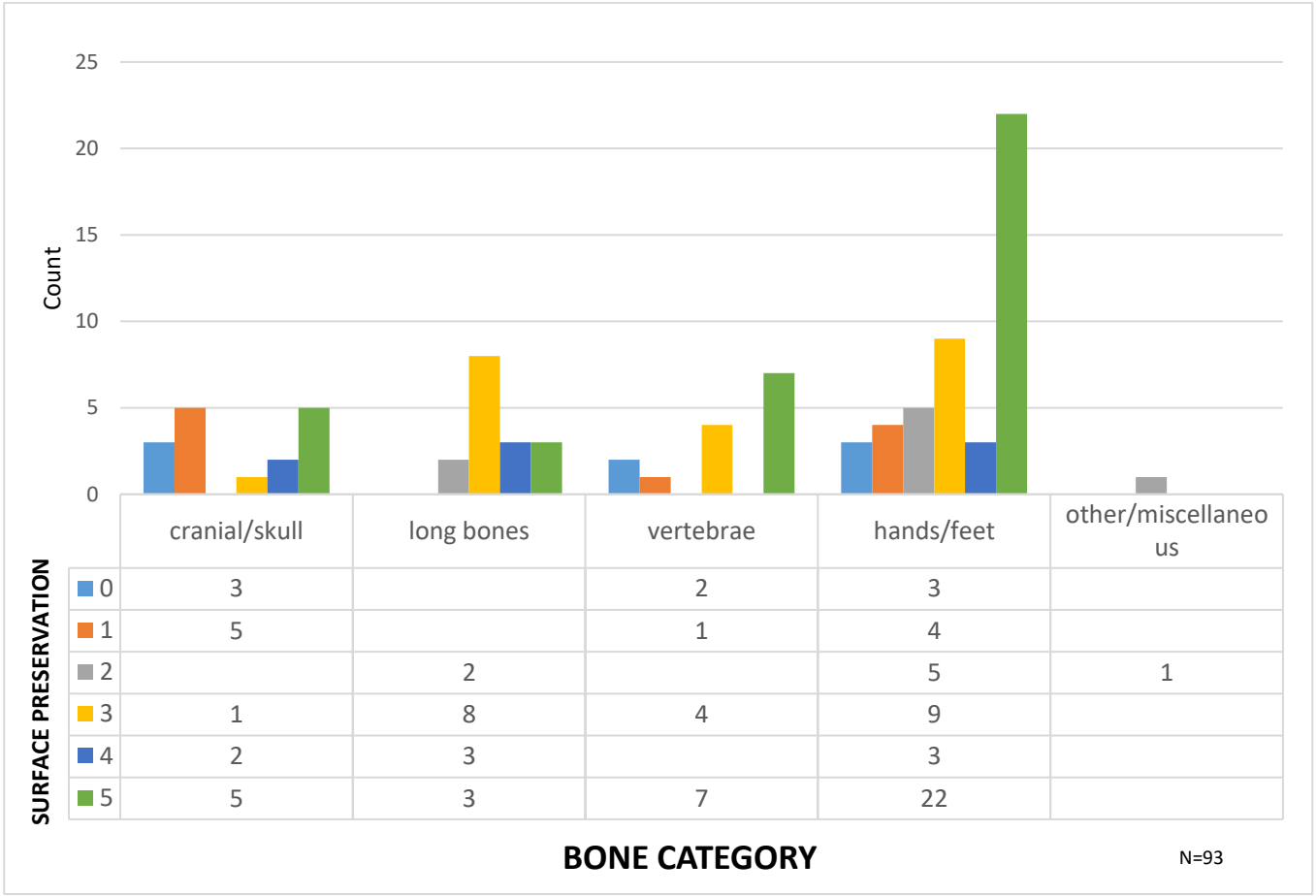


Figure 282. Frequencies of surface preservation scores in Gop Cave divided by bone type (0-5/poor-good).

Trampling

- Concretion residues on its surface must have created a hard exterior on one area of the bone, where signs of trampling marks were observed along with red stains. The trampled talus was very well preserved (score 5) similar to the majority of human remains discovered in Gop Cave. Trampling marks suggest disturbances in the cave from re-arrangements or exposure to other environments, where low intensity trampling occurred, followed by collection of the element amongst other and deposition in the cave.

Microscopic results

- Surface taphonomy amongst samples fluctuated with erosion (N=6, 60%), weathering (N=3, 30%), abrasion (N=8, 80%) and staining (N=5, 50%) present on several elements. Fractures were further identified on five long bones including four fresh (SNOs: 36-7, 39-40) and one dry (SNO: 38).
- Visual diagenetic parameters, including infiltrations, microstructural staining and microcracking/microfissures, were not visible amongst all samples whereas inclusions were observed in the microstructure of all samples primarily in low intensity. Collagen loss was extensive amongst most samples with birefringence scores ranging from zero to two and only a single sample (fibula SNO 35) with a high OHI score (4) demonstrating high birefringence.

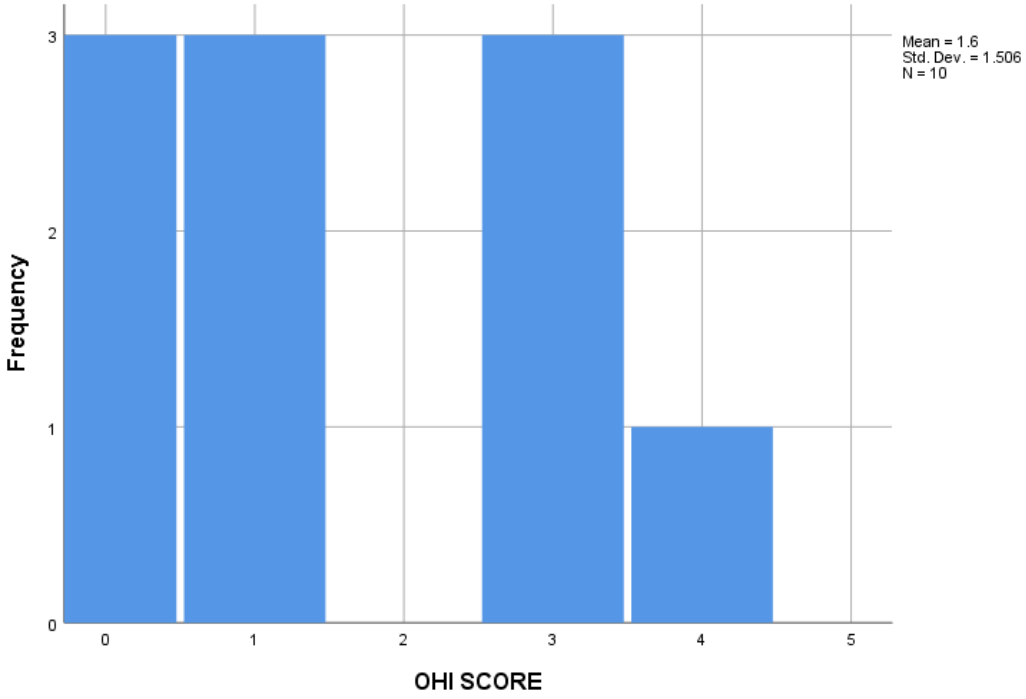


Figure 283. Histogram indicating OHI scores from Gop Cave.

