

Rivers in the Sand

The ancient Sahara may have harbored waterways and prehistoric humans

By BRUCE BOWER

The Eastern Sahara is one of the hottest places on Earth, its parched sands moistened by a rain shower every few decades. It may come as a surprise, then, that stretches of this African desert have inspired a scientific debate over water.

More specifically, the argument concerns ancient water. From around 2 million to 4,000 years ago, one group of investigators contends, a braided network of channels set into large valleys in the Eastern Sahara filled with flowing water during extended spells of humidity and substantial rainfall. The valleys attracted early humans at least 200,000 years ago, they say.

Another team maintains no such river system ever existed. In their view, fierce desert winds hollowed out depressions in the earth that became temporary ponds or lakes after rains. Human activity at these oases was minimal at best, they conclude.

One thing is sure: The debate owes its existence to the U.S. space program.

The first inkling that the Eastern Sahara once possessed some type of water drainage system came in 1982, when scientists at the U.S. Geological Survey (USGS) in Flagstaff, Ariz., examined radar images of Earth taken during a flight of the space shuttle Columbia. The radar penetrated large areas of the Sahara where the sand sheet is no more than several feet thick, revealing a web of valleys and smaller channels winding beneath the desert sands (SN: 4/21/84, p.244).

In 1984, guided by specially processed maps from Landsat, radar and other sources, USGS researchers located some of the radar-exposed channels with the aid of a satellite navigation device modified for land use. Excavations on the "shores" of two sand-covered valleys, directed by archaeologist William P. McHugh (who died in May), uncovered hand axes and other stone artifacts dating to approximately 200,000 years ago.

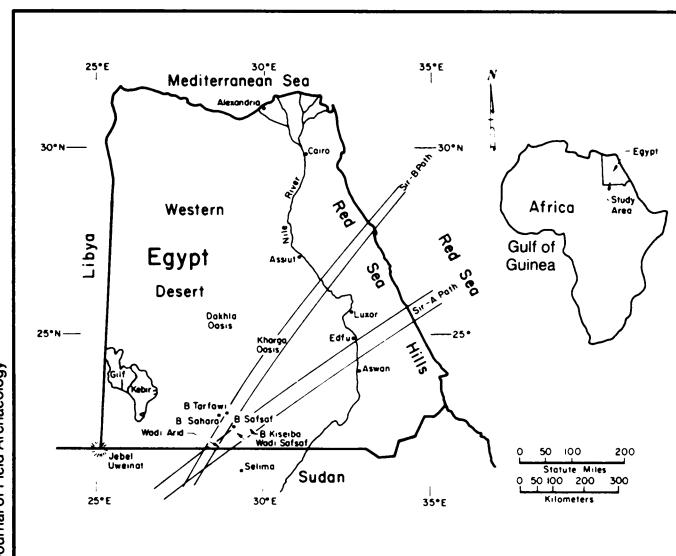
The archaeological evidence fits with

geological data, described by USGS scientist John F. McCauley and his colleagues in the July 1986 IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, indicating the "radar rivers" are missing links of a previously unrecognized trans-African river system. At least 30 million years ago, the researchers maintain, volcanic eruptions and shifts in the Earth's crust carved out the system's major streams, which flowed southwest from headwaters in Egypt and the Sudan, across northern Africa and into the Atlantic Ocean at the Gulf of Guinea.

The Amazonian proportions of the river system gradually receded. Geological disturbances cut off stream flow at several points in the valleys around 15 million years ago, McCauley's group says. A northward-flowing river arose about 6 million years ago and amputated still-operational sections of the river complex from its headwaters. The onset of extreme heat and virtually no rain around 2 million years ago dealt the final blow. Nevertheless, the USGS researchers

hold, ensuing rainy periods temporarily reactivated some of the rivers and streams in the Eastern Sahara. Archaeological remains indicate the streams drew groups of early humans until about 4,000 years ago, when climate changes made the area unlivable.

Archaeologist Fred Wendorf of Southern Methodist University in Dallas and his co-workers proposed a different interpretation of the radar-exposed channels in the spring 1987 JOURNAL OF FIELD ARCHAEOLOGY. They surveyed several hundred archaeological sites in and around the Eastern Sahara radar channels and concluded that no evidence supports the scenario of an ancient river system once coursing through the area. Over the last 2 million years, according to these investigators, desert winds probably dug out bedrock basins during "hyperarid" periods. The basins collected sediment and water dur-



Areas covered by space-shuttle radar, labeled "Sir-A Path" and "Sir-B Path," cross in the Eastern Sahara near the Egypt-Sudan border, where arrows point to ground study sites.

ing rainy stretches, creating transient ponds or lakes.

Archaeological sites in the survey represent short-term stops by very small groups of people, Wendorf argues. In his opinion, this confirms that prehistoric water sources in the Eastern Sahara could not support sustained human use.

The USGS scientists charge, however, that Wendorf's survey was conducted in an area where the sand is too thick for radar penetration and thus it sheds no light on the relation of prehistoric sites to the radar-exposed channels.

In a flurry of recent publications, including the winter 1988 *JOURNAL OF FIELD ARCHAEOLOGY*, the Feb. 24 *SCIENCE* and the June *ANTIQUITY*, McHugh and USGS scientists present further evidence for an early occupation of the African desert's ancient valleys. Uranium-series dating of carbonate found along the edges of the valleys indicates the rock was deposited in three episodes — about 45,000 years ago, 141,000 years ago and 212,000 years ago. These deposits apparently were generated by groundwater present during phases of wet weather, the researchers contend.

