# The Gibraltar Neanderthals and their extinction

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## 1. Introduction

1998 marked the 150th anniversary of the discovery of the Gibraltar Neanderthal skull in Forbes's Quarry on the north face of the Rock of Gibraltar (Busk, 1865). The history of this discovery, and that of the cranial remains of a Neanderthal child from the nearby Devil's Tower Rock Shelter in 1926, have been summarized recently (Barton et al., 1999). The Gibraltar Caves Project commenced in 1994 with a reconnaissance and investigation of Ibex Cave and continued in subsequent years in Gorham's and Vanguard Caves (Stringer et al., 1999, Fig. 1). The purpose of this paper is to summarize the results of the work in Gorham's and Vanguard Caves since 1995 and to place these in the context of the late Iberian extinction of the Neanderthals (Vega Toscano et al., 1988; Antunes et al., 1989; Barroso and Hublin, 1994; Zilhão, 1993, 1995, 1996; Hublin et al., 1995; D'Errico et al., 1998; Raposo and Cardoso, 1998; Finlayson and Giles Pacheco, 1999; Pettitt, 1999).

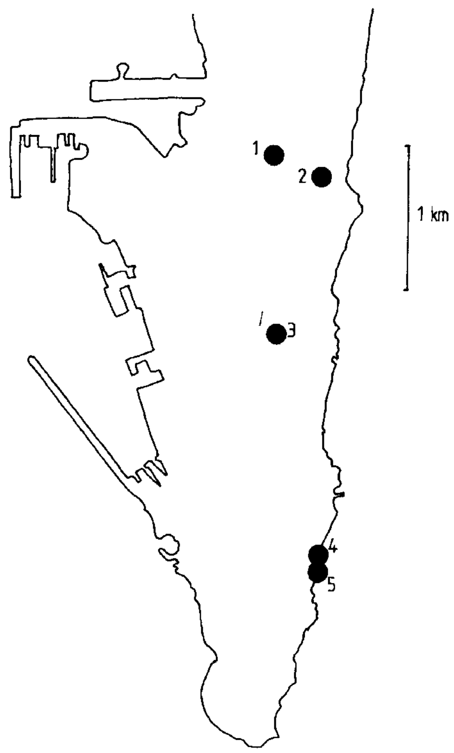


FIG. 1 – Map of Gibraltar showing location of sites mentioned in the text: 1 - Forbes' Quarry; 2 -Devil's Tower; 3 - Ibex Cave; 4 - Vanguard Cave; 5 - Gorham's Cave.

## 2. Gorham's Cave

Waechter (1951, 1964) described a well-stratified 16 m sequence of Late Pleistocene deposits in Gorham's Cave. The current work in this cave has been concentrated largely on three exposed stratigraphic units towards the back of the cave (Fig. 2). These cover three main time zones, Upper Paleolithic with dates spanning 26-30 ka BP, a group containing the youngest Middle Paleolithic and dated at around 31-32 ka BP, and a third group which covers the main Middle Paleolithic sequence which lies in and under units dated by a new accelerator date on charcoal of 45,3 ± 1,7 ka BP (OxA-6075) and above units dated between 80-100 ka BP by Uranium-series determinations (Barton et al., 1999; Pettitt, 1999; Stringer et al., 1999). The younger Paleolithic units show great charcoal concentrations that have been identified as combustion zones. These units also contain burnt bone but few diagnostic lithic artifacts, including small backed blade material (Barton, 1999). Context 9, which has been equated to Layer D1 of the initial excavations at Gorham's in the 1950s, is one of the richest

