EARTH SCIENCES

Rise and fall of the Great Salt Lake

The Great Salt Lake has had its ups and downs. And, according to a report from the U.S. Geological Survey in Salt Lake City, the lake's fluctuations have alternately brought fears of flood or desert. Yet, says author Ted Arnow, the lake level has actually varied within a range of only 20 feet, and today stands at the same level—about 4,200 feet above sea level—as it did when the Mormons first measured it in 1847.

After rising 12 feet in 12 years, the lake reached its highest level in 1873—4,211.5 feet above sea level. Fearing that Salt Lake City and surrounding farms would be flooded, says Arnow, the Mormon settlers sent out an exploration party to see if the lake water could be spilled into the desert on the west. But the lake peaked and, like so many urban projects, the plan was discarded.

When the lake hit an all-time low of 4,191.35 feet in 1963, the city's residents decided it was drying up. Roads, railroads, wildfowl-management areas and industries crept onto the newly exposed land, says Arnow. But once more the lake rose, reaching 4,202 feet by 1976. Again explorations were made — this time called feasibility studies—to pump the lake into the desert. And again the plans were dropped when the lake level fell because of low snowfall.

Because the lake has no outlet, its fluctuations are due to the balance between evaporation and the inflow from runoff and precipitation. Human use has had an effect as well: Arnow notes that the 1978 level would have been 5 feet higher but for human use of the water for reservoirs, irrigation and other uses.

Leg 65 picks a fast ridge

The Gulf of California is a perfect spot in which to study the formation of ocean crust. Part of the fast-spreading center called the East Pacific Rise splits the Gulf lengthwise, and is quickly (at a rate of 5.6 centimeters a year) pushing Baja California west and north away from Mexico. The spreading center is close enough to land that sediments accumulate rapidly and thickly on top of the freshly extruded ocean crust. Therefore, unlike the sediment-barren Mid-Atlantic Ridge, the East Pacific Rise has enough sediment to support a drilling rig. Taking advantage of this situation, the team of Leg 65 of the Deep Sea Drilling Project, led by Paul Robinson of the University of California at Riverside and Brian T. R. Lewis of the University of Washington, chose to sample the volcanic, or basaltic, rocks produced by that fast-spreading ridge. In order to learn what happens to new ocean crust as it is carried away from the spreading center, the *Glomar Challenger* drilled a series of holes from the center of the ridge to the continent.

According to Robinson, crustal formation begins with the extrusion of the commonly found, fluffy-looking "pillow" basalts, mixed with massive horizontal flows of lava. Then, less pillow basalt is produced and more massive flows—indicating a higher rate of eruption—are found, alternating with the rapidly deposited sediments. The massive horizontal flows of lava are probably characteristic only of fast-spreading ridges, the researchers believe, but the composition of the rocks indicates they are chemically probably the same as those found on a slow-spreading ridge. Unlike earlier attempts to construct such a profile at the Mid-Atlantic Ridge, the same rock units could be traced over 200 meters laterally, Robinson noted, so that the change in structure and composition of the crust over time can be studied.

Other evidence of the rate of activity along the spreading center was recovered in the form of hydrothermally altered basalts. The heat of the rapidly rising magma is believed to be dissipated by the circulation of water through the crest; the retrieval of rocks altered by water and heat is further evidence of this convection system, Robinson said.

ARCHAEOLOGY

Kendrick Frazier reports from Santa Fe at the Conference on Archaeoastronomy in the Americas

Solstice sites in Southern California

Winter solstice was a major crisis time for early Indian groups in California. They held ceremonies to ensure the sun's return from its southward progression along the horizon. A recent survey of widely scattered ethnographic literature shows that 40 California tribes are known to have recognized and observed the solstices. Two archaeological sites have been found that appear to mark solstice observatories or the locations of solstice ceremonies. The most common method used was that consisting of the direct observation of sunrise with reference to horizon markers.

Ken Hedges of the San Diego Museum of Man now reports documentation of two more apparent winter solstice observatory sites. They are in the territory of the Kumeyaay Indians in San Diego County. Ethnographic literature provided clues that led to the two sites and observations of winter solstice in 1978 demonstrated that a horizon marker exists for each. From the first location, a cross-shaped rock alignment on the summit of Viejas Mountain, the winter solstice sun rises directly behind the prominent Buckman Peak, 14 miles away. The second location, a stone circle with a bisecting line, is on Cowles Mountain, within the San Diego city limits. From this point, the first gleam of winter solstice sunrise is dramatically bisected by a small rocky peak 16 miles away.

Concludes Hedges: "The specific association of unequivocal horizon markers with winter solstice sunrise leaves little doubt that these sites functioned as observatories for the solstice event."

Sun-sighting posts in Ohio

On the flood plain of the Great Miami River in Dayton, Ohio, archaeologists have been excavating an Indian stockade of the Fort Ancient culture consisting of rings of houses surrounding a central plaza. In the plaza is an unusual pattern of four vertical posts positioned in a parallelogram with a large red cedar post in the center. J. M. Heilman and Roger R. Hoefer of the Dayton Museum of Natural History have now shown that the posts apparently were used to chart the position of the sun at key times of the year. As viewed from various dwellings and pole structures on the periphery of the settlement, alignment with the post structure in the plaza appears to define the solstices, the equinox and May corn planting time. In fact, the combination of these features seems to have strongly influenced the entire village layout. "The alignments are tight," says Hoefer. "We feel we are onto something that no one has had on this particular culture before."

Lunar-watch window on Mujeres

On the southern tip of the island of Mujeres off the Yucatan coast is a dramatically situated but fast-deteriorating small Maya temple known locally as El Observatorio. In January Trygve B. Sletteland of California State University checked its narrow windows for possible astronomical alignment. He found that the line of sight through window 1 in the mainland-facing wall is at the azimuth of 249° 30′. This is within 25 minutes of arc of the southern extreme of moonset at minor standstill, one of the four points that defines the moon's 18.61-year cycle of north-south movement. The opposite, seaward wall long ago crumbled into the Caribbean, but a window placed exactly opposite window 1 would align within 20 minutes of arc of maximum northerly extreme of moonrise at minor standstill. That the temple was used to chart the lunar standstill cycle can't be proved, but Sletteland points to ethnohistorical evidence that the moon had special associations for the East Coast Maya.