

## New age estimates for the Swanscombe hominid, and their significance for human evolution

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The three cranial bones known as “The Swanscombe skull” were discovered in the Middle Gravel at the Barnfield gravel pit, Swanscombe, Kent, between 1935 and 1955. They were associated with Acheulian hand axes and a Middle Pleistocene mammalian fauna of Hoxnian Interglacial affinities. The occipital bone was found in 1935, the left parietal a year later, and the less well preserved right parietal in 1955. The three bones articulate together to form the back of a human skull. The bones show some possible archaic features in cranial thickness, particularly near asterion, and in the wide occipital and short, relatively flat parietals (Stringer, 1974, 1978), but in other respects, the material looks rather modern (Morant, 1938). Estimated cranial capacity is close to the modern average (ca. 1300 ml), and the occipital is rounded, without a centrally strong occipital torus. The specimen was initially considered as a possible common ancestor to the Neanderthals and modern humans (Sergi, 1953; Le Gros Clark, 1955; Howell, 1957; Breiting, 1964) or as a European “pre-*sapiens*”, directly ancestral to modern humans (Vallois, 1958). However, the occipital is also notable for its apparent Neanderthal features. The weak occipital torus displays a bilateral projection and it is surmounted by

a central suprainiac depression (Hublin, 1978; Santa Luca, 1978). The occipital plane is strongly convex (Hublin, 1988a). The occipito-mastoid suture displays the medial slope of a strong juxtamastoid ridge (Stewart, 1964). The so-called “modern” features of the specimen can be interpreted as plesiomorphous retentions, and do not exclude it from the ancestry of Neanderthals.

Because of its apparent Neanderthal affinities, the Swanscombe hominid has recently been regarded as a primitive Neanderthal, providing evidence of this lineage in the Middle Pleistocene. Though more primitive morphological stages along this lineage have been identified (Hublin, 1988b), they are less complete or are difficult to date (Stringer, 1985). Determining the age of the Swanscombe hominid is therefore of great palaeoanthropological interest with regard to Neanderthal origins and evolution. It might provide a minimum age for the existence of a distinct Neanderthal clade, and if this is regarded as the sister group of *Homo sapiens*, by implication it would also provide a minimum age for the origin of our own clade. The times of origin and divergence of these two lineages is currently the source of some discussion—for example, with the suggestion that the Atapuerca “Sima de los Huesos” material, of apparent early Neanderthal affinities, is

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about 300 ka (Bischoff *et al.*, 1997), and the Florisbad partial cranium from South Africa, a possible *sapiens* forebear, is about 260 ka (Grün *et al.*, 1996).

When rather simple glacial–interglacial schemes were still favoured, the Swanscombe site and its hominid were often assigned an age correlated with the so-called “Great Interglacial” of continental Europe, the “Mindel-Riss”, supposedly at about 250 ka. However, attempts at dating absolutely the Swanscombe hominid or its associated materials have not produced convincing results. Szabo & Collins (1975) dated a mammalian bone from Swanscombe to 272 ka, but two out of three specimens from the Middle Gravel showed ratios indicating open system behaviour—excess  $^{230}\text{Th}$  or deficient  $^{234}\text{U}$ . Southgate (in Bridgland *et al.*, 1985) obtained thermoluminescence ages for the Upper and Lower Loams in the range 200–230 ka, indicating that the intervening Middle Gravel must approximate this age. More recently, Bowen *et al.* (1989) used amniostatigraphy to correlate the Hoxnian Interglacial with oxygen isotope stage 9, but Swanscombe with oxygen isotope stage 11 (ca. 400 ka—Shackleton *et al.*, 1990), while Currant (1989) produced a relative dating scheme based on mammalian evidence which places the “Swanscombe stage” as younger than the Boxgrove and Westbury-sub-Mendip interglacial faunas but, similarly, older than those of the Hoxnian interglacial. More recently still, Barton & Stringer (1997) attempted to date the Swanscombe skull bones directly, using gamma-ray emissions, but found results from the three bones were too inconsistent to provide a realistic age estimate.

However, the most convincing recent evidence for a chronological placement of the Swanscombe hominid has come from geomorphological investigations of the Swanscombe terrace gravels in the context of the history of the River Thames. Here,

the geomorphological work of Bridgland (1994) suggests that the Swanscombe site and hominid must derive from the phase immediately following the southward diversion of the River Thames to its approximate present course. Before the Anglian glaciation, the River Thames ran across eastern England well to the north of its modern position. However, during the Anglian glaciation, it was blocked by ice and pushed southwards to occupy the preexisting Darent–Medway drainage system, bringing a new range of lithologies to the deposits of the region, including those at Swanscombe. Bridgland (following Shackleton, 1987) argues that the severity of the Anglian glaciation matches only that of oxygen isotope stage 12 in the relevant records of various deep sea cores. The sequence at Swanscombe must therefore date from the immediately succeeding interglacial, stage 11, with an age of about 400 ka.