McHugh's 1984 excavations, they add,

uncovered stone hand axes from the 212,000-year-old carbonate deposits, providing a minimum age estimate for human occupation of the valleys. In McHugh's view, these early inhabitants were hunters and gatherers, drawn to the game and vegetation near the riverbanks. A long succession of people followed, culminating with groups that raised cattle in the ancient valleys between 7155 and 2900 B.C.

Around that time, according to the USGS group, the drying up of the Sahara reduced water-carrying channels to a few separate water holes, much as the billabongs of the Australian desert now lie along the courses of defunct ancient rivers.

More support for some form of prehistoric water connection in the Sahara, although not necessarily a vast river network, comes from a report soon to appear in *QUATERNARY RESEARCH*. Excavations conducted in 1987 at a wind-formed basin near the radar-exposed channels yielded several thousand remains of fish, amphibians, reptiles, birds and small mammals, say zoologist Kazimierz Kowalski of the Polish Academy of Sciences in Krakow and his co-workers — including Wendorf. The fossils came from sediment dated at about 135,000 years old.

Animals uncovered at the site, including crocodiles and water turtles, indicate a large lake was once present, the researchers contend. Annual rainfall at the time was at least 20 inches, they add.

The 1987 excavations also uncovered remains of deep-water fish, now under study by paleontologist Wim Van Neer of the Royal Museum of Central Africa in Tervuren, Belgium. Only through direct water connections can these creatures colonize new areas, Van Neer says. McCauley and his USGS colleagues suggest that around 100,000 years ago, streams represented by the radar-exposed channels hooked up with water sources in the Nile Valley nearly 200 miles to the east.

Wendorf, however, still doubts humans inhabited the area for extended periods. He says the archaeological sites unearthed by McHugh probably represent remains of tool workshops used intermittently over tens of thousands of years.

Although McHugh and his co-workers noted in the January 1988 *GEOARCHAEOLOGY* that their research "has literally only scratched the surface," exploration under the Saharan sands will resume in 1991, when three new space shuttle radar flights are planned. Remarks USGS geologist Carol S. Breed, "We want to map the distribution of ancient river channels across all of northern Africa." □

Letters continued from p. 131

The EPA is neither the guardian of the English language nor our authority on scientific terminology. If they wish to consider all "bad things" as "pests" and all means of stopping those things "-cidal," then that just illustrates their scientific illiteracy. Designating daminozide a pesticide just because that fits their legal scheme of things is nonsense. Daminozide is a plant-growth regulator, and this is true even in the case you cite of its use in the peanut industry. Preventing rank vine growth to reduce the moisture-holding capacity of foliage, and thus to discourage fungal infection, is hardly an active killing of fungal tissue. We could just as well, with the same false logic, say that low-nitrogen fertilizers are pesticidal because they discourage development of lush, juvenile plant tissues that invite fungal infection.

The ivory towers of sciencedom do need some realignment now and then from the ranks of us who are far enough removed from the bureaucratic self-protection to see their glaring goofs.

Richard W. Ikenberry
Kearney, Neb.

More on headlines

As I read the Letters column in your July 8 issue, I felt that certain letters were selected so that those who objected to the "cutesy" titles would be written off as literary scrooges and those who thought the titles were great were the good guys.

I never thought to write to you about such an issue until I realized how many others had strong opinions on the subject. But *SCIENCE NEWS* is one of the important magazines I read

in my all-too-busy life, and I would appreciate it if your writers, in their efforts to be light and clever, would at least be primarily influenced by the idea that the headline should let the reader know what is in the article.

Sometimes all one can do is scan headlines to see what to get at later. A headline may, of course, be humorous, light, clever, etc., but not at the expense of being informative. Sometimes when it's obvious that someone has bent over backwards to be cute at the expense of being informative, I can see why some readers get miffed.

Michael Safdiah
New York, N.Y.

In selecting letters on headlines, we intended no slant. All critical letters arriving in time for publication were included, as were most of the supportive ones. Your point, however, is well taken.
— the editors

Closeting sexual statistics

Perhaps the real reason the government is trying to prevent a full-scale survey of U.S. sexual behavior ("Desperately Seeking Sexual Statistics," SN: 7/8/89, p.28; Letters, SN: 8/5/89, p.83) is not the purported concern about privacy. As the preliminary research you describe already indicates, normal human behavior spans a much broader spectrum than the currently powerful right-wing ideologues and religious fundamentalists wish to acknowledge. It would be very upsetting to their agenda if our society ever faced up to the realities that almost 30 percent of us have had homosexual experiences, that hiring prostitutes is a mainstream event and that sodomy is a common practice. The political

hacks seem to feel that when their world view conflicts with reality, the best strategy is to suppress the truth.

Steven E. Miller
Cambridge, Mass.

Beyond knowing?

J. Eric Triau (Letters, SN: 7/15/89, p.35) states that "by using an active verb, Wickelgren seems to imply that evolution has a purpose, which it has not." How does Mr. Triau know whether evolution has or has not a purpose?

John H. Hall Jr.
Houston, Tex.

CORRECTION

In the photo depicting forest damage at Mt. Mitchell, N.C. ("Where Acids Reign," SN: 7/22/89, p.56), most of the dead trees are Fraser fir, not red spruce as stated. The distinction is important, according to entomologists Robert G. Hollingsworth and Fred B. Hain of North Carolina State University in Raleigh, because the most dramatic episodes of tree mortality in the southern Appalachians are associated with the presence of a small, sucking, aphid-type insect called the balsam woolly adelgid, which attacks only fir. At Mt. Mitchell, scientists first detected this introduced pest in the mid-1950s; infested fir trees have been dying rapidly ever since, according to Hollingsworth and Hain. A 1988 U.S. Forest Service evaluation of spruce-fir mortality in the region states that "patterns of tree death . . . are consistent with accounts of balsam woolly adelgid infestation."