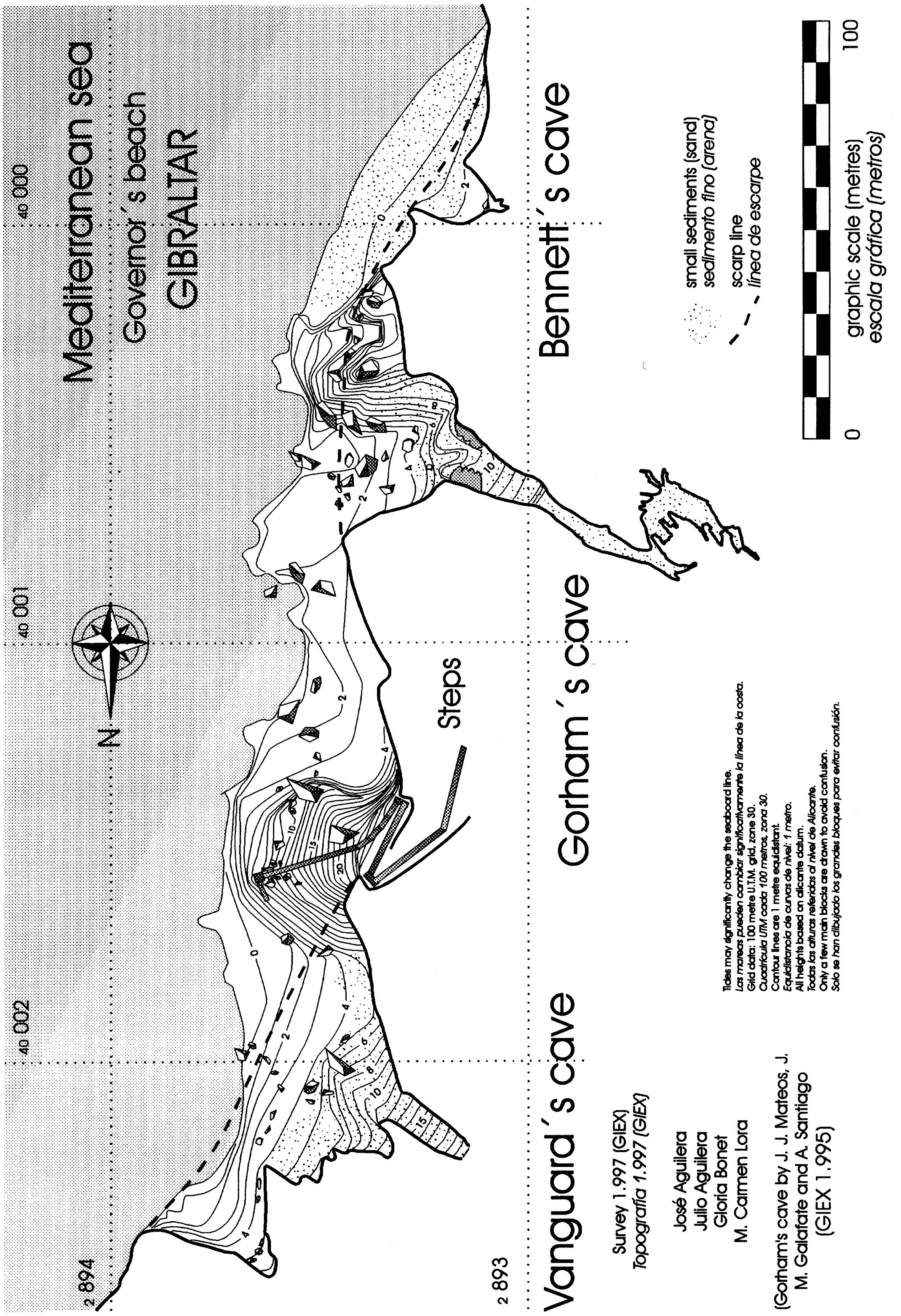


FIG. 2 – The cave sites along Governor's Beach, Gibraltar.