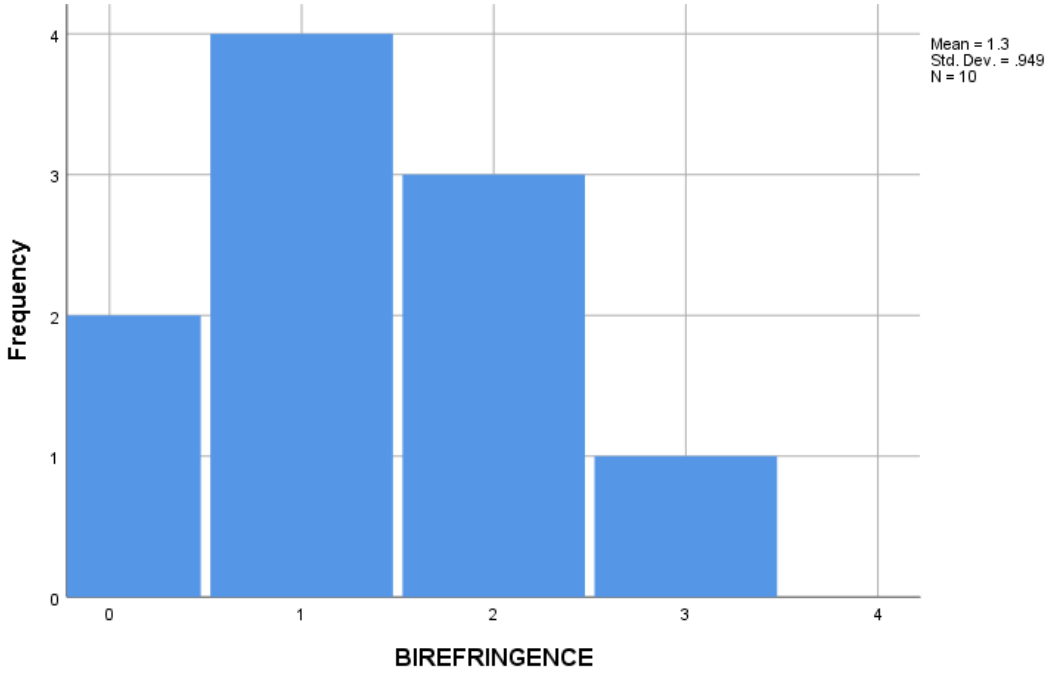


Figure 286. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from Gop Cave.

- Fibula 34 (SNO) showed the highest histological preservation (OHI score: 4) which was correlated with high birefringence whereas extensive bacterial

bioerosion (OHI score: 0) of humerus 39 and Middle/Late Neolithic cranial fragment 44 was related with absence of collagen preservation (0).

OHI SCORE	BIREFRINGENCE INDEX			
	NONE (0)	LOW (1)	MEDIUM (2)	HIGH (3)
0	2	1	0	0
1	0	3	0	0
3	0	0	3	0
4	0	0	0	1

Table 161. Birefringence scores from samples from Gop Cave cross-referenced with OHI scores. N=10.

OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICROFISSURES
0	3	1	2	0
1	3	3	1	1
3	3	3	3	2
4	1	1	1	1

Table 162. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=10.

Lower scores (0-1) indicated lower presence of extraneous material/cracking/microstructural staining and medium to higher OHI scores (3-4) showing medium to high intensity patterns.

- Intensity patterns amongst inclusions and infiltrations were primarily low (score 1) (N=7 and N=6 respectively) whilst cracking intensities ranged low to medium (scores 1 and 2/N=1 respectively) and high (score 3/N=2).
- A single mandible (SNO: 42) was associated with presence of high intensity microcracking and surface weathering.

OHI SCORE	INCLUSION INTENSITY			INFILTRATION INTENSITY			CRACK INTENSITY			
	1	2	3	0	1	2	0	1	2	3
	LOW	MEDIUM	HIGH	ABSENT	LOW	MEDIUM	ABSENT	LOW	MEDIUM	HIGH
0	3	0	0	2	1	0	3	0	0	0
1	3	0	0	0	3	0	2	1	0	0
3	1	1	1	0	2	1	1	0	0	2
4	0	1	0	0	0	1	0	0	1	0

Table 163. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=10.

OHI SCORE	STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)	MICROCRACKING & SURFACE EROSION	MICROCRACKING & WEATHERING (STAGE 1)
0	1	0	0
1	1	0	0
3	1	0	1
4	0	1	0

Table 164. Stained samples (surface and microstructural staining), eroded, weathered (surface) with evidence of microcracking. N=10.

- Inclusion and infiltration colour ranged from brown (fair/dark) to black/brown and brown/grey, red and red/brown. Microstructural staining further showed wide variation in colours from brown (fair/dark) to brown/red (dark) and blue (under polar), red (dark) and brown/orange.

- Red infiltrations and red/blue staining were noted amongst long bones (SNO: 35-6, 39) and were observed under both polar and normal light (SNO: 39).

DATE	SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
	35	LB	4	brown - fair/dark	black/brown	brown - fair	3
	36	LB	3	brown - dark, fair; grey - fair	red/brown (polar)	brown/red - dark and blue (polar);	2
	37	LB	1	brown - dark, fair	brown - dark, fair	brown - fair (polar)	1
	38	LB	0	brown - fair, dark	no infiltrations identified	no staining identified	1
	39	LB	0	brown - fair, dark; brown/red	brown/grey - fair	brown/red - fair; red-dark	0
	40	LB	3	brown - dark	brown -fair/dark	brown - fair and dark brown (polar)	2
MIDDLE/ LATE NEOLITHIC	41	M	1	brown - dark; black	brown - dark	no staining identified	1
	42	M	3	brown - fair	brown/black	brown - fair, dark; orange - fair; brown/orange	2
	43	CF	1	black/brown	black	no staining identified	1

MIDDLE/ LATE NEOLITHIC	44	CF	0	brown - fair	no infiltrations identified	brown - fair (polar); orange/brown; brown	0

Table 165. Samples (N=10) from Gop Cave. Indication of available radiocarbon date (DATE), element (ELEM) – cranial fragment (CF), mandible (M) and long bone (LB), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high).

