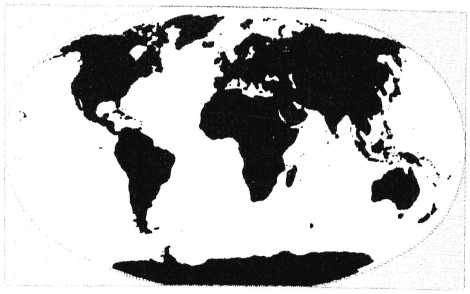

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but will help to improve the chronology and increase confidence in the results of the study. In the meantime, and completely independently, Thomas, Massone, and Benavente (1984:76) have developed a relative chronology for the pottery of San Pedro de Atacama and compared it with our results: in their opinion, these results confirm the sequence they have proposed. A massive program of thermoluminescence dating might yield important dividends, especially with regard to subphases. At any rate, the 43 dates presented here contribute to the reordering of the chronologies and sequences of other Atacameñan regions (see Aldunate et al. 1986, Berenguer and Dauelsberg n.d.) and to a reorganization of museum materials (see Universidad del Norte 1986).

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Auditory Exostoses and Evidence for Fishing at Vlasac[1]

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Auditory exostoses are bony anomalies located on either the posterior wall or the floor of the lateral aspect of the tympanic portion of the temporal and projecting superiorly into the acoustic meatus (fig. 1). Also known as auditory tori, they vary in size, generally develop bilaterally, and are limited in occurrence to late adolescents and adults. They also appear to increase in size with age. Presence or absence of exostoses in the external acoustic meatus was recorded in the course of a recent survey of virtually all European Upper Paleolithic and Mesolithic human skeletal material. Although this trait is exceedingly rare in most of the European late glacial and post-

 I greatly appreciate the opportunity to examine the Vlasac material and thank Dragoslav Srejović and Zagorka Letica of the Odeljenje za Arheologiju, Filozofski Fakultet, Beograd, for granting me permission. I also thank Miroslav Lazić and other members of the Archaeological Institute for their help. James R. Hummert (Kansas) provided important critical input. Research was supported by NSF Grant BNS 8419057.

FIG. 1. *Left temporal of Vlasac 2, showing* (arrow) *auditory exostoses on the floor of the external auditory meatus.*

glacial material (having frequencies of less than 5% in more than 200 skulls), at the Yugoslav site of Vlasac it occurs in about a third (13 of 38) of the individuals. This late Mesolithic site (6300–5300 B.C.), situated on a small terrace overlooking the Danube in the Iron Gates region between Yugoslavia and Romania, represents a semi-sedentary encampment of hunter-gatherers (Srejović and Letica 1978). Numerous human burials, correlated with three continuous archaeological phases, are associated with habitation structures or located on site peripheries. A major study of the skeletal material that documents cranial metrics, nonmetric variation, demography, and pathology has been published by Nemeskéri and Száthmary (1978), and y'Edynak and Fleisch (1983) have reviewed trends toward dental and facial reduction at Vlasac and the nearby site of Lepenski Vir. Neither of these sources mentions the high frequency of auditory exostoses in the sample, but it is noted by Zoffmann (1983) in a study of the Lepenski Vir skeletons in which absence of exostoses among them is reported.[2]

Although often considered to have some genetic basis (Berry and Berry 1967), auditory exostoses have recently been linked by Kennedy (1986) with diving for cold-water resources. According to her review of the clinical evidence, habitual exposure of the ear canal to cold water triggers a local reaction in the soft tissue that leads to osteogenic activity. In support of this hypothesis, her worldwide skeletal survey shows the highest frequencies of auditory exostoses in populations living between 30° and 45° north and south latitudes, where water temperatures are below 19° C. Variation in frequency within this region, which ranges from 0 to 72.2%, seems to be related to exploitation of aquatic resources; shellfish divers of California have especially high frequencies (14.2–72.2%) while Plains Indians have low frequencies (2.3–8.8%). In addition, the trait shows distinct sexual dimorphism. Of the 21 groups in the world sample, only 3 show frequencies greater in females than in males. In Koskimo and Ainu the frequencies for females and males are virtually identical; Tasmanian females show an incidence of 7.7% in contrast to males' 0.0% (Kennedy 1986:table 1). Kennedy provides ethnographic evidence indicating that "women dived for shell-fish" (p. 409) in Tasmania as a possible explanation for this reversal of the usual situation. Differences between males and females in the cold-water-regional subsample reported in table 1 are significant at the .0003 level and presumably relate to the sexual division of labor.[3]

