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Gibraltar excavations with particular reference to Gorham's and Vanguard Caves

Gibraltar (36°07'13"N 5°20'31"W) is located at the southern end of the Iberian Peninsula, at the eastern end of the Bay of Gibraltar. It is a small peninsula being 5.2 km in length, 1.6 km in maximum natural width and about 6 km² in total land area. This peninsula forms part of the northern shore of the Strait of Gibraltar, linking the Mediterranean Sea and the Atlantic Ocean (Fig. 1). Currently, the Rock of Gibraltar includes 213 catalogued cavities, at least 26 catalogued as containing archaeological deposits. Among these, Gorham's Cave is perhaps the most referenced in the research and general literature; however, there are other significant Pleistocene archaeological sites, as Vanguard Cave, Devil's Tower Rock Shelter, Forbes' Quarry, Ibex Cave and Beefsteak Cave, among others.

Early developments

The history of cave research in Gibraltar goes back to the 18th Century. The Reverend John White, brother of the famous Gilbert White of Selborne, who was chaplain at Gibraltar during the 1770s, collected many zoological specimens and kept detailed records, corresponding regularly with his brother and other famous zoologists of the day, in particular Thomas Pennant and Daines Barrington. White wrote a *Fauna Calpensis*, the first detailed zoological account of Gibraltar, which was sadly never published, with the manuscript now lost (Mullens, 1913).

Interest in the geology, pre-history and natural history of Gibraltar during the 19th and early 20th centuries

Great interest and excitement about the geology and prehistory of Gibraltar was generated during the 19th Century following the discovery of rich deposits of bone breccia, as well as bones and human artifacts in caves in the limestone of the peninsula. The material recovered was considered to be of such great importance that it attracted the attention of famous names of the day, for example Sir Hugh Falconer and George Busk. As early as 1846 James Smith, who was an officer stationed in the Garrison of Gibraltar and who had become an active member of the Gibraltar Scientific Society, published a paper "On the Geology of Gibraltar" in the *Quarterly Journal of the Geological Society of London* (Smith, 1846).

Gibraltar, being a military fortress, acted as a magnet which concentrated individuals who would otherwise not have come to the area. The knowledge accumulated and disseminated by these officers was crucial in highlighting the uniqueness of Gibraltar and the surrounding areas of Spain. Among them, Lieutenant Colonel Willoughby Verner was an intrepid explorer with an insatiable passion for collecting and classifying birds and birds' eggs. Verner was also interested in prehistory. In 1911 he had heard of a cave with paintings in the Ronda area in southern Spain and was responsible for making known the exist-

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ence of La Cueva de la Pileta and its Palaeolithic Cave Art. The eminent prehistorians Professor H. Obermaier and L'Abbé Henri Breuil learnt of the existence of the cave and visited it with Verner in 1912. The relationship between Verner and Breuil developed from this contact and is another example of the fortuitous way in which discoveries were often made. Breuil, who was Professor at the Institut de Paléontologie Humaine de Paris, visited Gibraltar in 1914 at Verner's instigation and, while walking along the north-eastern side of the Rock, commented to Verner that the brecciated talus he had observed should prove fruitful in investigating the existence of prehistoric Man at Gibraltar (Verner, 1919).

Breuil returned in 1917 and examined the brecciated talus. At the time he was in the war service of the Naval Bureau and the French Embassy at Madrid and was employed on several occasions as courier between Madrid and Gibraltar (Breuil, 1922). He found animal bones and Mousterian implements but was prevented from exploring further by a military policeman. He returned yet again in 1919, on this occasion with a Governor's permit to excavate. He found conclusive evidence of use of the site by "Palaeolithic Man" (Breuil, 1922). At Breuil's instigation, Miss Dorothy Garrod conducted detailed excavations of the site between November 1925 and January 1927 –her results included the discovery of fragments of the skull of a Neanderthal child. Gibraltar's second Neanderthal had been found, a few hundred metres from the 1848 find in Forbes' Quarry. The discovery is indirectly attributable to Verner– without his initial discovery of La Pileta and contact with Breuil, the latter might never have visited Gibraltar.

Perhaps the individual most responsible for bringing Gibraltar's caves and deposits to the forefront of scientific research was Captain James Brome, Governor of the Military Prison on Windmill Hill, Gibraltar, between April 1863 and December 1868. His investigations were so detailed and thorough that it prompted scientists such as Falconer and Busk to visit Gibraltar and examine the Rock's rich deposits. When Brome arrived in Gibraltar, the scientific community had begun to recognize the importance of Gibraltar's palaeontological deposits, especially the bone breccias. He took up the appointment of Governor of the Military Prison on Windmill Hill, Gibraltar. Windmill Hill is an ancient wave-cut platform at the southern end of the Gibraltar peninsula and it is here that a system of fissure caves (known as

