

## Preface

“**C**uriously and curiously” describes how this book evolved. I never planned to write a book on hydrology and myth in ancient Greece. And I certainly never intended to examine ancient stories set in a karst environment—in this case, limestone-dominated mountains, plains, and seabeds with sinkholes and caves.

Instead, this book began as a series of tangential questions that arose during my research for a philosophy book. Soon the tangents coalesced into a separate project.

While reading texts by Greek mythographers of classical antiquity, I kept noticing passages about the behavior of water near caves and in rocky areas. Knowing that two-thirds of Greece is dominated by limestones, I began to wonder whether the springs and rivers mentioned in the ancient texts were karstic.

Eventually, my curiosity about karst yielded this book. It represents the first integration of hydrology and karstology with Greek and Latin mythographic narratives spanning the millennium from Homer to Pausanias.

Whereas most commentators gloss over physical landscape features, I take great interest in the karstic terrains which served as backdrops for many Greek myths. To me, the richness of ancient texts lies not in references to a few spectacular volcanoes and earthquakes, but in descriptions of crystal springs ringed by greenswards and connected to rivers that disappear underground.

I recognize that the ancient Greeks’ collective knowledge of karst terrains drew only in part from the Greek mainland. In the centuries preceding and following Homer, the Greeks amassed stories involving

karst landscapes scattered throughout the Mediterranean and West Asia. Consequently, the myths that ultimately were written down by Greek and Latin mythographers often referenced areas that were colonized and known by the mobile Greeks. The title of my book therefore specifies “the ancient Greek world” rather than the relatively small geographic region known as Hellas Proper.

## KARSTS OF HOME

Although my curiosity about the karst hydrology of ancient Greece sprang from recent research of Greek philosophy and religion, my long-standing interest in karst emerged decades ago. Childhood visits to my grandparents’ Tennessee home on the karstified Cumberland Plateau taught me that snakes and crayfish from streams several kilometers from the house could find their way into the old-fashioned, unscreened water-well. Visits to nearby Cumberland Caverns illustrated the degree to which karstic processes could modify Earth’s veneer.

“Dryshave” is the local name for the closed karst basin where my father and his Clendenon relatives once lived. Dryshave is comprised of a stream-free, flat-bottomed plain surrounded by low mountains. Until about 1940, my Clendenon relatives farmed Dryshave’s bottomland, which possessed rich soils in an otherwise soil-poor environment.

My father remembers that on one of its flanking hillsides, Dryshave had a “blowing cave” that continually blew cool air in summer and sucked air in winter. On the flat bottomland during the first spring plowing, the clip-clop of mule hooves created reverberations in the rocky cavities beneath the crusted soil. Also on the bottomland, bowl-shaped depressions known as sinkholes sometimes would appear. These depressions typically were less than a half meter deep and two meters across, and were routinely obliterated when the farm fields were tilled.

Whereas the tillable, soil-plugged sinkholes in the farm fields did not drain significant amounts of water, a large, rocky sinkhole in the topographically lowest part of the bottom provided a rapid exit for floodwaters, thereby keeping the soils well drained. But when the sinkhole throat became plugged with tree limbs, leaves, and trash, overland runoff could not drain and the cropped area would flood. My grandfather Harlie or another of the Clendenon clan would remove the clutter to restore drainage.

Waters that drained through the Dryshave sinkhole were said to resurge as a small cave-spring located on the opposite side of the mountain near

the paved road. The cave contained cornstalks and other crop debris carried by waters that had washed into the sinkhole.

On a topographic map, Dryshave is depicted as a depression. Although I could find no written information on Dryshave's local hydrogeology, I assume that the Dryshave bottom is a collapse structure meeting the definition of a karst gulf, a term once used by Indiana University geomorphologist Clyde Malott (1887–1950). I suppose that Dryshave, like Wesley Chapel Gulf in southern Indiana, was created by the collapse of one or more broad, shallow, subterranean cavities. Any former surface streams had been diverted underground by the twentieth century, and probably much earlier. Europeans might call Dryshave a *polje* (“field”), which describes a sizable flat plain amidst karstic territory.

