

Collapse of Earliest Known Empire Is Tied to Long Drought

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the drought finally ended in about 1800 B.C., leadership in the region had passed from Akkad to Ur and then to the Amorites, whose power was centered at the rising city of Babylon. Hammurabi, the great ruler of Babylon in 1800 B.C., was a descendant of Amorites.

The correlation between drastic climatic change and the Akkadian downfall also appears to complete the picture of widespread environmental crisis disrupting societies throughout the Middle East in the same centuries. Earlier studies had noted the effects of severe drought, including abandoned towns, migrations and nomad incursions, in Greece, Egypt, Palestine and the Indus Valley. Until now, the connection between chronic drought and unstable social conditions had not been extended to Mesopotamia, the land between the two rivers, the Euphrates and the Tigris, often called "the cradle of civilization."

As to what caused such a persistent dry spell, the scientists said they had no clear ideas, though they suggested that changing wind patterns and ocean currents could have been factors. A tremendous volcanic eruption that occurred in Turkey near the beginning of the drought, the scientists said, almost certainly could not have triggered such a long climate change.

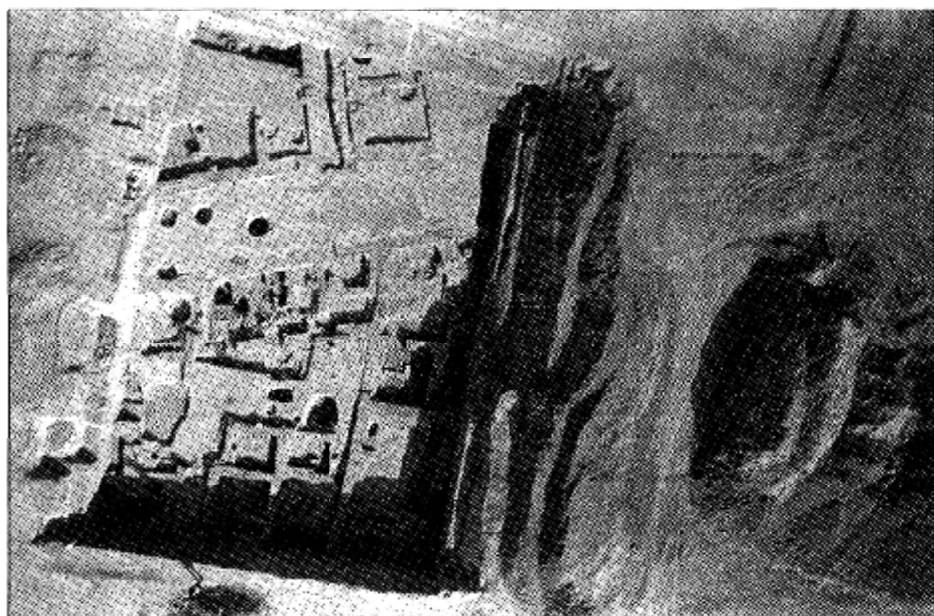
Archeology's Sophistication

"This is a research frontier for climatologists," Dr. Weiss said in an interview.

Dr. Weiss proposed the new theory for the Akkadian collapse at a recent meeting of the Society of American Archeology in St. Louis and then in a report in the current issue of the journal *Science*. His principal collaborators in the research were Dr. Marie-Agnès Courty, an archeologist and soil scientist at the National Center for Scientific Research in Paris, and Dr. François Guichard, a geologist at the same institution.

Other archeologists said the theory was plausible and appeared to provide the first logical explanation for the Akkadian downfall. Although he had not studied the report, Dr. Robert Biggs, a specialist in Mesopotamian archeology at the University of Chicago, said this was a good example of "archeology's growing sophistication in seeking reasons for serious political changes in the past."

