b20 Pluvial lakes < Gilbert; Lake Bonneville >

During glacials, Earth's climatic zones are narrower about the equator. In equatorial regions, at low altitude, it is never cold. High-altitude equatorial glaciers (as yet on New Guinea's mountains, and Africa's Ruwenzori, Mt. Kenya and Kilimanjaro) get longer and the air there dustier and colder (200 times dustier and 5-6°C colder is recorded in a col glacier at 19,800-ft on Peru's Huascaran volcano, Cordillera Blanca).[1] Temperate climatic belts are cooler, lessening evaporation there. Also evident is a redistribution of local climates. For example, northbound Russian rivers that debouch into the Barents and Kara seas were dammed by an ice sheet during the last glacial. The resulting lakes (their area twice that of the Caspian Sea) because of their large heat capacity had the effect, according to Gerhard Krinner, of prolonging ice-sheet melting by cooling the regions' summer climate.[2]

Today in the southwestern United States the climate is arid and, as a consequence, there are few major rivers or lakes. During glacials, due to both lessened evaporation rates and increased precipitation, lakes formed in this same region. Called *pluvial lakes,* these are recorded by features such as shorelines (beaches, wave-cut cliffs) now high and dry, deltas perched at high elevation, and salt flats in basins with interior drainage. Great Salt Lake, Utah, is a shrunken remnant of Lake Bonneville that was the largest (area 50,000 sq km, depth to 335 m) of the pluvial lakes.[3]

Ancient, datable, lake shores of Lake Bonneville can be traced around numerous embayments, and islands. Landscape deformation is most evident where these shorelines are no longer level. Careful surveys of their elevations allow for uplift isobases to be known. **Grove K. Gilbert**'s study, *The inculcation of scientific method by example, with an illustration drawn from the Quaternary geology of Utah*, 1886, of Lake Bonneville's shoreline (***Figure b20.1***) has become a classic because it let him show why "the method of multiple working hypotheses" (phrase strung by T. C. Chamberlin in 1889) is essential for adjudicating geological explanations.[4] ❑

Grove Karl Gilbert [5] (1843-1918). Charter member with the first director Clarence Rivers King (1842-1901) of United States Geological Survey in 1879 and its first Chief Geologist, 1889 to 1892.

He coined the term "laccolite" (now laccolith) for the dome shaped intrusion that resulted in the structure of the Henry Mountains, Utah (USGS report, *Rocky Mountain Region*, 1877).[6]

In historical science, cause and effect discovery is replaced by the reverse process of linking consequences to antecedents (both plexuses).

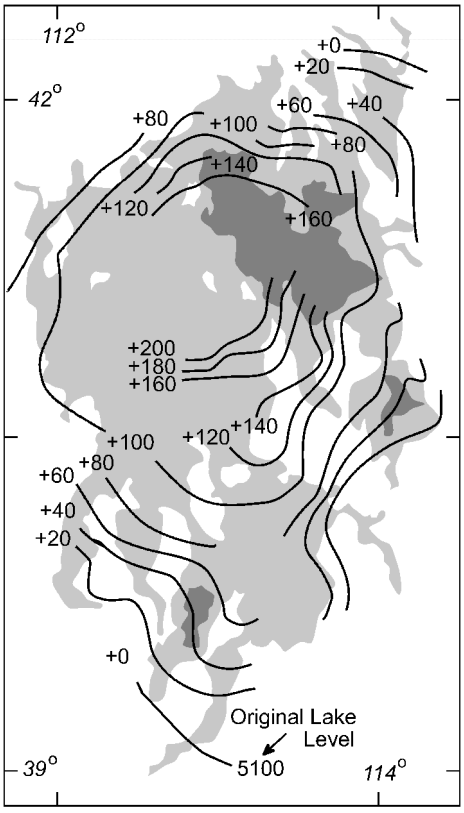

Figure b20.1 [7] Place to place depths of water of former Lake Bonneville (pale gray) is indicated by its shoreline elevations now above the original shoreline elevation (*isobases* are contours, here in feet, of that data) that had an altitude of 5100 feet during the Ice Age. Uplift is greatest where the pluvial lake was deepest—near where Great Salt Lake (large dark grey area) puddles today.