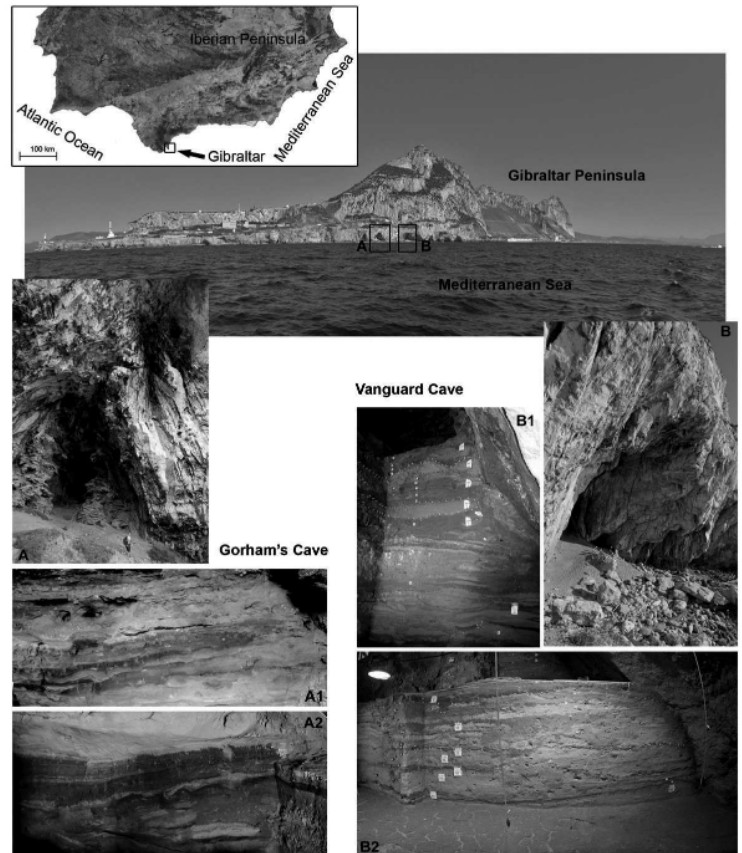


Figure 1. Location of Gibraltar at the southern Iberian Peninsula (top) and the present-day Rock of Gibraltar showing the location of Gorham's (A) and Vanguard Cave (B) on its east face: (A1, A2) Stratigraphic sequence of the outer area of Gorham's Cave; (B1, B2) new excavations at the Upper part of the stratigraphic sequence of Vanguard Cave.

the Genista complex) is to be found. The largest and most important of the system is Genista I which was discovered by Brome. He used convict labour to excavate this deep fissure, which yielded large quantities of bone some of which are thought to be the oldest so far found in Gibraltar. Brome was a thorough researcher and gained the respect of scientists of the day with whom he corresponded and to whom he sent most of what he collected in Gibraltar. The bulk of Busk's paper (Busk, 1868) on the Gibraltar bone finds is a verbatim account of Brome's discoveries.

The Neanderthal finds

The year 1848 saw many momentous events in European politics, but it was also an archaeological

watershed. Another momentous event, although unrecognised at the time, was the recognition and curation of a fossilised human cranium found during work at Forbes' Quarry, Gibraltar (Busk, 1865; Broca, 1869; Sollas, 1907). Although, technically speaking, the child's skull from Engis in Belgium was the first known discovery of a Neanderthal fossil, some 18 years earlier, its features were less obviously distinct from those of a modern human, and it was over a hundred years before its importance was recognised. In the case of the Forbes' Quarry discovery, the unusual morphology of the face and vault alone could have been enough to alert an educated observer to its possible significance, but instead fate decreed that today we discuss "Neanderthal Man" (*Homo neanderthalensis*) rather than "Calpican Man" ("*Homo calpicus*") (King, 1864; Keith, 1911). So it was that on the 3rd of March, 1848, a Captain Edmund Flint, secretary of the Gibraltar Scientific Society (at this time renamed the Gibraltar Museum Society) presented a human skull to this body of essentially military officers. The minutes of the meeting simply read: "*Presented a human skull from Forbes' Quarry, North Front, by the Secretary...*". Flint had been in charge of the society's museum since the 5th June, 1844, and his efforts were recognized in the minutes of 3rd October, 1849.

Nobody took much notice of the skull which was promptly put away in the Society's museum. The skull was in fact that of a Neanderthal but this was not realized until eight years later when another was found in the Neander Valley in Germany. Brome sent the skull to England with his extensive material from the Genista Caves. This material was being examined by Falconer and Busk. In 1864, Busk visited Gibraltar and went to Forbes' Quarry with Lieutenant Alexander Brown. There they found the matrix in which the skull had been embedded. It was then that Busk pronounced the skull: "*to be of a human being of the lowest known organization somewhat analogous to the Neanderthal*" (Busk, 1868), a view supported by Falconer: "*This human skull yielded by the Rock, appears to us to point to a still higher antiquity of man than even those found in the valley of the Vezere in the south of France. In fact, it is the most remarkable and perfect example of the kind now extant*" (Murchison, 1868).