In an article accompanying the report in *Science*, Dr. Robert McC. Adams, secretary of the Smithsonian Institution and an anthropologist specializing in Mesopotamia, cautioned that Dr. Weiss and his colleagues had not thoroughly established the link between climate and the empire's fall. He questioned whether such widespread and persistent drought could be inferred from local soil con-



Part of the city of Shekhna, now known as Tell Leilan in Syria, excavated by Dr. Harvey Weiss of Yale University. A 300-year drought, beginning about 2200 B.C., may have been the cause of the city's demise.

ditions at a few sites.

"It will demand of other people in the field to either refute it or replicate it with their own work," Dr. Adams said of the theory. "And the only way to get people to pick up that challenge is for Weiss to stick his neck out. I applaud it."

Dr. Weiss said the conclusions were based on tests of soils mainly at the sites of three Akkadian cities within a 30-mile radius, places now known as Tell Leilan, Tell Mozan and Tell Brak in present-day Syria. Evidence of similar climate change was found in adjacent regions, and the archeologist said further tests of the theory would be conducted with the resumption of field work this week.

Land of Rainy Winters

The most revealing evidence has come from Tell Leilan, where Dr. Weiss has been excavating for 14 years and finding successive layers of ruins going back some 8,000 years. For several millennia, this was a small village established by some of the world's first farmers. Around 2800 B.C., it suddenly expanded sixfold to become the city of Shekhna, with 10,000 to 20,000 inhabitants. They lived in the middle of a land of rainy winters, dry summers and a long growing season for wheat and barley, much as it is today.

All the more reason the kings of Akkad, or Agade, a city-state whose location has never been exactly de-

termined but is assumed to have been near ancient Kish and Babylon, reached out and conquered places like Tell Leilan about 2300 B.C. The region became the breadbasket for the Akkadian empire, which stretched 800 miles from the Persian Gulf to the headwaters of the Euphrates in Turkey.

Ceramics and other artifacts established the Akkadian presence there in Tell Leilan and other northern towns. And for years archeologists puzzled over the 300-year gap in human occupation of Tell Leilan and neighboring towns, beginning in 2200 B.C. It occurred to Dr. Weiss that since no irrigation works had been uncovered there, the region must have relied on rain-fed agriculture, as is the case there today, in contrast to the irrigated farming in southern Mesopotamia. A severe drought, therefore, could be disastrous to life in the north.

This idea was tested by Dr. Courty, using microscopic techniques she pioneered in a scientific specialty, soil micromorphology. By examining in detail the arrangement and nature of sediments at archeological sites, it is possible to reconstruct ancient environmental conditions and human activity.

One of the first discoveries was a half-inch layer of volcanic ash covering the rooftops of buildings at Tell Leilan in 2200 B.C. All ash falls leave distinctive chemical signatures. An

analysis by Dr. Guichard traced the likely source of this potassium-rich ash to volcanoes a few hundred miles away in present-day Turkey.

Migration From North

Since the abandonment of Tell Leilan occurred at the same time and the climate suddenly became more arid, volcanic fallout was first suspected as the culprit. Ash and gases from volcanic eruptions can remain suspended in the atmosphere for years, creating sun-blocking hazes and reducing temperatures. But from their knowledge of recent volcanoes, scientists doubted that the eruptions could have perturbed the climate over such a large area for 300 years.

And there seemed no doubt about the drought lasting that long, Dr. Courty said. In the surrounding countryside at Tell Leilan and elsewhere, she examined a layer of soil nearly two feet thick and lying just above the volcanic ash. This layer contained large amounts of fine wind-blown sand and dust, in contrast to the richer soil in earlier periods. Another telltale sign was the absence of earthworm holes and insect tracks, which are usually present in soils from moister environments.

This was strong evidence, the researchers reported, of a "marked aridity induced by intensification of wind circulation and an apparent increase" of dust storms in the northern plains of Mesopotamia.

Akkadians to Babylon

• Sometime before the third millennium B.C.: A tribe of Semitic-speaking herding nomads, perhaps originally from Arabia, gradually settles down in northern Mesopotamia, which comes to be called Akkad.

• Middle of the third millennium B.C.: Akkadian names first appear in Sumerian documents.