7.9. Ogof Pant-y-Wennol

Frequency of skeletal elements

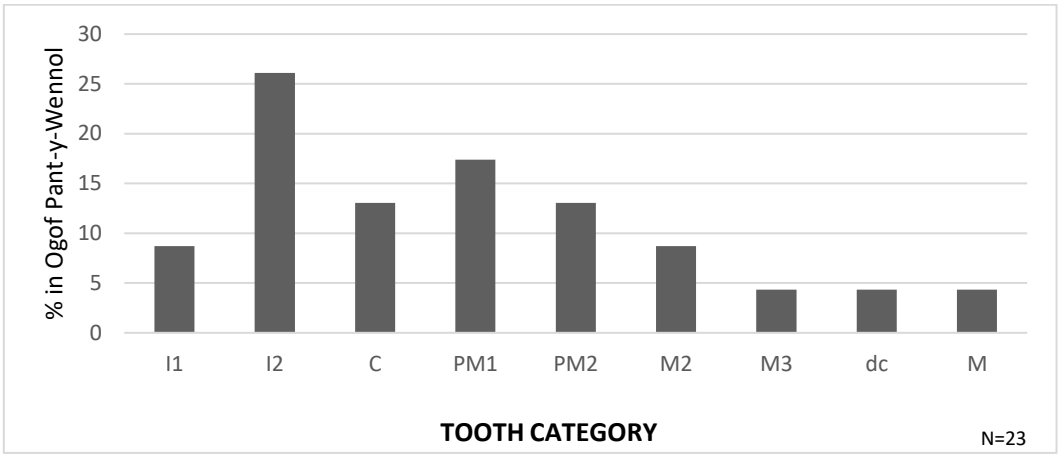


Figure 289. Teeth distributions in Ogof Pant-y-Wennol. I1= 1st incisor, I2= 2nd incisor, C= canine, PM1= 1st premolar, PM2= 2nd premolar, M1= 1st molar, M2= 2nd molar, M3= 3rd molar, dc1= deciduous canine and M=molar (no identification of exact tooth).

- Tibiae (N=6) and ulnae (N=3) epiphyses as well as radii, ulnae and tibiae shafts (N=4 respectively) demonstrated higher representation amongst long bones with only a single femur and two tibiae (SNOs: 1190, 1194-5) showing full zone completeness.
- Four long bones (SNOs: 1191, 1196, 1198, 1202) exhibiting dry (N=3) and fresh (N=1) fractures further sampled for microscopic analysis demonstrated varied OHI scores with lower (1-2) to higher (5) histological preservations.

LONG BONE	EPIPHYSIS ABSENT	EPIPHYSIS PRESENT	SHAFT ABSENT	SHAFT PRESENT
HUMERUS	1	2	1	2
RADIUS	3	1	0	4
ULNA	1	3	0	4
FEMUR	2	1	0	3
TIBIA	2	6	4	4
FIBULA	3	1	1	3

Table 167. Presence/ absence of epiphysis and shafts based on long bone representation in Ogof Pant-y-Wennol. N=26 (excluding three perinate long bones).

MNI, demography and pathology

- One loose temporal (SNO: 1210), unstratified, from a probable male (nuchal crest surviving), was not included in the analysis as it could have derived from the unstratifed Neolithic cranium 1174 (from probable male).
- Presence of calculus on two loose teeth (SNOs: 182-3) could not be determined with confidence due to presence of concretion/stalagmite residues. Signs of pathology could have been masked by concretion and were not observed on any human remains.

Taphonomy – Macroscopic results

Weathering

- The humerus SNO 57 was further sampled for microscopic analysis and demonstrated very good histological preservation (OHI score: 5), with minor signs of budded and linear longitudinal bacterial attack, supporting early disarticulation of the skeleton that did not allow enteric gut bacteria to attack the bone during putrefaction, followed by sub-aerial exposure, collection and deposition in the cave.
- Abrasion and weathering were more often associated with presence of erosion whilst presence of red stains (N=3) could suggest these elements derived from the first excavation and unearthed from passages within the cave filled with a matrix of sticky red and brown n clay and accompanied by faunal remains.
- Gnawing was apparent on one proximal hand phalanx (SNO: 1337) and was overall not observed on surviving human remains (excluding two elements).

WTH STAGE	EROSION		STAINING		ABRASION		GNAWING	
	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT	ABSENT	PRESENT
1	7	17	1	23	11	13	23	1
2	0	1	0	1	0	1	1	0
3	3	0	0	3	3	0	3	0
4	1	0	0	1	1	0	1	0

Table 168. Weathering (WTH) stages 1-2 correlated with other taphonomic modifications. N=29 (only weathered bones).

Gnawing

- Both elements showed low surface preservation (score 2).
- Disturbances in the cave must have resulted from human action. The high frequencies of fragmented flat/irregular bones and hands/feet compared to the much lower presence of long bones, some accompanied by weathering (2-4), and cranial/skull remains suggests possible selection of certain elements for deposition along with primary depositions in the cave. OHI scores amongst sampled remains (both cranial and postcranial) further showed large differentiations (0-3 and 5) supporting distinct treatment and patterns amongst individuals.

Erosion

- Nine loose teeth were also eroded which were unearthed from the area beneath the cave's overhang outside the cave during the second phase of excavation.
- Surface preservation amongst eroded and non-eroded remains showed similar distributions amongst scores (medium to poor preservation) with most eroded remains indicating lower preservation (score 1) from non-eroded elements (score 3).
- No particular patterns were observed amongst surface preservation scores of eroded and non-eroded remains as a very low number of elements demonstrated good surface preservation (scores 4-5).

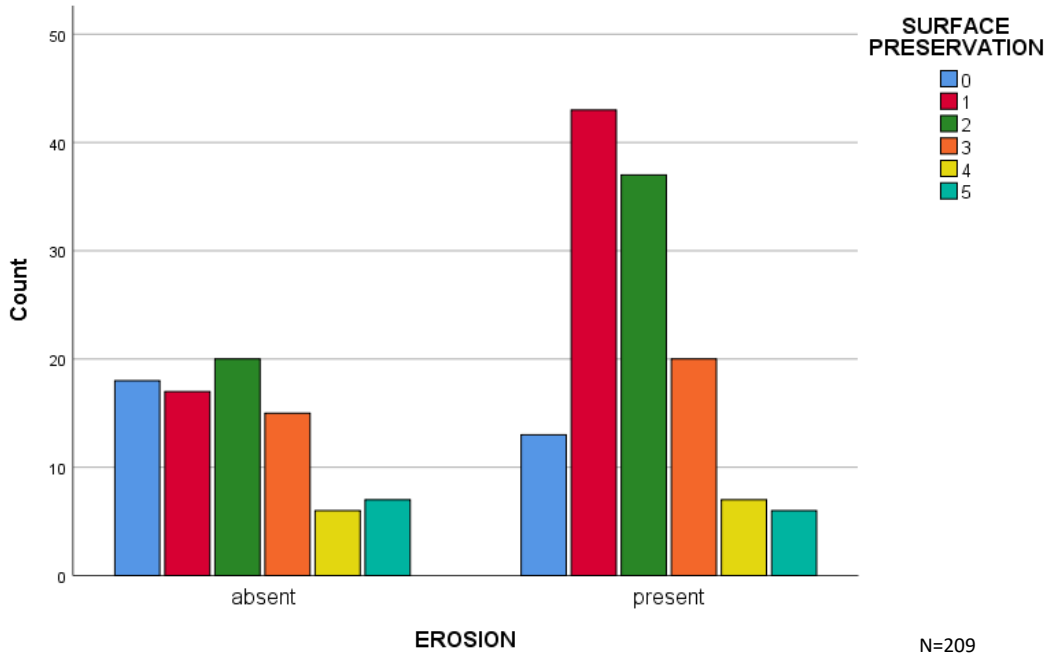


Figure 294. Surface preservation scores on eroded and non-eroded remains across sites in Ogof Pant-y-Wennol (0-5/poor-good)

	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4	GN ABSENT	GN PRESENT	STAINING ABSENT	STAINING PRESENT	ABRASION ABSENT	ABRASION PRESENT
EROSION ABSENT	72	7	0	3	1	82	1	27	56	63	20
EROSION PRESENT	108	17	1	0	0	125	1	10	116	57	69

Table 169. Eroded and non-eroded remains from Gop Cave compared with other taphonomic modifications (WTH=weathering, GN=gnawing, staining and abrasion). N=209.