The skull was exhibited at the meeting of the British Association in Bath in 1859. Busk subsequently presented the skull to the Royal College of Surgeons in 1868 – it caused a sensation and

became known as the Gibraltar Skull. The skull was examined by Professor Sollas and Dr. Sera of Naples and Professor Keith of the Hunterian Museum and it was stated to be of a woman who may have lived 200,000 years ago (Duckworth, 1911). Recently, as part of his research on George Busk (Gardiner, 1999), Professor Brian Gardiner located a review paper by Cook (1997), which referred to two neglected publications of Busk from 1864. These provide further information on the Forbes' Quarry discovery, and show that Busk was remarkably prescient in identifying some key morphological features of the fossil – in fact he was the first to note the midfacial projection and inflated cheekbones which are now considered one of the most distinctive of Neanderthal characters. As these sources were apparently unknown to Sir Arthur Keith when he described what was known of the early history of the specimen (Keith, 1911), we quote some of the pertinent material from these papers. On the 16th July 1864, Busk wrote a short communication in *The Reader* (Busk, 1864) entitled "Pithecoïd Priscan Man from Gibraltar". Near the end he stated of the Forbes' Quarry cranium: "*Its discovery also adds immensely to the scientific value of the Neanderthal specimen, if only as showing that the latter does not represent, as many have hitherto supposed, a mere individual peculiarity, but that it may have been characteristic of a race extending from the Rhine to the Pillars of Hercules: for, whatever may have been the case on the banks of the Dussel, even Professor Mayer [a contemporary sceptic regarding the Neanderthal find] will hardly suppose that a rickety Cossack engaged in the campaign of 1814 had crept into a sealed fissure in the Rock of Gibraltar.*"

In the *Bath Chronicle* Busk (1864) described the fossil in more detail, making morphological comparisons with "Negro", Australian and Tasmanian crania. He stated: "*The cranium in question, we understand, was originally deposited in a museum of natural curiosities, which at one time existed at Gibraltar, but which it is to be much regretted has of late years been allowed to fall into a state of confusion and neglect [...] Its extraordinary peculiarities fortunately struck the notice of Dr Hodgkin in a visit paid by that ethnologist to Gibraltar in the course of last year, in company with Sir Moses Montefiore, and it was at his instance that Captain Broune [Brome?], with his eminent zeal in the cause of science, was induced to procure its being forwarded to us for examination and description. [...] it was dug up in the course of some excavations being made in what is*

termed "Forbes Barrier", which is situated near the entrance into the fortress from the neutral ground or mainland. [...] the Gibraltar skull exhibits not only several of the striking peculiarities of the neanderthal [sic] calvarium but also many others, which from the imperfect condition of that famous specimen, are altogether wanting in it [...] In general outline the Gibraltar cranium viewed in profile, bears a strong resemblance to that from the Neanderthal, except that the supraorbital [sic] projection is not quite so great. The forehead is equally receding, and the great depression in the hinder part of the cranium is equally remarkable in both [...] One consequence of the great breadth and convexity of the nasal process of the maxillary bone, combined with the increased width of the nasal opening, is, as it were, to throw forward the entire nasal framework, whilst at the same time the canine fossa [...] is entirely filled up, the central portion of the bone rising in a uniform curve on either side, so that the central part of the countenance projects in a very remarkable manner".

It was the virtual absence of information on the skull and the circumstances of its discovery that led to Dr. W.L.H. Duckworth's (Cambridge University) visits between 1910 and 1912. His stated objective was: "to learn from personal observation and inquiry, so much as might be possible about the circumstances of the discovery of the now classical 'Gibraltar Skull'" (Duckworth, 1911). Duckworth found very little – the site had been extensively quarried and the cave's depth reduced (Duckworth, 1911). To make matters worse, a rock fall during Duckworth's visit sealed off the cave completely.

The skull is today in the Natural History Museum in London, transferred from the Royal College of Surgeons. A cast is exhibited in the Gibraltar Museum. Forbes' Quarry is the subject of a research and conservation project by the Gibraltar Museum. As we have already discussed, a second Neanderthal skull was found much later, in 1926. Dorothy Garrod found the fragmented skull of a child in Devil's Tower Rock Shelter and took it back to England along with all the material collected from this Mousterian Rock Shelter. This skull is also in the Natural History Museum in London.

Today, Forbes' Quarry is nearly stripped of Pleistocene sediments, but there are lingering pockets of a cemented, shelly sand which, to judge from the remaining matrix on the fossil, may relate to the provenance of the cranium. However, it will only be by direct age estimates using tech-

niques such as Electron Spin Resonance on tooth enamel, or Gamma Ray dating on the whole cranium, or OSL on the matrix, that we will eventually determine whether the Forbes' Quarry Neanderthal dates from the earlier or later part of the Late Pleistocene. The neighbouring site of Devil's Tower produced the partial skull of a Neanderthal child in 1926 (Garrod *et al.*, 1928), and has greater potential for further excavation and discoveries. It preserves much more Pleistocene sediment than Forbes' Quarry, and it is possible to relate that sediment to the previous excavations.