• Around 2500 B.C.: Inscriptions written in Akkadian appear.

• 2340-2316 B.C.: Reign of Lugal-zagesi, last of a line of Sumerian kings. It is a time of struggles among city-states for regional supremacy.

• Around 2300 B.C.: Rise of Sargon of Agade or Akkad, a Semitic-speaking ruler; he defeats Lugal-zagesi and reigns for 56 years. The exact location of his city has never been found.

• 2278-2270 B.C.: Reign of his son Rimush, killed in a palace revolt.

• 2270-2254 B.C.: Reign of Rimush's brother Manishtushu, also killed in a palace revolt.

• 2254-2218 B.C.: Reign of Manishtushu's son Naram-Sin, thought to be the first to claim kingship as a divine right. His downfall was traditionally ascribed to divine retribution in the form of invading hordes from the east, called the Guttians. However, new research suggests complex internal problems and the beginning of a 300-year drought as the culprits.

• 2217-2183: Reign of his son Shar-kali-sharri, followed by a period of anarchy.

• 2200 B.C.: Volcanic eruption in Anatolia, after which many Akkadian settlements are abandoned.

• Around 2220-2120: A Gutian dy-

nasty is recorded, among others.

• 2123-2113: Rise of Utu-hegal, who appoints Ur-Nammu as military governor at Ur. Ur-Nammu overthrows his protector, assumes the title of King of Ur and founds a well-organized dynasty. The ziggurat, or stepped tower, prototype of the Tower of Babel, is first recorded in his reign. Ur falls gradually, besieged by invaders like the Amorites and Elamites.

• 2028-2004: Reign of Ibbi-Sin ends with loss of empire. Some years later, a former underling, Ishbi-Erra, expels the Elamites.

• 1984-1975: His son, Shu-Ilishu, using the title King of Ur, continues a dynasty noted for peace and prosperity. Amorite influence remains strong and the desert sheikhs who lead them are respected. An Amorite dynasty is founded at Larsa. Amorites are gradually assimilated into the Babylonian population.

• 1932-1906 B.C.: An Amorite king, Gungunum, claims titles of King of Sumer and Akkad and of Ur.

• Around 1894 B.C.: Emergence of an Amorite dynasty at Babylon. A city called Shubat-Enlil is built on the ruins of Shekhna, abandoned in the drought.

• 1813-1781: Reign of Shamshi-Adad, a powerful Amorite king.

• 1792-1750 B.C.: Reign of Hammurabi, famous king and law-giver; toward the end of his reign, Babylon becomes a great military power and the seat of kingship.

• 1585 B.C.: Sack of Babylon by the Hittites, an Indo-European-speaking people from Asia Mi-

nor.

It was during the 300-year desertification that archives of the southern cities reported the migration of barbarians from the north and a sharp decline in agricultural production, and showed an increasing number of names of people from the northern tribes, mainly the Amorites.

According to the evidence of the sediments, rain in more abundance returned to northern Mesopotamia in 1900 B.C. and with it the tracks of earthworms and the rebuilding of the deserted cities. Over the ruins of Shekhna, buried in the sands of the drought, rose a new city named Shubat-Enlil, which means "dwelling place of Enlil," the paramount Mesopotamian god. The builders were Amorites.

In earlier excavations at Tell Leilan, Dr. Weiss discovered an archive of clay tablets showing that this was

the lost capital of a northern Amorite kingdom often mentioned in the cuneiform writing of the period. This was the archive of Shamshi-Adad, the Amorite king who reigned from 1813 to 1781 B.C., containing the king's correspondence with neighboring rulers who concluded the ransoming of spies.

By then, the Akkadian kingdom of Sargon and Naram-Sin — the world's first empire — was long lost in the dust, apparently also the first empire to collapse as a result of catastrophic climate change.

"Since this is probably the first abrupt climate change in recorded history that caused major social upheaval," Dr. Weiss said, "it raises some interesting questions about how volatile climate conditions can be and how well civilizations can adapt to abrupt crop failures."