This age assessment can be supported from the Swanscombe stratigraphic sequence itself (Conway, 1996) and from biostratigraphic studies of British mammalian faunas (Schreve, 1997). Bridgland (1994) also proposes correlations between Oxygen Isotope Stages and subsequent Thames terraces, but these have been questioned by Gibbard (1994). However, Bridgland’s suggestion that the Lower Gravel, Lower Loam and Middle Gravel at Swanscombe are correlates of Oxygen Isotope Stage 11 is not disputed. The precise time-range of Oxygen Isotope Stage 11 (i.e. the “Swanscombe Interglacial” in this context) is not certain, but in the recent paper by Petit *et al.* (1999) on calibrating the Vostok core, the peak of the interglacial (11.3) is dated at about 410 ka, and the first marked climatic deterioration (11.24) at 390 ka. If these estimates are reasonably accurate, and given the lack of real cold climate indicators in the sediments, fauna and mollusca of the Middle Gravel, it seems unlikely that the fossil human material can

be later than about 390 ka, even though there is an apparent hiatus between the Lower Loam and Middle Gravel. Features such as ice wedges only appeared *after* the Middle Gravel had been deposited, and thus an age for the Swanscombe "skull" of about 400 ka is a reasonable estimate, lying as it does in the period of climatic decline between the interglacial optimum (ca. 410 ka) and the first marked deterioration (ca. 390 ka).

If the age assessment is accurate, then the Swanscombe fossil human is one of the oldest, if not the oldest, hominids to show clear Neanderthal affinities in the cranial vault. If Neanderthals and modern humans represent sister clades, then their origin could stretch back to at least 400 ka. A divergence of the two lineages in the middle of the Middle Pleistocene would be consistent with the data recently provided by mitochondrial DNA extracted from the Neanderthal fossil (Krings *et al.*, 1997; Ward & Stringer, 1997). A divergence estimate of between 550–690 ka was calculated, and this has subsequently been revised from additional data to between about 317–741 ka, with a mean figure of 465 ka (Krings *et al.*, 1999). However, this would represent a maximum age for morphological separation, since population and clade separation would inevitably postdate mitochondrial divergence by an unknown amount of time. Bermúdez de Castro *et al.* (1997) have proposed an even earlier origin for the Neanderthal and *H. sapiens* lineages based on hominid finds from level TD6 at Gran Dolina, Atapuerca. They argue that this material represents a new human species *H. antecessor*, a common ancestor for the Neanderthal and *sapiens* lineages prior to the Lower/Middle Pleistocene boundary. Subsequent European Middle Pleistocene fossils would therefore belong to the Neanderthal lineage. The morphology and newly-determined age of Swanscombe would be consistent with this scheme. However, we

remain cautious about the taxonomic status of the Gran Dolina material, and in particular the significance of the "modern" morphology of the infraorbital region of the immature individual ATD6-69. The adult form of this fossil may not have looked so "modern", and there is enough variation in the infraorbital region of African and European hominids from the Middle Pleistocene to warrant caution about its taxonomic value. Additionally, while arguments for the Neanderthal affinities of early European fossils such as Mauer and Arago can be proposed, clade features of *H. sapiens* in African fossils, such as those from Bodo, Kaphurin, Elandsfontein, Nduetu and Broken Hill, are more debatable. Such features are not clearly present until the later Middle Pleistocene (Hublin, 1992; Stringer, 1998). This would support either a later clade separation or a faster accretion of derived features in the Neanderthal lineage. While Foley & Lahr (1997) have argued for a relatively late clade separation in Africa on archaeological grounds, we feel that neither the archaeological nor morphological bases for this are sound, and it is more likely that there was a faster accretion of derived clade characters in Europe than in Africa.

The presence of Neanderthal apomorphies in the Swanscombe occipital is certainly significant, but do such features therefore demand membership of the Neanderthal clade and species? These features were certainly not plesiomorphous, but may have been present in the common ancestral species of Neanderthals and modern humans as polymorphisms which later became fixed in the European descendant lineage but not that in Africa. So while their presence reflects Neanderthal affinities and origins, they do not necessarily require the assignment of Swanscombe to *H. neanderthalensis*. Apomorphies, like species, must originate within pre-existing species. Additionally, it should be noted that these derived conditions have never been observed

in the equivalent African specimens so far (with the possible exception of the juxtama-toid eminence of Ngaloba-Laetoli hominid 18), which would support an ancient individualization of the Neanderthal clade. A larger sample of middle Middle Pleistocene specimens from both Europe and Africa should eventually allow us to resolve these taxonomic problems.

There are further implications from the morphology and antiquity of the Swanscombe hominid. We (Hublin, 1982, 1988b; Stringer, 1985) and others (Arsuaga *et al.*, 1993, 1997) have argued for a gradual emergence of the Neanderthals in Europe through an accretion of apomorphous characters. The placement of Swanscombe as perhaps 100 ka older than the Atapuerca "Sima" hominids, with their somewhat less derived occipital morphology, and perhaps also one interglacial cycle (ca. 100 ka) older than the Vértesszöllös and Bilzingsleben cranial fragments, with their distinctly more archaic occipital morphologies, suggests a greater complexity in the patterns of European Middle Pleistocene human evolution than has generally been assumed in recent years (Stringer, 1998). It supports the view that the accretion of Neanderthal features during the late middle Pleistocene might result from a shift in the frequency of the derived conditions rather than from the clear cut emergence of new morphologies (Hublin, 1998). If such a process occurred, it will inevitably complicate our attempts to erect simple taxonomic schema.

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