combustion horizons and lies directly on a natural floor of cemented limestone cobbles and has produced four statistically indistinguishable AMS dates in the time range 28-31 ka BP (Waechter, 1964; Barton et al., 1999; Stringer et al., 1999). Near the base of the sequence artifacts characteristic of the Middle Paleolithic (discoidal cores and flakes from them) and the Upper Paleolithic (a platform rejuvenation flake from a prismatic core) have been recovered but this may represent material of mixed age (Barton, 1999). Below this a Middle Paleolithic industry was recovered associated with a hearth, from which charcoal was dated to ca 32-33 ka (Radiocarbon) BP (Pettitt, 1999). The main Middle Paleolithic deposits show significant evidence of human activity with lithic artifacts and residues of food processing activities that appear to include charred pine seeds (Barton et al., 1999; Stringer et al., 1999) and cut marked Ibex *Capra pyrenaica* and Hermann's Tortoise *Testudo hermanni* (Barton, 1999; Fernández-Jalvo, 1999; Currant, *pers. comm.*). Artifacts from these levels are of Mousterian tradition and are characterized by the use of discoidal core technology and its variants (Bordes, 1950, 1961; Boëda, 1988, 1993). The raw materials are largely of local origin, from within the Gibraltar peninsula, although the source of honey-colored, fine-grained, cherts used in the manufacture of some tools has been identified 17 km north-west of the Rock. These tools may well have been imported after manufacture (Barton et al., 1999; Stringer et al., 1999). Also of interest is the presence of very large blade-like flakes in one of the lower Mousterian levels. These are of a "classic Levallois" blade technology (Mellars, 1996) and, from their size, are unlikely to have been manufactured from locally obtained sources.

## 3. Vanguard Cave

This, previously unexcavated, cave has a 17 m deep sequence of deposits that consist largely of sands interspersed with finely laminated organic-rich silts and clay (Barton, 1999). Each of the identified archaeological levels has been systematically excavated and sampled for paleoenvironmental and dating purposes (AMS, ESR, OSL and U-Series techniques) and results indicate that, with the exception of the uppermost levels, most of the units lie beyond the age range of AMS radiocarbon dating (Barton et al., 1999; Stringer et al., 1999). It appears that the cave filled up to its present level by ca 45 ka BP (Barton et al., 1999; Stringer et al., 1999). A Mousterian discoidal core technology, comparable with that at Gorham's, has been found in a number of separate contexts (Barton, 1999). A well-defined layer of ash and charcoal, which included a concentration of broken and burnt mussel shells with associated quartzite flakes and a number of coprolites, has been excavated within the upper units of this cave. It represents a short-lived episode. The artifacts are refittable and indicate a limited knapping event. Of particular interest were a chert side scraper and a heavily utilized chert flake that appear to have been introduced in a ready-made state given that no evidence of *in situ* manufacture was found (Barton, 1999; Fernández-Jalvo, 1999; Stringer et al., 1999).

A series of Mousterian occupation horizons with artifacts, bones and hearth material have been found lower down the cave sequence, separated from the «mussel» level by a thick intervening deposit of sterile sand. The area excavated includes smashed, cut-marked and burnt bone (mostly Ibex) around combustion zones that are rich in charcoal and lithic artifacts (Fernández-Jalvo, 1999). The artifacts are of a discoidal core technology and are low in retouched tools and of locally obtained raw materials (Barton, 1999).

A small alcove on the north side of the chamber has produced well-preserved Spotted Hyaena, *Crocuta crocuta,* bones and a small, sub-circular, hearth but no artifacts have been found in association. An AMS date on pine, *Pinus* sp., charcoal from within this feature has given a date of >44,1 ka BP (OxA-7078; Pettitt, 1999).