Neanderthal archaeological sites

There are several other sites in Gibraltar which preserve evidence of Neanderthal occupation. One, IbeX Cave, lies high up on the eastern face of the Rock, while four others lie to the southeast, close to the sea near "Governor's Beach". The present beach mainly consists of fine limestone blast debris from military tunnelling operations, but there are also cemented remnants of more ancient beaches which presumably accumulated during Oxygen Isotope Stage (OIS) 5. The caves are named (from the south) Bennett's, Gorham's, Vanguard and Boat Hoist. Three of these caves (IbeX, Gorham's and Vanguard) have been excavated since 1994 as part of the Gibraltar Caves Project and the project PalaeoMed.

Gorham's Cave

Gorham's Cave was discovered in 1907 by Captain A. Gorham of the 2nd Battalion Royal Munster Fusiliers, who opened up a fissure at the back of the cavity which bears his name. Subsequently, for convenience, both the cavern and the system of fissures came to be known as Gorham's Cave.

The cave appears to have been forgotten after 1907, although it may have been visited sporadically by military speleologists. However, on 16 March 1945, Lieutenant George Baker Alexander, R.E., a graduate geologist from Cambridge University, arrived in Gibraltar and conducted a thorough geological survey of Gibraltar at this time, concluding with the production of a new geological map of the region (Rose and Rosenbaum, 1990). Alexander became the first person to excavate Gorham's Cave, along with his companion, Lt. Monke. Both set out to excavate the upper layer of the site. Alexander's work, how-

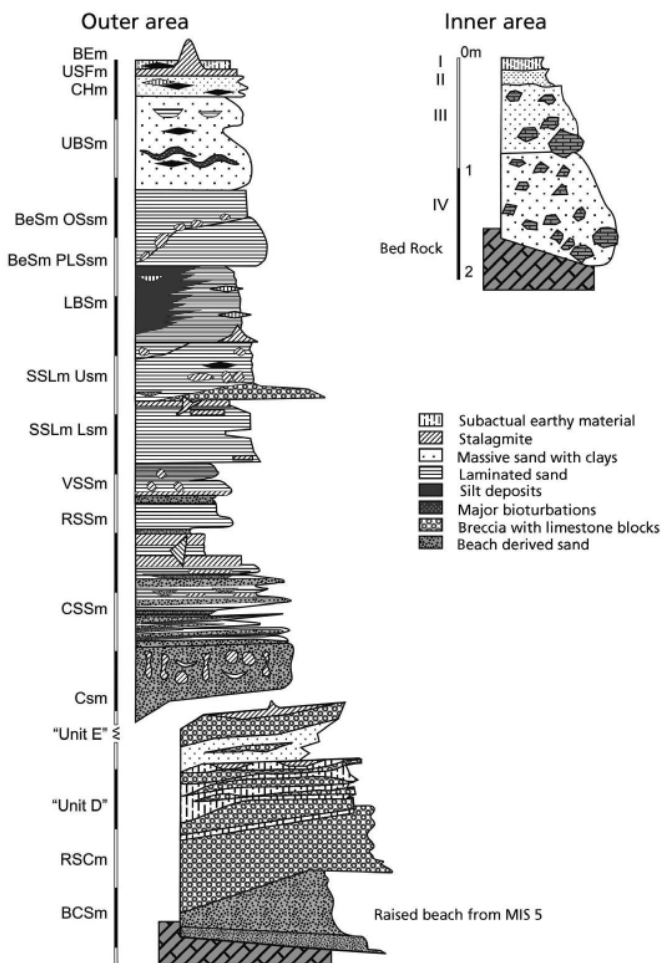


Figure 2. Stratigraphic profile of Gorham's Cave: Schematic profile of the outer sector (middle area of the cave) modified from Collcut (2013) in Barton *et al.*, (2013) (left) and stratigraphic profile of the inner sector (right).

ever, was not viewed well by the Gibraltar Museum Committee of the day. At about the same time (spring of 1948), the then governor, Sir Kenneth Anderson, presumably on the advice of Padre Brown, stopped further digging and wrote to the British Museum asking them to continue any further explorations. However, the British Museum had no staff available and the governor's letter was forwarded to Prof. Dorothy Garrod at Cambridge University, who had excavated Devil's Tower Rock Shelter in 1927–28. She was unable to undertake the work, and asked Dr John D'Arcy Waechter, fellow of the British Institute of Archaeology, Ankara, to fit the work in with his own programme in Turkey.

Waechter's excavations represented the first large-scale excavations in Gorham's Cave and established that it contained a record spanning perhaps 100 kya of Middle Palaeolithic, Upper Palaeolithic and Holocene occupation (Waechter, 1951, 1964). Waechter reported the presence of ancient hearths at various levels in the cave, and of faunal material throughout the sequence, dominated by the remains of ibex, rabbit and many species of bird. Unfortunately, many aspects of Waechter's excavations were never properly recorded or published, and much of the material he recovered has since disappeared. On the other hand, Waechter's stratigraphic sequence of layers running approximately horizontally east-west must have been simplified considerably compared with the complex reality which has since been observed.

