

Stability and Permanence

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What could seem more stable in our lives than the majestic Sierra Nevada, the towering White Mountains, and the waters that issue from them? Water resources, the mountains, and the continents are neither stable nor permanent, though many think they are. To a geologist, the words “stability” and “permanence” are counter to observation and inference.

At one time, not so long ago, the stability and permanence of the Earth’s continents and their relative locations were strongly supported by North American geologists who countered Francis Bacon’s 1620 and Alfred Wegener’s 1912 proposals that continents had drifted apart. Bacon’s and Wegener’s ideas that continents drifted and their positions are not permanently fixed were held in abeyance for decades until large parts of the Earth—the ocean basins—were better observed. Two-thirds of the way into the 20th Century we determined what the Alps, the deep seafloor, Bacon, and Wegener were trying to tell us: that continents drift thousands of kilometers and that rocks of the seafloor are not stable and permanent but appear and endure for only a fraction of Earth’s history.

If we look to the east from Bishop and the eastern Sierra Nevada, we see mountains where there was ocean 600 million years ago. If we look to the west from Bishop, we see sedimentary rocks that are remnants of old ocean floors altered by massive intrusions of molten rock. These granitic and metasedimentary rocks have been uplifted tens of kilometers within only the last few million years. Five million years ago there were no majestic pines and firs in the Sierra Nevada, but oaks, sycamores, and avocados, the latter indicating frost-free winters and rainfall of 63 cm (25 in) or more. Five million years ago the Sierra Nevada was a scant 500 to 1,000 m (1,500 to 3,000 ft) in elevation. These great mountains are hardly stable and permanent.

If we look westward beyond the Sierra Nevada, we see a terrane that 4 million years ago was more than 300 kilometers farther to the south than it is today. If we extrapolate the rate of movement of this great block of the earth’s crust west of the San Andreas fault, we can marvel that within several million years, Los Angeles will be a suburb of

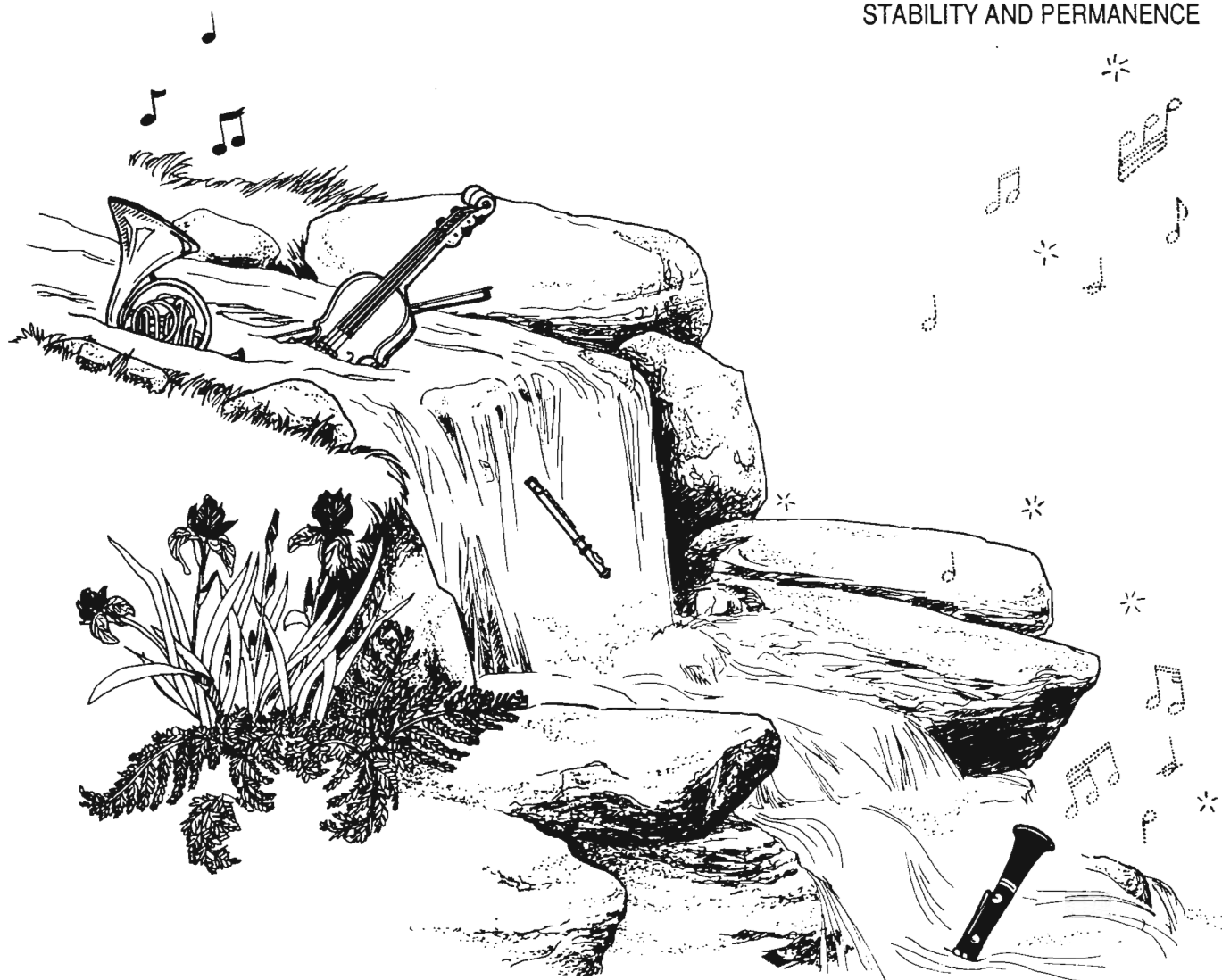
San Francisco, that the University of California, Los Angeles, and the University of California, Berkeley, will be one campus. The University of California, Santa Barbara, may be an island off our northern coast, or have been drawn beneath the continent, or be seen heading toward Hawaii!