## 4. Environmental Change

Using the data from the Gibraltar caves, supplemented by a regional survey of Middle and Upper Paleolithic sites (Finlayson and Giles Pacheco, 1999) and published studies of other sites in southern Iberia (Carrión, 1992a, 1992b; Carrión et al., 1993; d'Errico et al., 1998; Raposo and Cardoso, 1998), a start has been made at interpreting the effects of climate-induced environmental change on the Paleolithic populations of southern Iberia during Oxygen Isotope Stages (OIS) 4-2 (Finlayson et al., in prep.) and at modeling the wider context of the evolution of these populations in Iberia (Finlayson, in prep.). Currant (1999), Finlayson and Giles Pacheco (1999) and Finlayson et al. (in prep.) have highlighted the constancy of the species composition of the large mammal community of the region during the Late Pleistocene and its similarity to the contemporary fauna with the exception of the loss of several of the larger carnivores, such as the Spotted Hyaena and the Leopard *Panthera pardus,* and rare megafaunal species, such as the Narrow-nosed Rhinoceros *Stephanorhinus hemitoechus*. The avifauna is similarly that of open woodland and savanna-like environments to which are added local components associated with cliffs and wetlands (Finlayson and Giles Pacheco, 1999).

Using a combination of contemporary data obtained across Portugal and southern Spain and anthracological and osteological data from Gorham's, Vanguard and Ibex Caves in Gibraltar, Finlayson et al. (in prep.) have modeled the environments around the Rock of Gibraltar during OIS 3. Their results indicate that for much of OIS 3 Neanderthals were living around Gibraltar in open wooded savanna environments with a rich grass cover and a patchy shrub layer. The dominant components of the vegetation were typically thermo-Mediterranean (Rivas-Martínez, 1981) species, particularly Stone Pine (*Pinus pinea*), Olive (*Olea europaea*) and Lentisc (*Pistacia lentiscus*). The main conclusion is that throughout much of OIS 3 the Neanderthals of southern Iberia lived in a situation that, at human generation timescales, must have appeared highly seasonal but inter-annually constant. They were widely distributed across the landscape (Finlayson and Giles Pacheco, 1999) and occupied open-air and cave sites. They exploited seasonal food resources and were omnivorous, consuming plant matter, intertidal mollusks, tortoises, birds, small and large mammals. Such prey diversity has also been described for Italy and Israel (Stiner, 1994; Stiner et al., 1999) and was probably the rule across the heterogeneous landscapes of the Mediterranean Basin.

The Gibraltar data indicate that the onset of colder conditions towards the end of OIS 3 signified massive environmental changes (Finlayson et al., in prep.) with the replacement of open woodland by dense forests of Mediterranean montane pines (*Pinus nigra/sylvestris*). At the same time the Mediterranean montane vegetation inland was being replaced by arid steppe vegetation (Carrión, 1992a). Finlayson et al. (in prep.) have shown how such changes would have been accompanied by a significant reduction of biomass which was only partly compensated by the arrival of high latitude marine mammals and birds in response to southward shifts in the polar front (Ruddiman and McIntyre, 1981). The major implication of this environmental transformation is the disruption of the Neanderthal seasonal activity cycle in a very short time that would have stressed their populations beyond recovery especially if associated with the arrival of Modern Humans from the north (Finlayson et al., in prep.). Finlayson (in prep.) has shown, however, that the demise of the Neanderthals could be explained without recourse to competition from Modern Humans.

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REFERENCES

ANTUNES, M.T.; CABRAL, J.M.P.; CARDOSO, J.L.; PAIS, J.; SOARES, A.M. (1989) - Paleolítico médio e superior em Portugal: datas 14C, estado actual dos conhecimentos, síntese e discussão. *Ciências da Terra*. 10, p. 127-138.

BARROSO RUIZ, C.; HUBLIN, J.J. (1994) - The Late Neanderthal site of Zafarraya. In RODRÍGUEZ VIDAL, J.; DÌAZ DEL OLMO, F.; FINLAYSON, C.; GILES PACHECO, F., eds. - *Gibraltar during the Quaternary*. (Monografías AEQUA), p. 61-70.

BARTON, R.N.E. (1999) - *Middle and Upper Palaeolithic occupation evidence from Gorham's and Vanguard Caves 1995-7*. In STRINGER, C.B.; BARTON, R.N.E.; FINLAYSON, J.C., eds. - *Neanderthals on the edge: 150th anniversary conference of the Forbes' Quarry discovery, Gibraltar*. Oxford: Oxbow.

