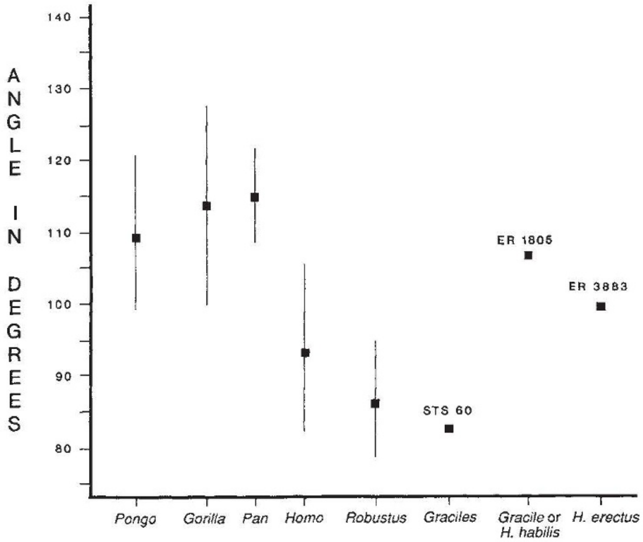

Petrous crest angles in degrees. Error bars 1 s.d. above and below the mean are included for samples having more than one observation. All measurements from the right hemisphere except for STS-60. The mean angles are 110° for *Pongo*, 114° for *Gorilla*, 115° for *Pan* and 94° for *H. sapiens*. Robust australopithecines include OH-5 (95°) and SK-1585 (79°). Other fossils include STS-60 (83°), ER-1805 (107°) and ER-3883 (100°).

results: (1) The angle of the petrous crest was smaller (sharper) in the four humans than in the 15 pongids ($t(17)$ = 2.86, $P<0.02$, two-tailed), although the range for humans overlaps to some degree with those of all three great apes. (2) Tobias' suggestion[7] that the angle of the petrous crest of OH-5 is like that of modern humans is supported by our measurements (OH-5 = 95°; *H. sapiens* = mean of 94°). (3) There appears to be extensive overlap between the range of angles of the petrous crest for *H. sapiens* and that for a variety of fossil hominids. (Of the five fossil hominids that we measured, only ER-1805 fell slightly above the human range.) (4) As the figure clearly shows (and as *t*-tests confirm), a sharp angle of the petrous crest fails to separate extant and fossil *Homo* from australopithecines. Because the *Homo* and australopithecine petrous crest angles are so similar, no matter what the angle of the petrous crest of the Chemeron temporal or any other fossil may be, that angle cannot be used to attribute the fossil to the genus *Homo*.

A medially positioned mandibular fossa is the second feature that theoretically sorts the Chemeron fossil exclusively with *Homo*. In an earlier study of the Chemeron fossil, Tobias compared measurements of the length, breadth and depth of the mandibular fossa in various hominids and pongids[9]. He found that the length and breadth of the Chemeron fossa fell within the australopithecine range, whereas its absolute depth fell between those for australopithecines and *H. erectus*, but nearer that for the former, leading him to conclude that the exact taxonomic affinities of the specimen could not be determined from these features. The reappraisal by Hill *et al.*[1] provides no measurements to alter this conclusion.

Since we submitted this Scientific Correspondence, Andrew Hill kindly lent us a copy of the Chemeron temporal bone, from which we measured an angle of the petrous crest of approximately 90°.

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HILL *ET AL.* REPLY — The general stratigraphic point that Feibel makes about radiometric dates and hominid fossils is important but rudimentary; naturally we were aware of it as we reported in our paper[1]. ". . Preliminary age results from tuffaceous units higher in the sequence . . . support an age of about 2.4 Myr for the hominid . ." By our statement, we meant that preliminary age results from tuffaceous units higher in the sequence support an age of about 2.4 Myr for the hominid. Our paper reported the initial phase of a continuing investigation. We had justifiable confidence in our preliminary ages on overlying strata, but felt it best to finalize these data and add more information for a comprehensive geochronological treatment of this fossil site.

For the purposes of this reply we can state that single crystal, laser-fusion $^{40}Ar/^{39}Ar$ age determinations from a tuffaceous unit occurring 4.7 m directly above the inferred level of the hominid produced a date of 2.38±0.01 Myr. Another stratigraphically higher tuff from a nearby locality, estimated by correlation of sections to be about 10 m above the hominid horizon, produced an age of 2.35±0.02 Myr. Relevant analytical details are contained in a manuscript about to be submitted to the *Journal of Human Evolution*. These dates firmly support an age of about 2.4 Myr for the hominid.

Falk and Baker's measurements of hominid petrous crest angles have some interest, but are irrelevant to our analysis of KNM-BC1. A closer reading of our paper[1] shows that we were not concerned with the angle of the petrous crest, but with the morphology of the edge. As we reported, the edge of the petrous crest is sharp, along the surface where the tentorium cerebelli attaches to the petrous. Wood in his News and Views article[2] noted metric aspects of petrous temporal orientation that we intentionally did not include in our assessment of KNM-BC1. The acuteness or obtuseness of the angle of the petrous crest discussed by Falk and Baker has nothing to do with our analysis.

The second part of Falk and Baker's note purports to address the position of the temporomandibular joint fossa, but instead discusses temporomandibular joint fossa size. Falk and Baker accuse us of a lack of metric rigour without contributing any new metric observations, but say we should accept the conclusions Tobias reached on the basis of a quite small sample of early hominid crania available to him nearly a quarter of a century ago[7]. We have studied the original specimens of all published East and South African crania, and find tremendous variation in temporomandibular joint size. Moreover, the topographic anatomy of the joint is far more useful in taxonomic assessment than simple measurements of its length and breadth. We conclusively showed that the temporomandibular joint fossa of the Chemeron temporal bone is medially placed below the middle cranial fossa, as it is in *Homo*. None of Falk and Baker's comments leads us to modify our conclusions.

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1. Hill, A., Ward, S., Deino, A., Curtis, G. & Drake, R. *Nature* **355**, 719–722 (1992).
2. Wood, B. *Nature* **355**, 678–679 (1992).
3. Gibbons, A. *Science* **255**, 1071 (1992).
4. Bower, B. *Science News* **141**(9), 134 (1992).
5. Martyn, J. E. & Tobias, P. V. *Nature* **215**, 476–480 (1967).
6. Feibel, C. S., Brown, F. H. & McDougall, I. *Am. J. phys. Anthrop.* **78**, 595–622 (1989).
7. Tobias, P. V. *Olduvai Gorge 1951–1961*, **2** (Cambridge University Press, 1967).
8. Falk, D. *Contr. Primat.* **15**, 1–95 (1978).
9. Martyn, J. & Tobias, P. V. *Nature* **215**, 476–480 (1967).