Abrasion

- Surface preservation scores amongst both abraded and non-abraded remains showed medium to low preservation (scores 3-0) with abraded remains showing slightly better preservation (score 2) than non-abraded remains (score 1).

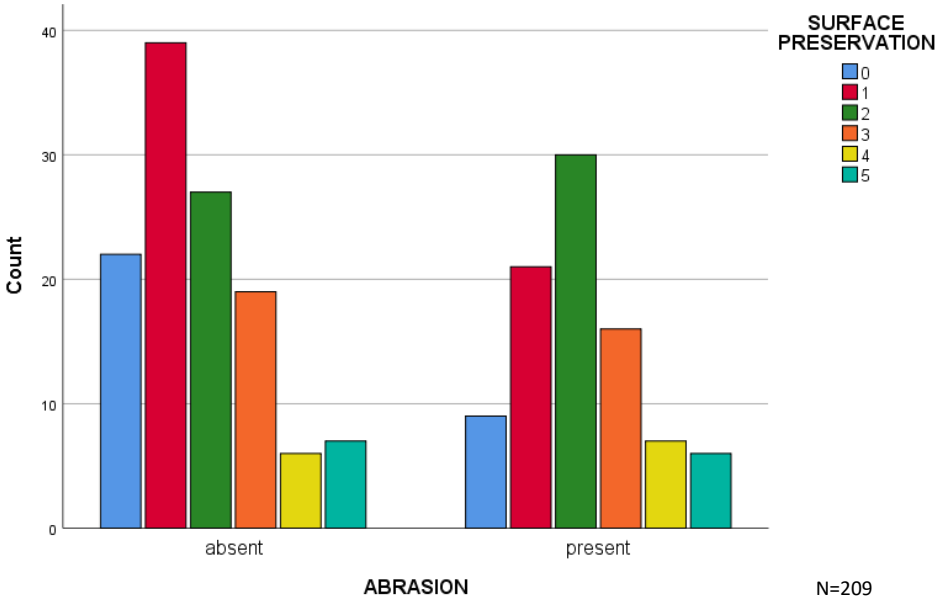


Figure 296. Surface preservation scores of abraded/non-abraded remains across sites in Ogof Pant-y-Wennol (0-5/poor-good).

	EROSION ABSENT	EROSION PRESENT	STAINING ABSENT	STAINING PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4
ABRASION ABSENT	63	57	27	93	119	1	105	11	0	3	1
ABRASION PRESENT	20	69	10	79	88	1	75	13	1	0	0

Table 170. Abraded and non-abraded remains from Gop Cave correlated with other taphonomic modifications (erosion, staining, gnawing, and weathering – WTH). N=209.

Staining

- Staining marks included black, brown and red (to light orange) (N=8) discolourations supported by manganese/mould staining (black) often encountered in cave environments, and a matrix of sticky red and brown clay as noted in site reports (see Appendix 5/Site Backgrounds). Concretion residues/patches were further recorded on a large number of human remains due to presence of stalagmite reported in the cave. Concretion/stalagmite residues were recorded on 15 loose teeth. Red marks (resulting from iron-rich soils or clay) were noted on four bones of hands/feet (SNOs: 1217, 1288, 1305, 1296), two ribs (SNOs: 1172, 1178) and one femur (SNO: 1190) whilst light orange stains were apparent on a single vertebra (SNO: 1233).

	EROSION ABSENT	EROSION PRESENT	ABRASION ABSENT	ABRASION PRESENT	GNAWING ABSENT	GNAWING PRESENT	NO WTH	WTH STAGE 1	WTH STAGE 2	WTH STAGE 3	WTH STAGE 4
STAINING ABSENT	27	10	27	10	36	1	36	1	0	0	0
STAINING PRESENT	56	116	93	79	171	1	44	3	1	3	1

Table 171. Staining absence/presence correlated with other taphonomic modifications (erosion, abrasion, gnawing, WTH= weathering absence/presence stages 1-3). N=209.

Fractures (fresh vs dry)

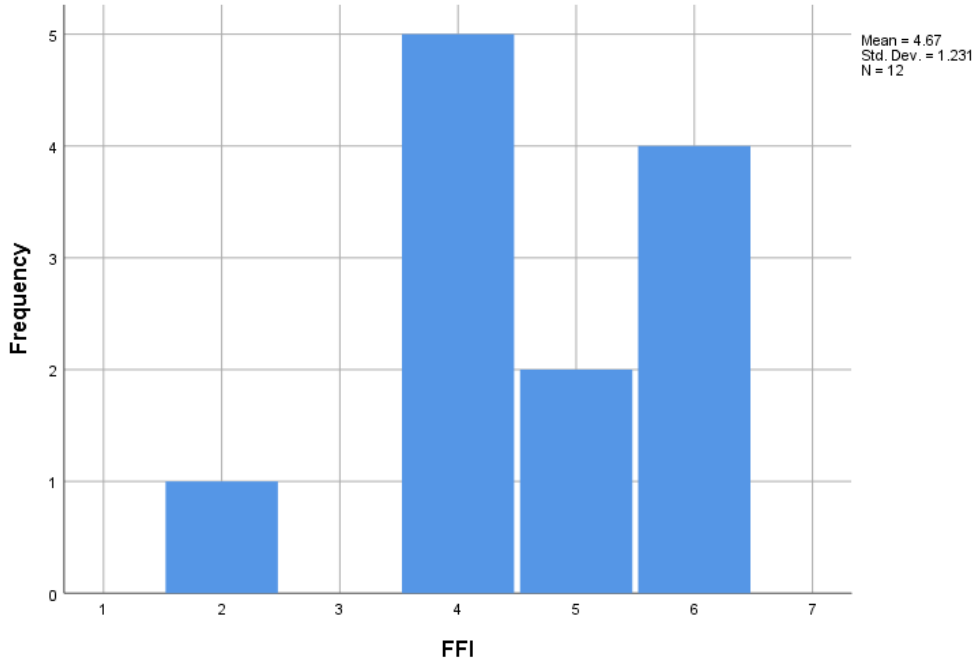


Figure 298. Total FFI (Fracture Freshness Index) scores in Ogof Pant-y-Wennol. N=double entries for fractures identified in both proximal and distal ends