When geologists find tropical palm fronds in 60-million-year-old rocks not far from Mount Rainier in Washington or giant tropical oysters and scallop shells as large as dinner plates in rocks 20 million years old at the same latitude as Bishop and across the Sierra Nevada, we understand that little about us is permanent. Yet we are aghast if told that the groundwater has been mined out of the Great Valley of California, that it will soon be gone in the great aquifers of the mid-continent, or that those seemingly stable mountains that bound Owens Valley or those that lie east of the Great Valley have insufficient water to sustain the millions of acres of cotton and alfalfa and the populations of humans living in California. Water supplies may fluctuate with local climate, overall climatic change, and possibly with global warming. Our groundwater supplies are a limited and finite natural resource.

As we read of the history of water in this volume, of its uses and its importance, we picture the travels and fate of water, beginning its cycle as precipitation from the sky. We conjure images of streams and creeks as they bounce down the precipitous eastern slope of the Sierra Nevada or western slope of the White Mountains, creating silvery bursts that tumble over boulders and cascade into local man-made catchments. We may notice the music of water as we sit next to a stream or flowing creek. If we give some thought to the water in that stream, most of us rarely stop to think that the water's symphony might not be perpetual as the waters play, depending on the season, *fortissimo* or *allegro* to *moderato* and finally *piano* passages. Water's symphony in this region silences as it disappears into a bajada, from whence it is drawn by giant pumps and sent, through human consumption, to the sea, returning eventually to the atmosphere to complete its cycle.

Tools, gauges, and instruments chart what happens to water as it falls through the atmosphere and is carried to the sea, and weather and precipitation records are available for several hundred or a few thousand years to model past climatic change and forecast future trends. Even though the information and data are sketchy and debated, there are indications that the protective coverings of the earth have been violated and disrupted. It is clear that climate is not stable and that the overall trend over the last several hundred years has been one of warming, although there are data to suggest that we may be in a short-term, *i.e.*, five- or ten-year, relative cooling trend.

Given this short period, a five- or ten-year window of time, does our generation have the conviction and will to act, to question past uses and abuses of water, and to persevere in efforts to question the right of a few to sequester large volumes of water? Does the scientific community have



Artwork from program cover for Handel's "Water Music," performed by the Eastern Sierra Chamber Orchestra at the History of Water Symposium banquet and concert on September 21, 1991. Reprinted with permission of graphic artist Janis Ament of Bishop, California.

the insight to move from reading gauges and computing the availability of water resources to more fundamental studies of the plants and soils of the watershed and the management of runoff and its consumption for irrigation? Will we be able to find inducements for the population to replant lawns and gardens with native plants and flowers? What is the socioeconomic impact of assessing penalties to individual homeowners—that part of the population that uses 10 or 15 percent of the available water, while the agricultural giants that use the 85 to 90 percent are able to use vast quantities of water at a cost far below what it costs to deliver? What will be the ecological, sociological, and economic impacts on society if water now used for crops is diverted to populated areas and areas proposed for urban development? What are the economic tradeoffs, what are the political realities? Are we wiser now that we have mined out many of our national natural resources, our hydrocarbons, metals, nonmetallics, and water? Are we wiser now knowing that we have polluted the air and ground that we count on to sustain us and our economic position? Is the public will strong enough to better utilize, question, and even stop use, abuse, and misuse of our resources, particularly water?

The role of the White Mountain Research Station's "History of Water" Symposium is to allow scholarly exposition of research on these questions. The goal of this Symposium is to better understand the history of water in the region from a time 600 million years ago to the present, to understand the level of water dependency of animal and plant groups, to provide a forum for discussions of the socioeconomic impacts that water—or lack of water—have on society, and to allow for the presentation of data relative to biology, hydrogeology, hydrology, groundwater, and engineering related to the mining and conservation of water. The topic "The History of Water: Eastern Sierra Nevada, Owens Valley, White-Inyo Mountains" was chosen because of its timeliness, because water is a part of every researcher's life and is in some way related to his or her research, and because it was believed that the University could help foster discussion, understanding, awareness, and research to benefit not only the inhabitants of the Owens Valley and the State of California, but much of the western part of the Nation.

Water, the subject of the symposium, is not a stable commodity, and its permanent supply cannot be guaranteed any more than we could have guaranteed that 5 million years ago avocado trees living on the then low-lying Sierra Nevada were not doomed or that Los Angeles would not move from the latitude of San Diego to its present latitude in the same space of time. Thus, we need to better understand the history, development, and conservation of a precious resource, we need to realize the meaning of the words "stability" and "permanence" in the context of water.

We have been alerted by others that the warning light for water's consumption is lit, the warning light of storage capacity is lit, the warning light of the nation's dependence on cheap hydroelectricity is lit; and that the warning light of overdrawing groundwater is burning a bright red. It is my hope that this Symposium will further our ability to answer some of the critical questions relating to water and help us reset the warning lights.