The second phase of systematic excavations was carried out by a joint team from the Natural History Museum, London, led by Dr Christopher Stringer, and the British Museum, London, and by Ms Jill Cook, who visited Gibraltar in 1989. After preliminary excavations, the work developed as the 'Gibraltar Caves Project', jointly directed by the Gibraltar Museum and the Natural History Museum, London. Work until 1997 focused on the outer part of the cave, which had previously been excavated by Waechter (1951, 1964). Since 1997, the project direction has expanded to include the Museo de El Puerto Santa Maria and the University of Huelva. It is at this stage that the excavations in the inner part of Gorham's Cave commenced; their first results were published by Finlayson *et al.*, (2006).

The excavations in the outer area have been recently described by Barton *et al.*, (2013), shedding light on the sedimentary formation of the cave with a stratigraphic sequence of more than 16 m in thickness (Fig. 2). This sequence is composed mainly of earthy materials covering a cemented beach-rock deposit which presumably accumulated during OIS 5. The nature and sedimentary structures of the sediments filling the cave show a massive aeolian accumulation related to transgressive coastal dunes that migrated during OIS 3 highstand substages and/or cold, arid periods (Jiménez-Espejo *et al.*, 2013). The stratigraphic series include dark-brown organic-rich silty clay, grey sand and irregularly bedded yellowish-brown sand, brown-black organic-rich clay with whitish gritty phosphatic lenses and interbedded, massive, homogeneous, coarse brown sand (Collcut, 2013).

Radiocarbon dates of between *ca.* 29 and 51 kyr BP were obtained for UBSm.7 and BeSm.1; nevertheless, the dates from the underlying LBSmff.1–5 (*ca.* 42 and 56 kyr BP) seem to suggest that most charcoal fragments could have been derived from lower down the sequence (Higham *et al.*, 2013). The single-grain (SG) optically stimulated luminescence (OSL) chronology and the Bayesian age model yielded an age of MIS 5 near the base of the stratigraphy ($119,300 \pm 14,800$ kyr for CSm; Rhodes, 2013a).

The excavations in the inner area exposed an area of ≈ 29 m² of bedrock and a stratigraphic sequence formed by four archaeological levels (IV–I from bottom to top; Fig. 2). The stratigraphic composition is different from that of the other sectors, displaying local rock falls, aeolian dust and mainly karstic clay (Finlayson *et al.*, 2006). The sedimentary deposit is thinner (<2 m) than that of the outer area due to the higher position of the cave substrate. Levels I and II correspond to Phoenician and Neolithic horizons, respectively. Level III (mean depth of ≈ 60 cm) is subdivided into a basal

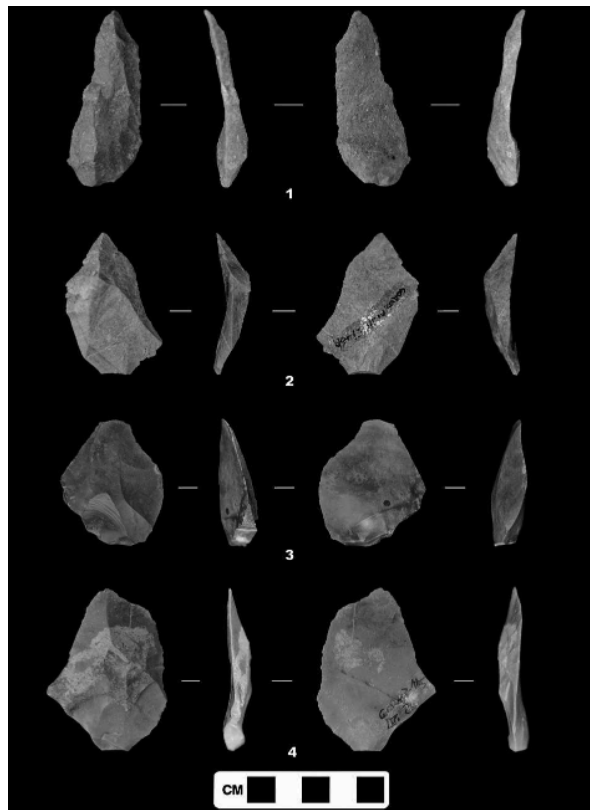


Figure 3. Mousterian tools from Level IV of Gorham's Cave.

Solutrean (IIIb) and an upper Magdalenian (IIIa) horizon. A distinctive feature of the middle part of this level is the high proportion of fallen fragments of angular limestone and speleothem. Levels III and IV are clearly differentiated by their textural composition, since level III consists of sandy sediment with dark brown clay in a sandy matrix, while level IV is characterised by a beige-coloured pure clay horizon (Finlayson *et al.*, 2006).