The Vlasac skeletons show high frequencies of auditory exostoses in both males and females (table 1). Overall frequency (34.2%) exceeds the average for the comparative sample (24.4%) but is well below the highest reported (72.2%); the difference between the two data sets in this regard is not significant. Again, the frequency of the trait in males at Vlasac does not differ significantly from that in the comparative sample. Differences between the samples in degree of sexual dimorphism and frequency of occurrence of the trait in females are, however, significant ($p = .0000$). While there is no sex difference in the occurrence of the trait at Vlasac, the exostoses are large in four of the six males and small in all seven of the females. This size difference is significant at the .01 level and suggests that males may have experienced greater exposure to cold water.

According to Bökönyi (1978), 60% of the vertebrate fauna recovered at Vlasac is fish. Species identified include pike *(Esox lucius)*, carp *(Cyprinus carpio)*, and catfish *(Silurus glanis)*. Bökönyi does not give minimum individual counts but does note that catfish were the most important and argues that "the Vlasac people [were] specialized for the catching of large samples of catfish" (p. 49). On the basis of the size of catfish vertebrae recovered, he estimates that many of these fish weighed over 100 kg. It is interesting to speculate on how they were captured, especially since Tringham (1971:94) reports that "these fish are not only difficult to catch, but . . . also difficult to kill." She suggests that they may have been collected when stranded on land or in backwater pools after seasonal inundations. No fishhooks have been recovered at Vlasac (Srejović and Letica 1978), and indeed one wonders what kind of bone or antler fishhook would be required to land a 100-kg catfish. Further, there are at most five harpoons from the site, though it is likely that many harpoons and spears were wooden and not preserved. Ground and polished stone artifacts occur in large numbers and may relate to net or weir fishing; there is, however, no evidence of nets, weirs, or boats such as occurs in Germany (Gramsch 1985), Sweden (Larsson 1978), and Denmark (Andersen 1985). Thus, despite indications of the impor-

2. In his brief report on the Padina skeletons, which are approximately the same chronological age as Vlasac and located in the same region, Živanović (1975) observes that auditory exostoses are "always present and very large." Unfortunately, material from this site was not available for study.

3. Statistical significance in all cases was measured by chi-square.

TABLE 1
Frequency of Auditory Exostoses in Vlasac Skeletons and in a Comparative Cold-Water-Regional Sample

	Vlasac			Comparative Sample			
	No. Individuals	No. with Exostoses	Percent	No. Individuals	No. with Exostoses	Percent	Range
Males	22	6	27.2	1,170	424	36.2	0.0–72.2
Females	16	7	43.8	709	35	4.9	0.0–30.0
Total	38	13	34.2	1,879	459	24.4	0.0–72.2

SOURCES: Author's study of the 38 skeletons with temporal bones in the Vlasac collection of the Archaeological Institute of the University of Beograd and Kennedy's (1986) tables 1 and 3, samples from populations living between 30° and 45° north and south latitudes.

tance of fish in the diet of the Vlasac folk, there is little direct evidence for an elaborate fishing technology.

The high incidence of auditory exostoses in the skeletal sample may provide a clue to the way fish were caught. Citing an ethnography by Wyndham on the Murray River Australian Aborigines, Kennedy (1986:408) reports that males hand-netted fish on the river bottom and along submerged ledges. High frequencies of ear exostoses (32.7–44.0%) in Murray Valley males (but not females) seem to correlate with this method. Vlasac is located at about 44° north latitude, and if fishing involved diving or submersion the water would surely have been cold enough to produce ear exostoses. There are no estimates of water temperature at Vlasac during the Mesolithic, but it is unlikely to have differed significantly from that of today (see Marković-Marjanović 1978) and certainly was not substantially warmer. Currently, average temperatures of the Danube at Beograd range between 0° C (January) and 23.3° C (July), with an average spring, summer, and fall temperature of 15.2° C (van der Leeden 1975). Although it is impossible to know if these Mesolithic people were diving for fish, their high incidence of ear exostoses suggests that both males and females were spending considerable time in cold water. Another possible explanation is bathing (Ascenzi and Balistreri 1975), but if bathing were a general cause of ear exostoses these would be expected to occur more widely in European Upper Paleolithic and Mesolithic skeletons than they do.