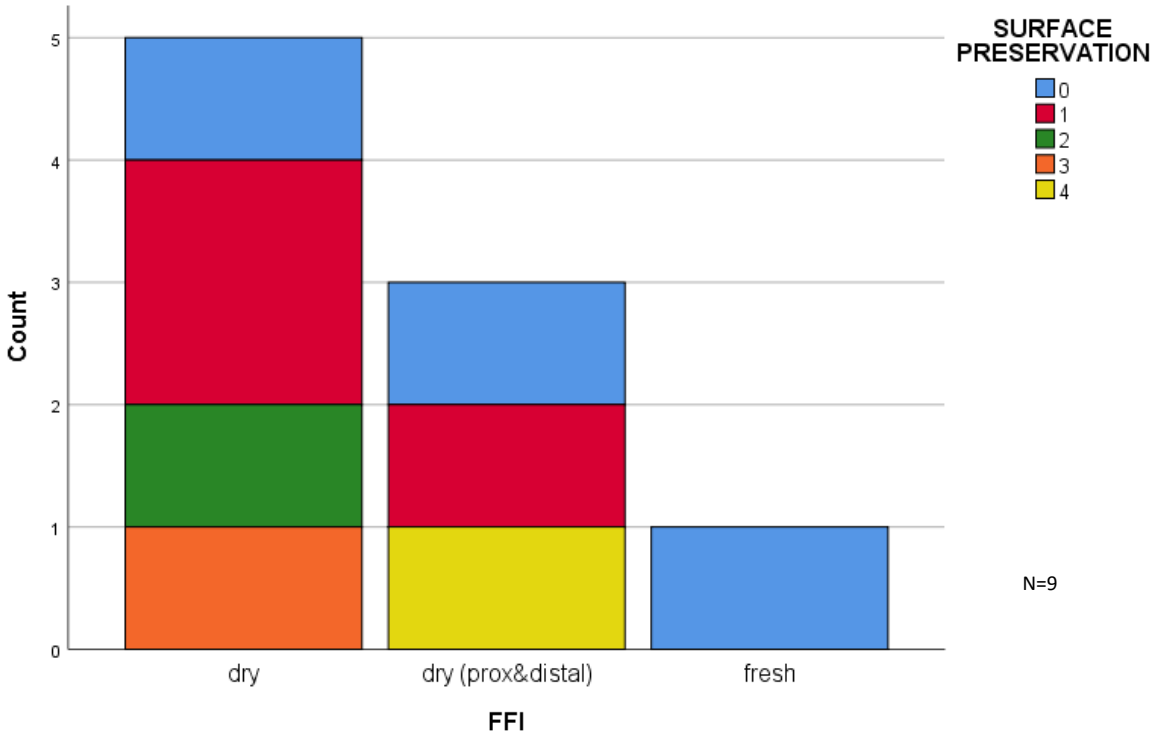


Figure 299. Fracture Freshness Index (FFI dry/fresh breaks) based on surface preservation scores in Ogof Pant-y-Wennol (0-5/poor-good).

- Microscopic analysis of humerus SNO 1196 further demonstrated very good histological preservation (OHI score: 5), suggesting peri-mortem manipulation and disarticulation of the bone, followed by prolonged sub-aerial exposure and final deposition in the cave.
- Other modifications included staining (all long bones), erosion amongst five long bones (only two weathered - stages 1-2) and abrasion on four long bones (only two weathered - stages 1-2).
- Abrasion absence could support differentiations in burial, such as selection of body parts and deposition in passages where water abrasion was obscured. Microscopic analysis of four more long bones exhibiting dry fractures (SNOs: 1191, 1202, 1198/ 56, 58-9) showed fluctuations in histological preservation (OHI scores: 1-2 and 5 respectively), supporting differentiations in treatment with handling of remains peri- and post-mortem.

FFI		WEATHERING				EROSION	ABRASION	STAINING
		STAGE 1	STAGE 2	STAGE 3	STAGE 4			
	DRY	0	1	1	0	3	3	5
	DRY (PROX&DISTAL)	1	0	1	0	2	1	3
	FRESH	0	0	0	1	0	0	1

Table 172. FFI correlated with taphonomic modifications in Ogof Panty-y-Wennol. N=9.