BARTON, R.N.E.; CURRANT, A.P.; FERNÁNDEZ-JALVO, Y.; FINLAYSON, J.C.; GOLDBERG, P.; MACPHAIL, R.; PETTITT, P.B.; STRINGER, C.B. (1999) - Gibraltar Neanderthals and results of recent excavations in Gorham's, Vanguard and Ibex Caves. *Antiquity* (in press).

BOËDA, E. (1988) - Le concept Levallois et evaluation de son champ d'application. In OTTE, M., ed. - *L'Homme de Neandertal. Vol. 4: la Technique*. Liège: Études et Recherches Archéologiques de l'Université de Liège. p. 13-26.

BOËDA, E. (1993) - Le debitage discóide et le debitage Levallois recurrent centripete. *Bull. Soc. Prehist. Francaise*. 90:6, p. 392-404.

BORDES, F. (1950) - Principes d'une méthode d'étude des techniques et de la typologie paléolithique ancien et moyen. *L'Anthropologie*. 54, p. 19-34.

BORDES, F. (1961) - *Typologie du Paleolithique Ancien et Moyen*. Bordeaux: Delmas.

BUSK, G. (1865) - On a very ancient human cranium from Gibraltar. *Report of the 34th meeting of the British Association for the Advancement of Science (Bath 1864)*, p. 91-92.

CARRIÓN, J.S. (1992a) - Late Quaternary pollen sequence from Carihuela Cave, southeastern Spain. *Palaeobotany and Palynology*. 71, p. 37-77.

CARRIÓN, J.S. (1992b) - A palaeocological study in the western Mediterranean area. The Upper Pleistocene pollen record from Cova Beneito (Alicante, Spain). *Palaeogeography, Palaeoclimatology, Palaeoecology*. 92, p. 1-14.

CARRIÓN, J., FUMANAL, M.P.; ITURBE, G. (1993) - La secuencia polínica de Cova Beneito en su marcolitoestratigráfico, arqueológico y geomorfológico. *Estudios sobre Cuaternario*. p. 139-148.

CURRANT, A.P. (1999) - The Late Pleistocene mammal fauna of Gibraltar and the surrounding region. In STRINGER, C.B.; BARTON, R.N.E.; FINLAYSON, J.C., eds. - *Neanderthals on the edge: 150th anniversary conference of the Forbes' Quarry discovery, Gibraltar*. Oxford: Oxbow.

d'ERRICO, F.; ZILHÃO, J.; JULIEN, M.; BAFFIER, D.; PELEGRIN, J. (1998) - Neanderthal acculturation in western Europe? *Current Anthropology*. 39 (Suppl.), p. 1-44.

FERNÁNDEZ-JALVO, Y. (1999) - The taphonomy of Pleistocene caves, with particular reference to Gibraltar. In STRINGER, C.B.; BARTON, R.N.E.; FINLAYSON, J.C., eds. - *Neanderthals on the edge: 150th anniversary conference of the Forbes' Quarry discovery, Gibraltar*. Oxford: Oxbow.

FINLAYSON, J.C.; GILES PACHECO, F. (1999) - The southern Iberian Peninsula in the late Pleistocene: Geography, Ecology and Human Occupation. In STRINGER, C.B.; BARTON, R.N.E.; FINLAYSON, J.C., eds. - *Gibraltar and the Neanderthals 1848-1998*. Oxford: Oxbow.

FINLAYSON, J.C. (in prep.) - *A Model of the Neanderthal Extinction in the Iberian Peninsula*.

FINLAYSON, J.C.; STRINGER, C.B.; BARTON, R.N.E.; PETTITT, P.B.; FINLAYSON, G.; GALE, R.; CURRANT, A.P.; GILES PACHECO, F.; CARRUTHERS, W. (in prep.) - *An Oxygen Isotope Stage Three Mediterranean Neanderthal Environment – A Model and Causes of their Iberian Extinction*.

