

typically Islamic. Chicco accepted the archaeological evidence that the Venafrò pieces were much older, however, and suggested that they had been brought back from the Orient by a traveling Roman warrior. That theory at least preserved the Oriental origins of the game, but it still generated uproar among chess scholars. The majority view is that the game originated as "chaturanga" in India in the sixth century, with the first documentary evidence for chess being played coming from Persia in the same period. Chess then spread westwards with the Moorish invaders of Spain in the eighth century and the Islamic conquerors of Sicily shortly after.

As far as chess scholars were concerned, there were two possibilities for the Venafrò find: Either they were not chess pieces, or they were not as old as they seemed. Radiocarbon dating of the chess pieces was discussed, but was considered too destructive: At that time the technique would have required hundreds of grams of bone, which would have meant destroying most of the Venafrò pieces. The unresolved controversy remained in the background until 1987, when Chicco's former pupil, chess historian Alessandro Sanvito of Milan, Italy, began a new study of the pieces. By this time a new radiocarbon dating technique was available that required only a few grams of material.

Radiocarbon dating relies on the fact that the tissue of living things contains a fixed ratio of carbon-12, carbon-13, and radioactive carbon-14. But when an organism dies, the ratio of the isotopes changes as carbon-14 decays, so the age of dead organic matter can be calculated from the isotope ratio. In October of last year, approximately 2 grams of bone from the heaviest, 40-gram, chess piece was released for analysis by Italy's Ministry of Cultural Heritage. Samples were sent for dating to two independent accelerator mass spectrometry labs: one near Sydney, Australia, and one in Naples, Italy. The labs came up with almost identical results: The pieces date from the period AD 885 to 1017, with 68% probability.

"The chess scholars are happy that the scientific test has proved without any doubt the date of the tenth century," reports chess historian Gianfelice Ferlito of Morosolo-Casciogo, Italy. Now, however, they have a whole new set of questions: How did the pieces end up in the Roman grave? Were they fashioned by a local artisan or brought by Saracen invaders who left southern Italy in the tenth century? But at least chess historians will not have to rewrite the whole basis of their discipline.

—Claire O'Brien

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U.S. RESEARCH SPENDING

Accounting Tricks Boost NSF Budget

It's a rookie year of which even Babe Ruth would have been proud. Last week, a House-Senate conference committee awarded the National Science Foundation (NSF), with its rookie director Neal Lane, a whopping 12.5% boost in its 1995 budget. The \$378-million increase, which brings NSF's budget to nearly \$3.4 billion, more than doubles the president's requested increase for the agency and stands in sharp contrast to the overall federal budget for discretionary spending, which was frozen for 1995.

The conference committee's bill—which reconciles versions passed separately by the House and Senate earlier this summer—is expected to pass both houses of Congress without further debate. It adds \$145 million, for a total of \$250 million, to renovate university research facilities and buy large equipment; \$117 million to NSF's \$2.1-billion research account; \$36 million to what NSF now spends on education programs, for a total of \$606 million; and \$21 million to complete the United States' half-share of the \$176-million, 8-meter Gemini telescopes to be built in Hawaii and Chile.

Why has NSF been so successful in a year when most agencies are happy to keep up with inflation? One answer is that Senator Barbara Mikulski (D-MD), chair of the appropriations subcommittee that controls NSF's budget, has rewarded Lane for meeting her demands to demonstrate that the agency's programs meet important national needs. Senate report language earlier this summer complimented Lane for preparing strategic plans in several areas (*Science*, 22 July, p. 469). But a more important reason is that Congress has boosted NSF's budget in a strategic way that will not immediately require cuts in other areas—but that could come back to haunt the agency in the future.

Mikulski's subcommittee kept within its total spending limits by carefully focusing increases on areas such as facilities modernization, large equipment, and education programs, in which a relatively small proportion of the money appropriated for 1995 will actually be spent in that year. In addition, the subcommittee stipulated that \$132 million of the academic facilities account will not be made available until the last month of the fiscal year, ensuring that an even larger proportion of the money won't be spent until fiscal year 1996, which begins on 1 October 1995. In contrast, a larger proportion of the money in NSF's research account will be spent in fiscal year 1995, so the subcommittee was able to give research only a modest increase.

Other agencies have benefited from similar budgetary maneuvers in the past, but the results are usually less dramatic for science. The National Institutes of Health, for example, has only a tiny infrastructure program and a much smaller education account. Many members, however, view delayed obligations as an accounting trick that could boomerang. The money will eventually get spent, and this could cause problems in future years when the delayed commitments must be accommodated within the agency's appropriation for that year. "It's a gimmick we try to avoid," says one House appropriations staffer on another committee. "We did it once, to the tune of \$4 billion, and it took us 3 years to get caught up."

In an era of flat budgets, analysts say that NSF's research account—the one watched most closely by scientists—is in particular jeopardy because of its higher outlay rate. For now, however, Lane is happy to accept congratulations for a spectacular rookie year.

—Jeffrey Mervis

NSF'S BUDGET FOR 1995 (\$ MILLIONS)				
Account	Current	FY '95 request	House-Senate conference	% change over '94
Research	2164	2349	2280	+5.4
Education	570	586	606	+6.3
Academic facilities	105	55	250	+138
Major projects	52	70	126	+142
Other programs	127	140	134	+5.5
TOTAL	3018	3200	396	+12.5