



HM GOVERNMENT OF GIBRALTAR
MINISTRY FOR SPORTS, CULTURE, HERITAGE & YOUTH
310 Main Street
Gibraltar

PRESS RELEASE

No: 130/2013

Date: 28th February 2013

Latest evidence of past climate change in Gibraltar

A series of recent papers published in international peer-reviewed journals is giving a clear signal of the way climate behaved in Gibraltar during the build-up to the last glaciation – the Great Ice Age – between 35 and 30 thousand years ago (kyr). At the time large areas of Europe became uninhabitable, much of Britain and Scandinavia being covered in thick ice sheets and huge areas of Europe frozen. What was happening in Gibraltar? For some time it has been clear that such severe conditions did not hit us in the same way – at Gorham's Cave, for example, the long sequence of rich deposits never records the presence of the cold fauna. Woolly Mammoths, Woolly Rhinos and Reindeer never got down here. We are now getting a more precise picture to a surprising level of detail.

It all got underway back in 2002 when a team from the Gibraltar Museum started reconstructing climate change, using fossil plants and birds found in Gorham's Cave as climatic indicators. The results, published in 2008 in the journal *Quaternary Science Reviews*, surprised everyone by showing that the climate had not been that different from today and hinting at only slight cooling and small changes in rainfall patterns. The regime was compared, in another 2008 paper, with the highly seasonal environments that we find today in places like the Doñana National Park in south-west Spain.

The museum team then joined forces with the University of Oxford to look at the wider southern Iberian picture, to situate Gibraltar in context. They used geographic information systems (GIS) to map the climate of Andalucía and Gibraltar today and they then modelled conditions during the cold and dry last glacial maximum. Their findings were published in the *Journal of Biogeography* in 2011. To their surprise, the Gibraltar area retained mild conditions and, importantly, the westerly location meant that, in the driest moments, Gibraltar received less rainfall but it was still much more than the rest of the area that had been looked at.

The Gibraltar Museum and Oxford University also collaborated in another exciting project that was published in the journal *Earth and Planetary Science Letters* in 2011. This work looked at the seasonal growth bands of present-day limpets and found that the chemical composition of these bands could be used as proxies for sea-surface temperature. The bands and direct surface temperature measurements were a close match. So what the team then did was to take measurements from fossil limpets from Gorham's Cave going as far back as 39 kyr. What they found was staggering in revealing the level of detail that could be achieved. The conclusion was that the temperature regime at Gibraltar had indeed stayed quite similar to today but that the winters had become slightly colder, with the summers remaining similar to today. The average winter-summer temperature range was 2°C higher than today.

In a paper published today in the *Journal of Human Evolution*, the Gibraltar Museum team worked with colleagues at Oxford, Murcia and Tarragona and looked at the fossil reptiles and amphibians from the Gibraltar caves. These animals are excellent indicators of temperature and they have very specific requirements. So finding them in the cave can give a precise measurement of temperature. But what these animals also do is inform us about rainfall. So what does the latest research tell us? Amazingly the temperature picture was almost a carbon copy of what the limpets had indicated. Summers were like today and winters were cooler, between 1.6 and 1.8°C cooler. The retention of humidity that the regional paper had modelled was confirmed, the summer dry months being four instead of the current five. So even though annual rainfall did drop by between 35 and 113mm, the rain was more spread out across the year. The most significant drop in rainfall happened precisely when the Neanderthals at Gorham's Cave disappeared.

That result matches those of another paper published by the Gibraltar Museum team last month, this time with colleagues from a range of institutions mainly from Huelva University, the Earth Sciences Institute in Granada and the Japan Agency for Marine-Earth Science and Technology. The paper was published in the journal *Geomorphology* and gave us another window into Gibraltar's past. One secret that Gorham's Cave had kept tight had been the absence of people in the cave between 28 and 23 kyr. After tens of thousands of years of occupation, the place was deserted and was recolonised later by our own ancestors. Now we have clues that suggest why the caves were deserted. Looking at the Rock's wider geology and using precise dating techniques, the team found evidence of widespread seismic activity. Stalactites fell from cave roofs in massive numbers; there were massive landslides and falls of huge boulders. The place became unliveable, but there was more.

Combined with this tectonic activity, marine cores drilled in the sea bed to the east of Gibraltar have given us a precise climate signal and it shows that there was a brief period of intense aridity, indicated by powerful wind-blown sand activity and a significant drop in fresh water discharge by rivers. It may have been brief but it spelt disaster for the Neanderthals, and our own ancestors kept well away. Previous work by the Gibraltar Museum and Huelva University team had also shown that Gibraltar had been hit by tsunamis at a frequency of one every thousand years, the last one being after the 1755 Lisbon earthquake. It all goes to show how quick and dramatic events can turn out to be, especially when earth movements combine with natural climate change. The work continues. One enigma that will now be tackled is with the birds. In spite of the absence of the cold mammal fauna in Gorham's Cave there is evidence of some Arctic birds getting down here. How can we explain this apparent paradox? The Gibraltar Museum team has a good idea but they will now seek out solid evidence. That is one of the next projects which is about to start.