Regarding lithic assemblages, the outer stratigraphic sequence is consistent with the Middle Palaeolithic techno-complexes in its middle and lower part. The knapping technique mainly follows discoid reduction sequences, although a significant increase in laminar flakes coming from bipolar Levallois cores is observed at SSLm.5–6. The last moments of the Middle Palaeolithic seem to be represented by a Levallois point from UBSm.4, as CHm.5 is the first attributed to the Upper Palaeolithic (Barton and Jennings, 2013). In the inner area, level IV corresponds to a Mousterian techno-complex (Giles Pacheco *et al.*, 2012; Shipton *et al.*, 2013; Fig. 3). All the lithics from this level – in flint, sandstone, limestone and others – are made from autochthonous raw materials from the fossil beach deposits near the caves and from the levels of flint immersed in the Jurassic units of the Rock. The characteristics of the assemblage indicate discoidal and Levallois reduction methods. Some cores show unipolar orthogonal and opposite bipolar reductions. The tools from Level IV show a predominance of sides-crapers and denticulates. Notches and abrupt retouches are also represented. The metrics of the flakes seem to be conditioned by the size of the pebbles, especially in the case of flint, since the nodules in the beach breccias are small. In contrast, the technology from the overlying Level III is characteristic of the Upper Palaeolithic, with diagnostic pieces attributable to the Solutrean and Magdalenian (Giles Pacheco *et al.*, 2012).

Palaeobotanical (charcoal and pollen) samples from Gorham's Cave have revealed a diverse Mediterranean landscape during the Middle and Upper Palaeolithic, covering the stratigraphic sequence of the cave (Carrión *et al.*, 2008). Inferred vegetation types include oak, pine, juniper and mixed woodlands and savannahs, grasslands with heaths, heliophytic matorrals, phreatophytic formations (such as wetlands and riverine forests) as well as a thermomediterranean coastal scrub. The macro-mammals do not show marked fluctuations

through time, as they appear taxonomically constant through the stratigraphy with a predominance of two ungulate species – *Cervus elaphus* and *Capra ibex* (Currant *et al.*, 2013a). Only the presence of grey seal (*Halichoerus grypus*) can be interpreted as punctual evidence of a cold phase in CHm (D unit in Waechter, 1951, 1964). At least 33 taxa of amphibians and reptiles have been recovered, including 24 in the inner area, including newts, toads, frogs, tortoises, turtles, lacertid and scincid lizards, geckos and several snakes (Blain *et al.*, 2013). In the outer area, the largest assemblage comes from LBSmcf.11 and involves 21 species. The most frequent specimen is the western spadefoot toad (*Pelobates cultripedis*; Gleed-Owen and Price, 2013a). Regarding small mammals, five species show predominance along the sequence – *Oryctolagus cuniculus*, *Apodemus sylvaticus*, *Eliomys quercinus*, *Microtus breccienensis* and *Terricola (Microtus) duodecimcostatus* (López-García *et al.*, 2011; Price *et al.*, 2013). The inner chamber also has an important representation of *Myotis myotis* (López-García *et al.*, 2011). The outer area has yielded a significant large assemblage of bird species, with at least 90 species (seabirds, ducks, birds of prey, partridges, waders, pigeons, swifts, crows and small passerines), which were registered by Cooper (2013a). Put together with recent finds in the inner chambers (Sánchez-Márco, in prep.) the total Pleistocene avifaunal list for Gorham's Cave is currently at 142, the highest recorded in any Pal-

aeolithic archaeological site. The fossil birds from Gorham's and Vanguard Caves have been used in the quantification of the habitats outside the cave (Finlayson, 2006) and data from birds, amphibians, reptiles, micro-mammals and intertidal molluscs have been used in climate reconstruction at scales down to seasonal (Finlayson, 2006; Ferguson *et al.*, 2011; López-García *et al.*, 2011; Blain *et al.*, 2013). Finally, Finlayson *et al.*, (2012) showed an association involving the direct intervention of Neanderthals on the wing bones of raptors and corvids, which was interpreted as evidence of extraction of large flight feathers (Fig. 4).

Vanguard Cave

Vanguard Cave, located on the southeast face of the Rock of Gibraltar, is one of four caves which make up the Gorham's Cave complex. Vanguard Cave shows a stratigraphic sequence which is less complex than that of Gorham's Cave (Fig. 1). It contains 17 m of deposits, mainly composed of massive, coarse-to-medium sands intermixed with tabular-to-lenticular units of silts and silty sands (Macphail and Golberg, 2000). Most of the Vanguard sediments are calcareous, with little diagenesis. In the upper area of the cave, the sands are interdigitated with black humic clays, showing evidence of phosphatisation. However, the sediment deposits at Vanguard are generally less phosphatic and organic, and exhibit fewer diagenetic