In summary, given the association between ear exostoses and cold water and the faunal evidence for the importance of fishing at Vlasac, it is reasonable to assume that these Mesolithic populations were spending considerable time in the Danube or its tributaries catching fish. The extremely low incidence of ear exostoses in other European Upper Paleolithic and Mesolithic specimens, despite the often abundant remains of fish and shellfish (Bailey 1978, Boone 1976, Desse and Desse 1976, Hayden 1981, Rozoy 1978), suggests that these groups were using other methods to gather aquatic resources.

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A New Look at Morton's Craniological Research[1]

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Samuel George Morton, M.D. (1799–1851), was one of the giants of the American scientific community of his time. In addition to being a practicing physician and a professor of anatomy, Morton was active in geology and ethnology. Because of his expertise in paleontology, he was regularly called on to examine and describe newly uncovered fossils. He was also lauded for his innovative approach to ethnological research, especially his use of illustrations and measurements (Gillispie 1974:540).[2] To provide specimens for his anatomy lectures, he collected skulls representing numerous populations (Stanton 1960:27–28). As the collection grew, Morton began to use it as the focus of his ethnological research. By 1849 the Morton Collection of Human Skulls contained over 800 human crania from throughout the world (Morton 1849*a*:vi).

With Blumenbach, Morton believed that there were five major races, each characterized in part by the shape of the head (Stanton 1960:4–11, 29). He considered cranial capacity an especially good indicator of race (Stanton 1960:31). To determine cranial capacity he filled crania with sifted mustard seed and then emptied the seed into a homemade volumetric cylinder (Stanton 1960:29–32). In 1839, he used 256 of these values to calculate a mean cranial capacity for each of the five races. The table listing these means, reproduced here as table 1, was published along with many of Morton's raw data in his *Crania Americana* (1839:260). The thesis of this work was that native Americans were one race distinct from Eskimos and Mongolians. *Crania Americana* implied, though it did not state, that each race had an independent origin,[3] and since Morton argued that the races were as immutable as species the reader was left to conclude that the racial differences in cranial capacity detailed in this table were as old as humanity.

As Morton continued his ethnological research and enlarged his collection, he improved the accuracy of his measuring technique by substituting lead shot for mustard seed and in 1849 used 623 of these "shot values" to construct an even more elaborate table of cranial capacities. This 1849 table, reproduced here as table 2, and all of the data used in its construction were published in Morton's (1849*a*) *Catalogue of Skulls* (pp. vii–viii). In this work, Morton proposed that the five established races would be more aptly described as "groups" and divided these "groups" into "families" in turn divided into "races." Late in his career, he began to apply the results of his research to enhancing the scientific understanding of species. From his 1849 table he concluded that each race was characterized by "a collective identity of physical traits" and said that he favored the independent origin of races (p. ix). By 1851 he was openly declaring that human races were in fact species; physical form was for him the ultimate criterion for determining species, and his ethnological research showed that each race had a distinct form (Stanton 1960:140–41). Morton's definition of species contradicted the widely accepted notion of specific infertility. Mixed-race humans, unlike hybrid animals, are indeed fertile, and many scholars used this to support the specific unity of

 This paper is based on research reported in "An Analysis of Samuel G. Morton's *Catalogue of the Skulls of Man and the Inferior Animals, Third Edition,* Based on a Remeasurement of a Random Sample of the Morton Collection of Human Crania," which was presented to the Macalester College Honors Program in the Department of Geology on May 1, 1986. I am grateful to Janet Monge, Gerald Webers, Joe V. Michael, and Tom and Bonnie Michael for support and encouragement.

2. Gillispie refers to Morton as "a founder of invertebrate paleontology in the United States" and describes his first ethnological publication as "a landmark in anthropology."

3. Stanton feels that Morton, a man of social standing, may have shied away from a direct discussion of racial origins in order to avoid any potential for scientific or religious controversy (pp. 32–33).