Surface preservation

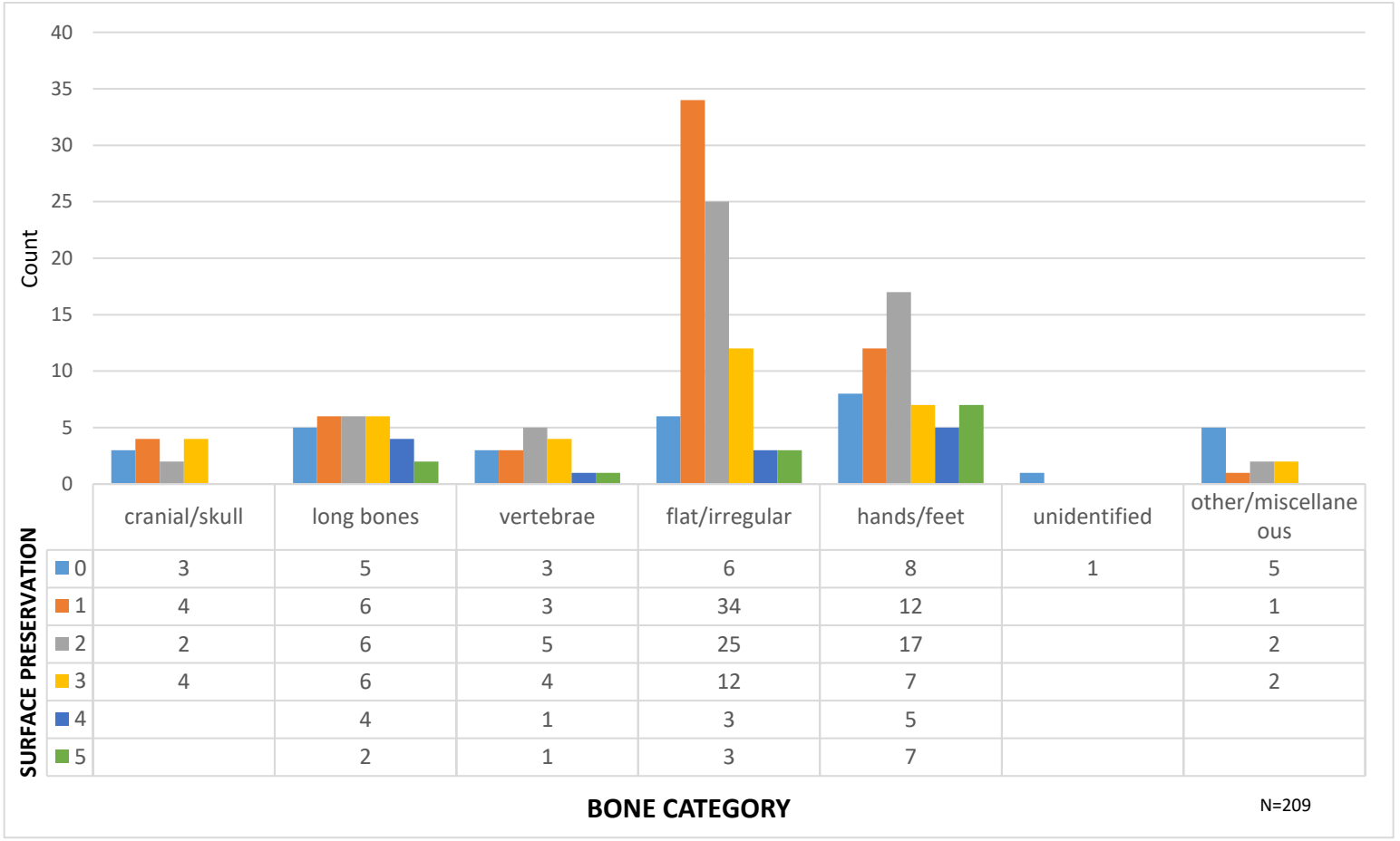


Figure 300. Frequencies of surface preservation scores in Ogof Pant-y-Wennol divided by bone type (0-5/poor-good).

- Whilst disturbances (possibly by the land owner) were mentioned in the original reports (Davies 1974b: 19), separate burial areas were in fact used for depositions in Ogof Pant-y-Wennol. The site was left disturbed by the landlord who used binding material (stalagmite) to construct a wall (possibly shutting the cave from further disturbances).

Trampling

- Remains were unearthed from separate trenches/areas (squares 11 and 0 respectively) with signs of erosion, abrasion, staining and low surface preservation (score 1). Cranial fragment SNO 1276 further exhibited concretion residues on its surface and must have been recovered by the inner cave floor where stalagmite was found in abundance (Davies 1974b: 19).

Microscopic results

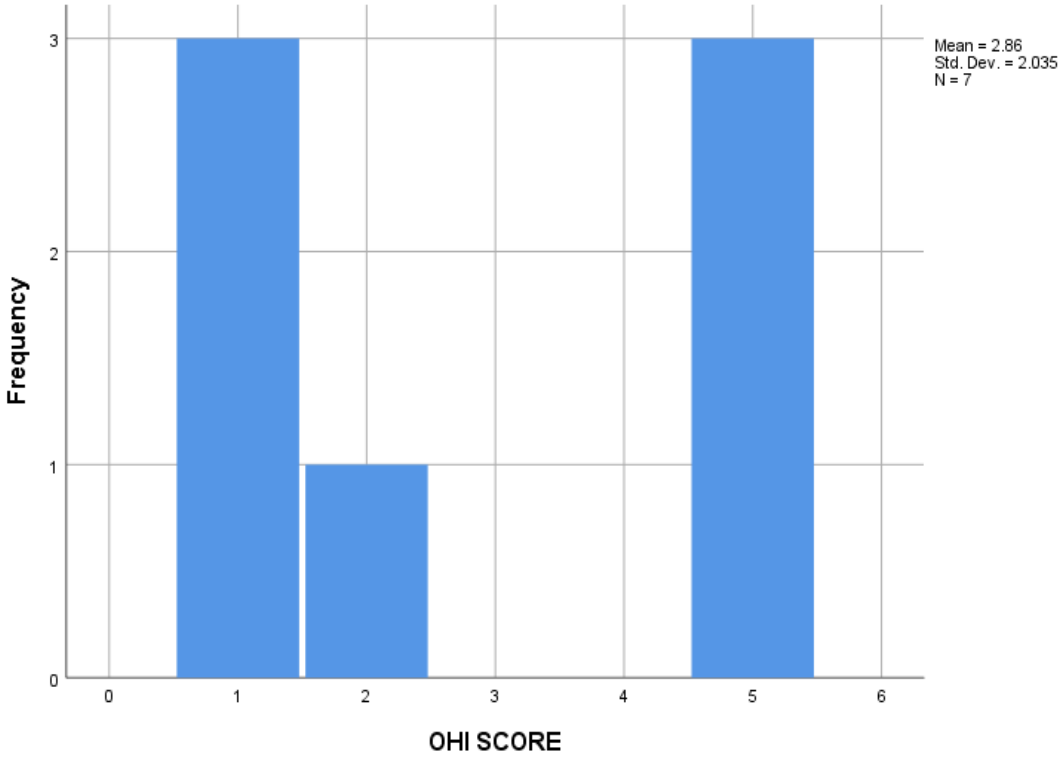


Figure 303. Histogram indicating OHI scores from Ogof Pant-y-Wennol.

ELEMENT		OHI SCORE		
		1	**2**	**5**
	CF	2	0	1
	LB	1	1	2

Table 173. Table demonstrating OHI score distribution amongst cranial fragments (CF/ including sample from cranium) and long bones (LB) sampled from Ogof Pant-y-Wennol. N=7.

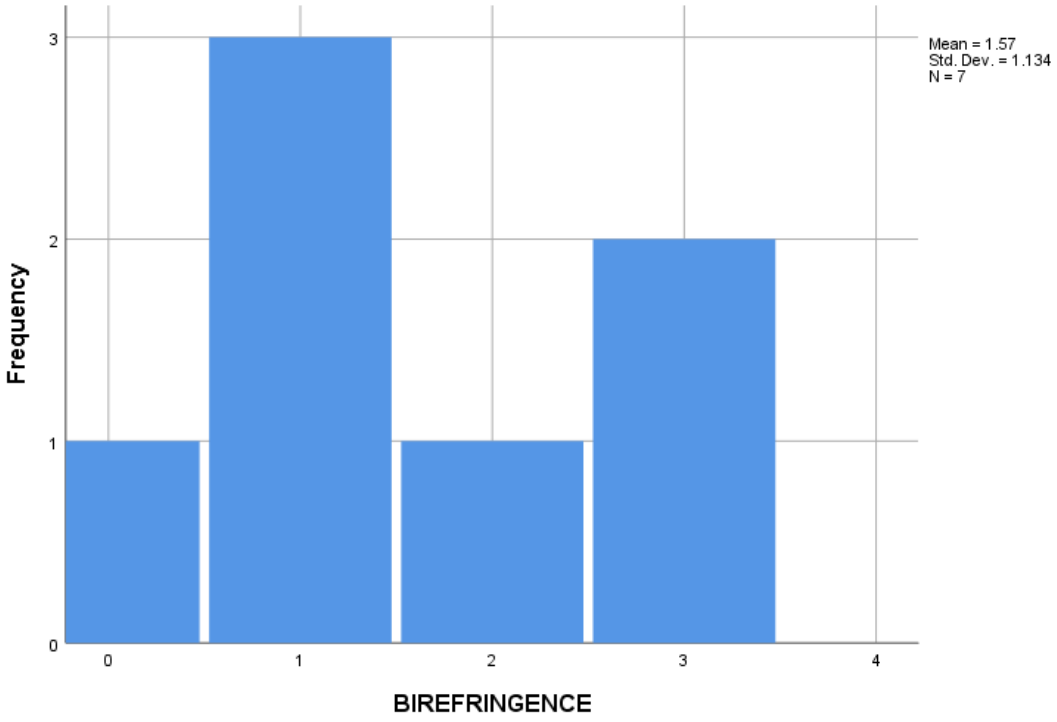


Figure 306. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from Ogof Pant-y-Wennol.