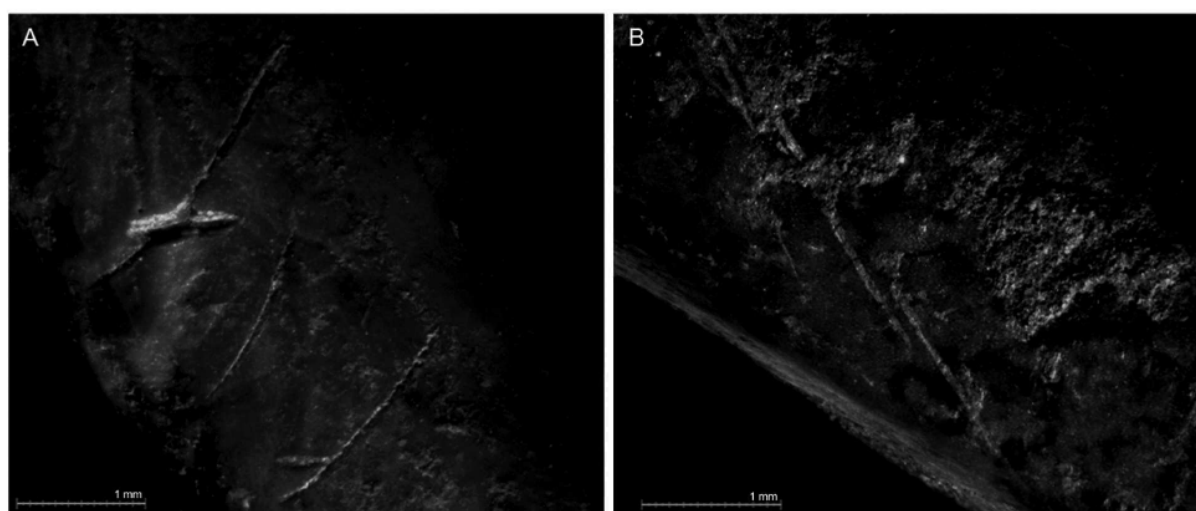


Figure 4. Examples of cut-marks on corvid wing bones from the Middle Palaeolithic levels of Gorham's Cave: (A) Proximal diaphysis of *Pyrrhocorax pyrrhocorax* humerus (GOR'96 NO. 299); (B) proximal diaphysis of *Pyrrhocorax graculus* ulna (GOR'00/B5/NIV/57). Images taken from Finlayson *et al.*, (2012).