HUBLIN, J.J.; BARROSO RUIZ, C.; MEDINA LARA, P.; FONTUGNE, M.; REYSS, J-L. (19959 - The Mousterian site of Zafarraya (Andalucía, Spain): Dating and implications on the Paleolithic peopling processes of Western Europe. *Comptes Rendus de l'Académie des Sciences de Paris*. 2:321, p. 931-937.

MELLARS, P. (1996) - *The Neanderthal Legacy*. Princeton: Princeton University Press.

PETTITT, P.B. (1999) - C14 and OSL dating of Late Pleistocene sites with particular reference to Gibraltar: the state of play and wider implications. In STRINGER, C.B.; BARTON, R.N.E.; FINLAYSON, J.C., eds. - *Neanderthals on the edge: 150th anniversary conference of the Forbes' Quarry discovery, Gibraltar*. Oxford: Oxbow.

RAPOSO, L.; CARDOSO, J.L. (1998) - Las industrias líticas de la gruta de Columbeira (Bombarral, Portugal) en el contexto del musteriense final de la Península Ibérica. *Trabajos de Prehistoria*. Madrid. 55:1, p. 39-62.

RIVAS-MARTÍNEZ, S. (1981) - Les Étages Bioclimatiques de la Végétation de la Péninsule Ibérique. *Actas III Congr. Optima. Anales Jard. Bot. Madrid*. 37:2, p. 251-268.

RUDDIMAN, W.F.; McINTYRE, A. (1981) - The North Atlantic Ocean during the last deglaciation. *Palaeogeography, Palaeoclimatology, Palaeoecology*. 35, p. 145-214.

STINER, M.C. (1994) - *Honor among thieves. A zooarchaeological study of Neandertal ecology*. Princeton: Princeton University Press

STINER, M.C.; MUNROE, N.D.; SUROVELL, T.A.; TCHERNOV, E.; BAR-YOSEF, O. (1999) - Paleolithic Population Growth Pulses Evidenced by Small Animal Exploitation. *Science*. 283, p. 190-194.

STRINGER, C.B.; BARTON, R.N.E.; CURRANT, A.P.; FINLAYSON, J.C.; GOLDBERG, P.; MACPHAIL, R.; PETTITT, P.B. (1999) - Gibraltar Palaeolithic revisited: new excavations at Gorham's and Vanguard Caves 1995-7. In CHARLES, R.; DAVIS, W., eds. - *Studies in Honour of D.A.E. Garrod*. Oxfors: Oxbow (in press).

VEJA TOSCANO, L.G.; HOYOS, M.; RUIZ-BUSTOS, M.; LAVILLE, H. (1988) - La sequence de la grotte de la Carihuela (Píñar, Grenade): Chronostratigraphie, et paléoécologie du Pléistocéne Supérieur du Sud de la Péninsule Ibérique. In OTTE, M., ed. - *L'homme de Néandertal. Vol. 2.: l'environnement*. Liège: ERAUL, p. 169-180.

WAECHTER, J.d'A. (1951) - Excavations at Gorham's Cave, Gibraltar. *Proc. Prehist. Soc*. 17, p. 83-92.

WAECHTER, J.d'A. (1964) - The Excavations at Gorham's Cave, Gibraltar, 1951-1954. *Bull. Inst. Arch. London* 4, p. 189-221.

ZILHÃO, J. (1993) - Le passage du Paléolithique moyen au Paléolithique supérieur dans le Portugal. In CABRERA VALDÉS, V., ed. - *El origen del hombre moderno en el Suroeste de Europa*. Madrid: UNED. p. 127-145.

ZILHÃO, J. (1995) - *O Paleolítico Superior da Estremadura Portuguesa*. PhD. Diss., University of Lisbon.

ZILHÃO, J. (1996) - The extinction of Iberian Neanderthals and its implications for the origins of Modern Humans in Europe. *Actes du XIII Congrès International des Sciences Préhistoriques et Protohistoriques*. 2. Forli: Abaco, p. 299-312.