OHI SCORE	BIREFRINGENCE INDEX			
	NONE (0)	**LOW (1)**	**MEDIUM (2)**	**HIGH (3)**
1	1	2	0	0
2	0	1	0	0
5	0	0	1	2

Table 174. Birefringence scores from samples from Ogof Pant-y-Wennol cross-referenced with OHI scores. N=7.

OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATION	CRACK/MICROFISSURES
1	3	3	3	1
2	1	1	1	1
5	3	3	3	3

Table 175. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=7.

OHI SCORE	INCLUSION INTENSITY		INFILTRATION INTENSITY			CRACKING INTENSITY		
	1	**3**	**1**	**2**	**3**	**0**	**1**	**3**
	LOW	**HIGH**	**LOW**	**MEDIUM**	**HIGH**	**ABSENT**	**LOW**	**HIGH**
1	3	0	2	1	0	2	1	0
2	1	0	0	1	0	0	1	0
5	1	2	0	0	3	0	0	3

Table 176. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=7.

OHI SCORE	STAINED TOTAL (SURFACE & MICROSTRUCTURAL STAINING)	MICROCRACKING & SURFACE EROSION	MICROCRACKING & WEATHERING (STAGE 1)
1	3	1	0
2	1	1	0
5	3	2	1

Table 177. Stained samples (surface and microstructural staining), eroded, weathered (surface) with evidence of microcracking. N=7.

- Inclusion and infiltration colours showed similarities with brown/black to black extraneous material observed in the microstructure amongst all samples. Microstructural staining ranged from brown (fair/dark) to (fair) orange/brown and (fair) red (SNO: 60) and was correlated with surface staining amongst all samples. Orange/brown discolorations were apparent amongst microstructural staining in two Early Neolithic cranial fragments (SNOs: 60-1) and one long bone (humerus SNO 57) that exhibited a fresh fracture and advanced weathering stage.

DATE	SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
MIDDLE NEOLITHIC	55	C	1	black	black	brown - fair, dark	1
	56	LB	2	black; brown - fair	black	brown - dark	1
	57	LB	5	black; brown - fair	black	brown/orange - fair	2
	58	LB	1	brown - fair	black/brown	black/brown; brown - fair	1

	59	LB	5	black	black/brown	brown - fair	3
EARLY NEOLITHIC	60	CF	5	black; brown - dark	black/brown	brown - fair, dark; orange/brown - fair; red - fair	3
EARLY NEOLITHIC	61	CF	1	brown/black; brown - fair	black/brown	brown/orange - fair; brown - fair	0

Table 178. Samples (N=7) from Ogof Pant-y-Wennol. Indication of available radiocarbon date (DATE), element (ELEM) – cranial fragment (CF), sample from more complete cranium (C) and long bone (LB), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high).

- Orange staining was overall identified amongst samples from various sites, that either demonstrated signs of weathering (stages 1, 3-4), erosion or abrasion. Exposure in certain soils (Booth 2014: 317) (e.g. clay, gravel possibly from stalagmites solidified patched in caves) or separate burial contexts (even prior deposition causing weathering and cracking/splitting of the surface) may be responsible for orange staining in the microstructure. OHI scores amongst aforementioned samples ranged zero to three and five, with all but a single sample exhibiting brown, black/brown inclusions and infiltrations (orange/brown in mandible SNO: 5)
- Similarly, birefringence scores demonstrated variations (0-3) amongst samples and no particular patterns were identified. Whilst not conclusive, presence of orange staining in the microstructure could suggest exposure in different environments, mirroring distinct burial stages. Context/stratigraphic information does not allow correct identification of element and possible artefacts (e.g. iron) that release materials responsible for the discolouration of bone microstructure (Shahack-Gross *et al.* 1997; Hollund *et al.* 2012) and, therefore, results must be considered with caution.

SNO	ELEM	TAPH	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
1	CF	erosion, staining, weathering stage 1	3	black/brown	brown - dark	brown- fair, dark; orange/brown	2
2	M	erosion, abrasion	5	black/brown	brown - fair, dark	brown-orange	2
3	M	erosion, staining, weathering stage 1	2	brown - dark	brown - dark	brown-fair, dark; orange/brown- fair, dark	2
5	M	erosion, abrasion, staining, weathering stage 1	1	brown - dark	orange/brown	brown/orange- dark, fair	1
6	M	weathering stage 1, staining, abrasion, root etching	3	brown - dark, fair	brown - dark; black	brown/orange	2
9	CF	erosion, staining, weathering stage 1	1	brown - fair	brown - dark	brown, dark; faded orange-brown, intense orange/red	2
10	CF	heavily stained; abrasion	2	brown - fair	brown - dark	intense orange, orange/brown fair; brown - fair;dark brown in areas where collagen is preserved under polar light	1
11	CF	erosion/root etching staining, weathering 1	1	brown - dark	brown/black; brown - dark	orange/brown fair; red/orange under polar	1
13	LB	erosion	1	brown - fair	brown	orange/brown - fair; brown - fair	0

27	LB	erosion, weathering stage 3, dry fractures (prox&distal)	5	brown - dark, fair	brown- dark; black/brown	orange, brown - fair; red	2
28	LB	erosion, weathering stage 3	5	brown - dark, fair; red	brown - dark; black/brown	orange/brown - fair	2
31	CF	erosion	3	brown - dark, fair; black	brown - dark; brown/black	orange - fair; brown dark; red (polar); green?	1
42	M	abrasion, weathering stage 1	3	brown - fair	brown/black	brown - fair, dark; orange - fair; brown/orange	2
44	CF	erosion, abrasion	0	brown - fair	no infiltrations identified	brown - fair (polar); orange/brown; brown	0
57	LB	staining, weathering stage 4, fresh fracture (distal)	5	black; brown - fair	black	brown/orange - fair	2
60	CF	erosion, abrasion, staining	5	black; brown - dark	black/brown	brown - fair, dark; orange/brown - fair; red - fair	3
61	CF	erosion, abrasion, staining	1	brown/black; brown - fair	black/brown	brown/orange - fair; brown - fair	
63	LB	not recorded (in primary analysis)	1	brown - fair; black/brown	brown/black; brown - dark	brown/orange - fair; brown - dark; red –intense/polar light)	

Table 179. Samples across sites (N=18) (Wales and north Somerset/SNO: 63) demonstrating presence of orange, orange/brown discolourations in their microstructure. Indication of element (ELEM) – cranial fragment (CF), mandible (M) and long bone (LB), surface taphonomy (TAPH), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high). SNO: 63= sample from Backwell Cave/north Somerset – sampling not conducted by author.

