

## Carter's lofty win: India gets A-fuel

The U.S. nuclear-nonproliferation stance was weakened Sept. 24 when the Senate failed to block shipment of fuel for India's Tarapur nuclear reactor. By not backing the House, which last week voted an overwhelming (three to one) condemnation of the proposed nuclear-fuel sale, the Congress failed to halt Carter in one of their most significant recent challenges of his foreign policy. The win is particularly important for Carter as a sign of his strength as the election nears.

In May, Carter had promised the Ghandi government that, although it was in violation of the U.S. Nuclear Antiproliferation Act (SN: 10/8/77, p. 231), its bid to buy 40 tons more fuel for Tarapur, near Bombay, would be approved. (The act clarified for the first time conditions — such as the refusal to adopt international safeguards on all its nuclear facilities — under which the United States would be forced to stop sales with nuclear-importing powers. A two-year grace period that was offered nuclear-importing nations for achieving compliance with the act expired last spring.) When the Nuclear Regulatory Commission refused several days later to approve the Indian fuel purchase — NRC's sanction is required for all U.S. nuclear exports — Carter overrode them with an executive order (SN: 5/31/80, p. 344).

Among the reasons Carter offered for his request to exempt India from having to comply with provisions of the act were:

- That India has threatened to view an interruption of fuel supplies guaranteed under its contract with the United States as absolving it from having to abide by that contract's clauses (such as those requiring that Tarapur remain under international safeguards and that U.S. approval be obtained before any extraction of weapons-grade plutonium is attempted from spent fuel now stored at Tarapur).
- That owing to India's strategic military importance to the United States, its "friendship" must not be jeopardized.

After apparently giving up any hope of swaying House intentions, the Carter administration had in recent weeks mustered an intensive pro-Tarapur lobbying campaign of Senate members. Although the Senate vote this week was close, the outcome of Senate deliberations — which included nearly 10 hours of floor debate prior to the polling — is surprising.

First, their ultimate consensus rejects the decisions of not only the five nuclear regulatory commissioners, but also both the House and Senate foreign-relations committees. Second, a refusal to ship India any more nuclear fuel could be interpreted as the United States' only legal contractual recourse (since the contract promising India fuel contains the statement that India must "comply with all ap-

plicable laws, regulations and ordinances of the United States"). Third, India has not exactly courted the friendship of the United States while these sensitive deliberations by the Congress have been underway: According to the chairman of the Senate's subcommittee on energy, nuclear proliferation and federal services, John Glenn (D-Ohio), since the President's decision in May to send it fuel, "India concluded a \$1.6 billion arms deal with the Soviet Union, became the only noncommunist country to recognize the pro-Soviet regime in Kampuchea and signed a long-term trade agreement with Iran that undercuts our ability to apply pressure for the release of our hostages."

Most important, the Indian fuel sale could threaten the U.S. nonproliferation efforts ongoing around the world. It could, for example, undermine negotiations with nations that have not yet signed the Nuclear Nonproliferation Treaty (NPT) — most notably Pakistan, Argentina, Brazil, Israel and South Africa — in adopting full-scope safeguards on any nuclear facilities they have or intend to build. It could also cause other nuclear-supplier nations that now require importers to apply safeguards to their facilities to reassess their own policies. Switzerland, for example, which has such policies, is already bristling over the threatened refusal by the United States to license the Swiss sale of nuclear fuel — originally purchased from the United States — to Italy. The reason U.S. diplomats gave this week is that the Swiss contributed to Pakistan's obtaining supplies it needed to produce a clandestine nuclear reprocessing plant.

Among possible last-minute swing factors influencing the Senate vote was the announcement in the Sept. 23 Washington Post that India's combative and worrisome neighbor, Pakistan, had resumed construction of a small, clandestine, nuclear-fuel reprocessing plant near Rawalpindi to produce bomb-grade plutonium. The story reports "U.S. intelligence experts" as claiming that the Pakistanis could generate "enough fissionable material to stage an initial atomic test in the fall of 1981."

India has already detonated a bomb and even flaunted defiantly its perceived right to conduct further bomb testing. Pakistan's actions now offer India even greater incentives to put off signing the NPT — which would have required that all its nuclear facilities become subject to international safeguards.

Blocking the U.S. sale of fuel for Tarapur would not necessarily have stalled development of an Indian nuclear arsenal, since some of India's nuclear facilities are not now "protected" — as Tarapur is — by adherence to international safeguards monitoring. It would have removed, however, the opportunity for others to interpret the sale as tacit endorsement of India's recalcitrance in adopting international safeguards. □

## Ancient bone glow: Is it tetracycline?



Light rings indicate fluorescence.

Debra L. Martin got more than she bargained for in a routine check of the thickness of bone sections taken from an ancient Sudanese cemetery. The optical light microscope normally used by researchers to examine such bone samples already was in use; so Martin — of the University of Massachusetts at Amherst — turned to a fluorescent microscope. There, under the ultraviolet light of the fluorescent scope, the bones glowed an intense yellow-green identical to the signal produced in modern bones by the widely used antibiotic tetracycline. Expecting only to gather data for an anthropological study on bone aging, Martin now had evidence that an ancient Sudanese people ingested fairly large doses of tetracycline about 1,400 years before common medical use of the antibiotic began.

Martin and her colleagues at Amherst, along with Antonio R. Villanueva of Henry Ford Hospital in Detroit, Mich., tell the tale of this fortuitous discovery in the Sept. 26 SCIENCE. The researchers recovered the bones from a cemetery that holds the remains of an agricultural population, the Sudanese Nubians, who cultivated flood plains of the Nile, about 600 miles south of Cairo, from about A.D. 350 to A.D. 550.

A source of tetracycline for the Nubian population may have been the mold-like bacterium *Streptomyces* — a natural producer of the antibiotic — that grew on the wheat, barley and millet the Nubians stored in mud bins. Each time the Nubians ate bread or drank beer made from this mud-bin grain, they also — most likely unknowingly — received a dose of naturally occurring tetracycline, Martin and co-workers report.

Intentional use of tetracycline as a broad-spectrum antibiotic began in the 1950s. At that time, researchers noted that, in a process similar to the stain-causing incorporation of the drug in tooth enamel, the antibiotic causes staining and fluorescence in other calcifying tissues. In bone, for example, tetracycline can bind to the surfaces of osteons (cylindrical bone units) that are actively mineralizing, or laying down calcium. A yellow-green