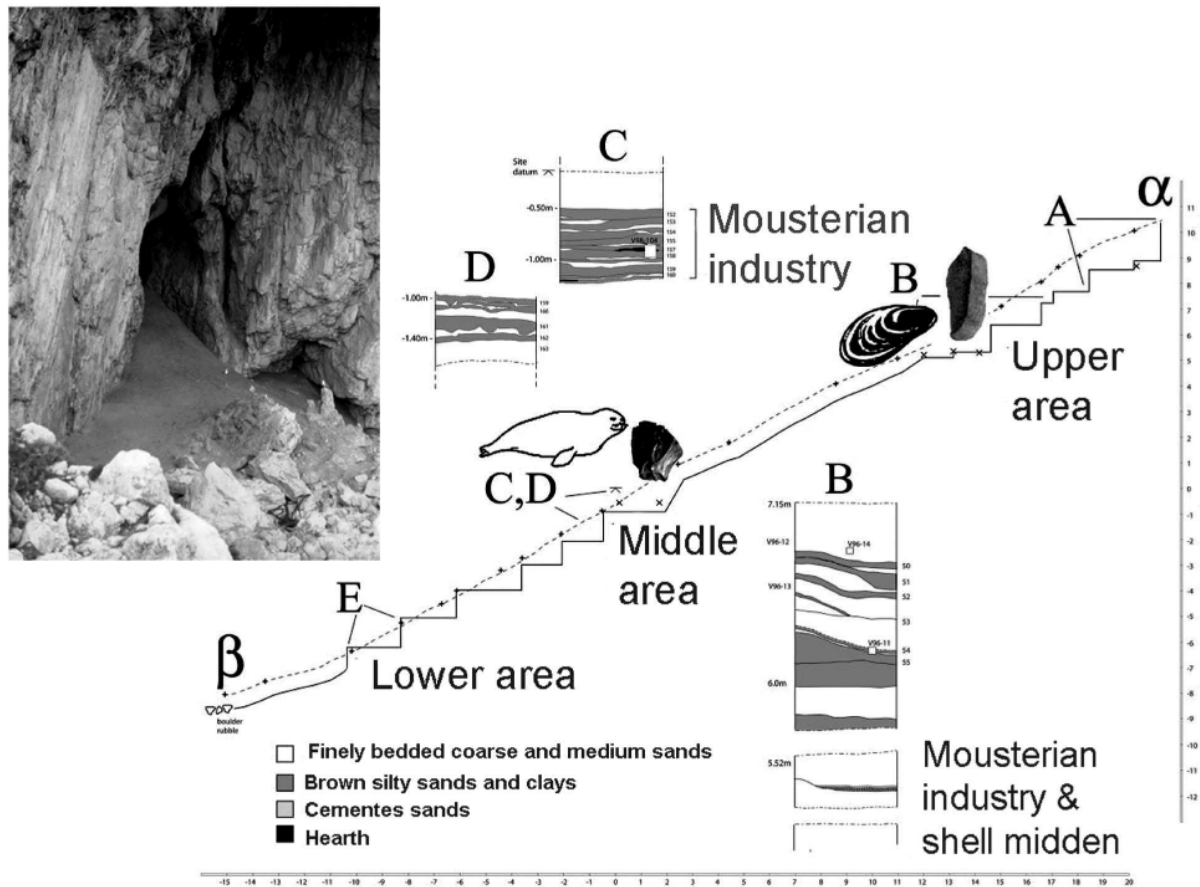


Figure 5. Section of Vanguard Cave showing excavation areas along the dune deposit. Graph taken from Stringer *et al.*, (2008).

changes compared to Gorham's Cave (Macphail *et al.*, 2013).

Five main excavation areas (A–E) were established at different heights of the dune, with A being the highest area and E the lowest one (Fig. 5; see Stringer *et al.*, 2008 and Macphail *et al.*, 2013 for more details). Sectors A and B are described as Upper area, C and D as Middle area and E as Lower area. From these areas, sediment samples were collected for optically stimulated luminescence (OSL). Quartz OSL data, including single-grain (SG) measurements, indicate that much of Vanguard Cave was filled around the time of OIS 5 (Rhodes, 2013b). This age estimation is older than the OSL chronology reported by Pettit and Bailey (2000), but for Rhodes (2013b), this is primarily due to a difference in dose rate estimation. The OSL date from the uppermost part of the sequence yielded an age of 75 kyr (when the cave

was practically silted). This age was obtained from breccia fixed in the wall of the cave; however, erosion phenomena could have altered some superficial sand layers, generating new earlier deposits.

Macroscopic analyses of charcoals indicate very little evidence of taxonomical change, with an arboreal landscape apparently dominated by warm-climate vegetation. *Pistacea* sp. and *Olea* sp. are registered as thermophilous indicators along the sequence, since both species are located within thermo-Mediterranean bioclimates (<600 m.a.s.l.; Ward *et al.*, 2013). The examination of the reptile and amphibian assemblages carried out by Gleed-Owen and Price (2013b) yielded a minimum of 17 species in the middle excavation area. A core of four species, including western spadefoot toad (*Pelobates cultripes*), stripeless tree frog (*Hyla meridionalis*), Moorish gecko (*Tarentola mauritanica*) and worm lizard (*Blanus cinereus*), was detected

at Vanguard Cave. Of these, *B. cinereus* is obligate thermophile, *T. mauritanica* does not tolerate extreme cool environments and *H. meridionalis* is restricted to meso-Mediterranean biomes with an overall dry climate. On this basis, the herpetofaunal remains suggest a remarkable environmental stability, with thermophilous species that are currently restricted to southern Europe (Gleed-Owen and Price, 2013b). A total of 73 bird species have currently been identified from Vanguard Cave (Cooper, 2013b; Sánchez-Marco in prep.) and are the subject of ongoing ecological and biogeographical analysis.

Macro-mammals show little variation, indicating environmental stability during the deposition period. The Middle area is characterised by the presence of ibex (*Capra ibex*), red deer (*Cervus elaphus*), wild boar (*Sus scrofa*) and bear (*Ursus arctos*), as well as evidence of marine mammals (seals and dolphins). Almost 50% of bones show human-induced damage (e.g. cut-marks, percussion marks) affecting ibex, red deer, wild boar and seal, and only 3% bear carnivore tooth-marks (Currant *et al.*, 2013b). In addition to the terrestrial fauna, two monk seal fossils (*Monachus monachus*) show human alterations on a proximal phalanx and a scapula (Stringer *et al.*, 2008). In

association to terrestrial and marine mammals, molluscan shells such as *Mytilus galloprovincialis*, *Callista chione*, *Acanthocardia tuberculata*, *Patella vulgate*, *P. caerulea* and a few barnacles (*Balanus* sp.) are widely documented.

The study of the lithic artefacts reported by Barton (2013) comes from the Upper and Middle areas of the cave and shows clear assignation to the Middle Palaeolithic techno-complex. Lithic industry suggests little variation through the sequence, with little change in the dominance of quartzite over finer-grained cherts. This reflects the more common availability of this material in comparison to other raw materials. Limestone from the cave bedrock was often used to make artefacts, representing a significant expedient behaviour. For Barton (2013), the low diversity of raw material and the limited range of tools in the assemblages are concordant with a succession of short-term human occupations at the cave.

Currently, new fieldwork is being carried out at the Upper part of the sequence. Our aim is to determine the complete stratigraphic sequence of the cave, developing a new programme of dates, and to deepen our understanding of Vanguard Cave during the Neanderthal occupation phases (see Fig. 1-B1, B2 for the new excavation).