7.10. Backwell Cave

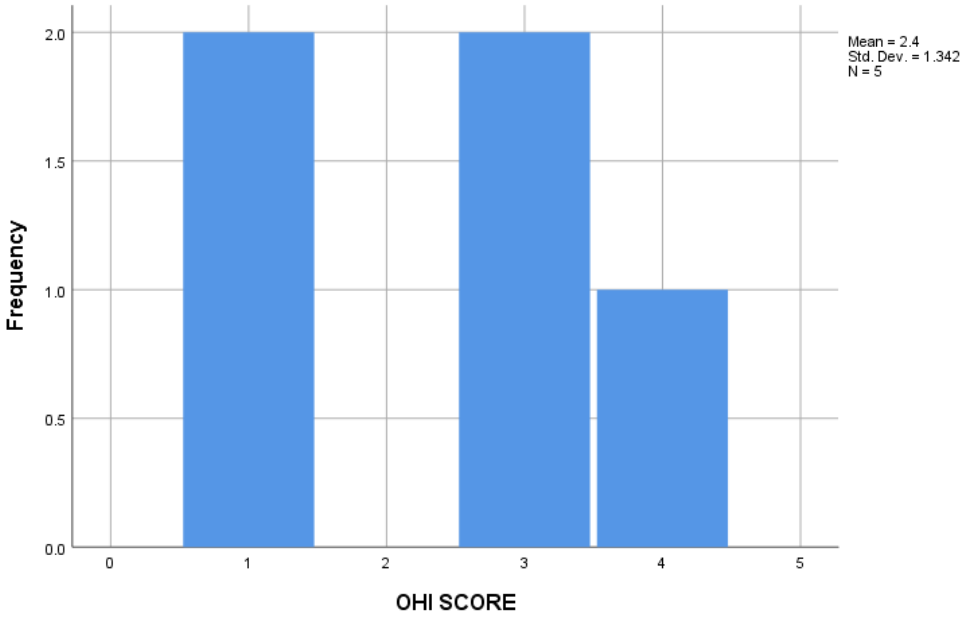


Figure 307. Histogram indicating OHI scores from Backwell Cave.

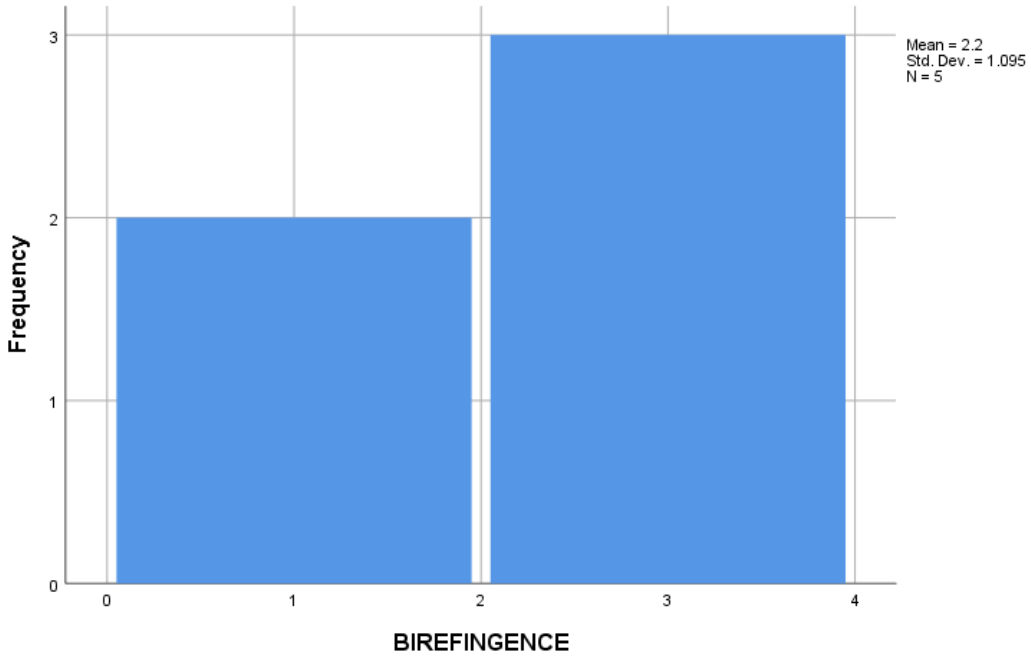


Figure 311. Frequency of birefringence scores (0= no birefringence, 1=low, 2=medium, 3=high) from Backwell Cave.

- Humeri SNO 63 and SNO 66 exhibited extensive bacterial attack (OHI score: 1) and collagen loss (Birefringence score: 1/low), absence of microcracking,

low/medium intensity inclusion and infiltrations (brown to brown/black and brown/red) and microstructural staining (brown). Humeri 62, 64-5 (SNOs) exhibited medium to high OHI scores (3-4), high birefringence levels (score 3), medium/high microcracking intensity, brown (fair/dark) microstructural staining and brown/black to red extraneous material (inclusions infiltrations) in high intensities.

OHI SCORE	BIREFINGENCE INDEX	
	LOW (1)	HIGH (3)
1	2	0
3	0	2
4	0	1

Table 180. Birefringence scores from samples from Backwell Cave cross-referenced with OHI scores. N=5.

OHI SCORE	INCL	INFIL	STAIN/DISCOLOURATIONS	CRACK/MICROFISSURES
1	2	2	2	0
3	2	2	2	2
4	1	1	1	1

Table 181. Extraneous material, microcracking, microstructural staining (INCL=Inclusions, INFIL=infiltration, STAIN=microstructural staining, CRACK=cracking) and OHI Scores. N=5.

OHI SCORE		INCLUSION INTENSITY		INFILTRATION INTENSITY		CRACKING INTENSITY		
		1	3	2	3	0	2	3
		LOW	HIGH	MEDIUM	HIGH	ABSENT	MEDIUM	HIGH
	1	2	0	2	0	2	0	0
	3	0	2	0	2	0	1	1
	4	0	1	0	1	0	0	1

Table 182. Inclusion, infiltration and cracking intensities (0-2) and associations with OHI scores. N=5.

- Inclusion, infiltration and staining colours demonstrated similarities (brown fair/dark to brown/black and brown/orange, brown/red) amongst all samples with varying levels of bacterial attack.

DATE	SNO	ELEM	OHI SCORE	INCL COLOUR	INFIL COLOUR	STAIN COLOUR	BIREFR
	62	LB	3	brown - fair; black/brown	black	brown - fair	3
	63	LB	1	brown - fair; black/brown	brown/black; brown – dark; red (polar)	brown - fair	1
	64	LB	3	brown - fair; dark; black; red - intense (polar)	black/brown	brown - fair, dark	3
EARLY NEOLITHIC	65	LB	4	brown/black; brown - dark	black	brown - fair, dark; brown/red (polar)	3

	66	LB	1	brown - fair, dark; brown/red	black, red (polar)	brown fair, dark	1

Table 183. Samples (N=5) from Backwell Cave. Indication of available radiocarbon date (DATE), element (ELEM) – long bone (LB), OHI score, inclusion (INCL), infiltration (INFIL), microstructural staining (STAIN) colours and birefringence (BIREFR) scores (0=absent, 1=low, 2=medium, 3=high).