My home state of Indiana contains a wealth of karst features ranging from sinkholes to caves to disappearing and resurging streams. Like some notable karst features in Tennessee, certain karst features in Indiana are National Natural Landmarks designated by the U.S. Secretary of the Interior. In the 1980s I learned about these landmarks during my preparation of an educational karst exhibit derived from interviews with Indiana geologist Richard Powell, a well-known cave explorer and karst expert.

Twenty years after learning about Indiana karst, I was learning about submerged karst sinkholes in the bed of Lake Huron in Michigan's Thunder Bay National Marine Sanctuary. Three fresh groundwater vent communities have been identified at various depths.

If I could travel in a time machine to the ancient lands that are now Tennessee, Indiana, and Michigan, as well as many other karstlands in North America, I suppose I might hear dramatic tales about gods who live in caves and who travel through cavities beneath the land surface. Ancient myths set in karstic terrains on one continent are fundamentally similar to karst-related myths from other continents. My book focuses on karstic waters of ancient Greece, but my analogies stem from my knowledge of mid-American karst.

## **A WORD ABOUT HYDROMYTHOLOGY**

Although the study of karst structures is a geological endeavor, considerations of karst waters lie in the related realm of hydrology. Hydrology is the scientific study of the occurrence and behavior of water on and below the land surface and in the atmosphere. Hydrology encompasses the accumulation of precipitation-derived water in the form of surface

runoff, soil water, streams, lakes, wetlands, seas, and underground water systems. Karst hydrology deals with aspects of water in terrestrial and coastal environments dominated by karstified rocks.

For this book's title, I could have proposed the word "karstomythology" in the spirit of the late Dorothy Vitaliano's 1966 coinage of "geomythology." But realizing the redundancy regarding karstic structures, I decided to expand the definition of "hydromythology."

Some authors have used the word "hydromythology" to mean misconceptions and disinformation about hydrology, especially in the context of contentious water management issues. The word "hydromythology" as it relates to myth first appeared in a professional context in 1978. William Back of the U.S. Geological Survey presented a paper entitled "Archaeological Hydrogeology and Hydromythology in the New World" at an international earth sciences symposium in Montpellier, France. Paralleling the definition of geomythology as presented in Vitaliano's 1973 book, Back defines hydromythology as "a study of hydrologically inspired folklore, myths, or legends that can be used to deduce beliefs of early people concerning water." He views mythology as "the intuition of reason and the efforts of reason to define the unknown."

In 1981 Back published an expanded version of the paper in *Water Resources Research*, an interdisciplinary journal of the American Geophysical Union. In the article, Back examines Indian cultures of the Americas and uses water-related myths to better understand their worldviews. He describes the role of water in Indian myths of origin and creation; eschatology and destruction; culture heroes and saviors; rebirth and renewal; supreme beings and celestial gods; and transformations. He uses myths to theorize the water-related beliefs of indigenous tribes and examine how these beliefs influenced their management of water resources within climatic and hydrogeological constraints.

By his own description, Back presents information on the hydrologic aspects of ethnoscience, where the word "ethnic" in Back's usage refers to Native Americans. Ethnohydrology includes primitive peoples' observations and interpretations of phenomena, plus the application of knowledge to the practical problems of water use and water management.

Whereas William Back uses hydromyths to make inferences about human culture, I use myths to make inferences about natural water features. Modifying Back's conception, I define the word "hydromythology" to mean "the study of myths, legends, and folklore inspired by the natural

occurrence of water in the ecological environment, and the objective assessment of these nonscientific accounts from the perspective of hydrologic plausibility, including karst hydrology.” In other words, hydromythology is the study of the hydrologic origins of tales that historically explained natural water features in nonscientific terms.

Although hydrology includes the extreme events of drought and flood, my main interest is water under nonextreme conditions. My research does not include ancient water management, which is widely covered in books and journal articles. I prefer to focus on natural hydrologic features rather than engineered ones. My conception of hydromythology is limited to stories of natural waters and their divine stewards.

## **A WORD ABOUT ECODAIMONS**

In the world of ancient Greek water divinities, each river has its own god; each spring its own Naiad nymph; each cloudscape its own Nephele nymph; and each rainfall its own Oceanid nymph. The sea has an array of male and female divinities. Greek and Greco-Roman mythographs collectively contain thousands of literary references to water-related Nature spirits. The worldwide body of ancient texts about water divinities is enormous.

I coined the words “ecodaimon,” “ecodeity,” and “ecotheon” to help me distinguish earthly divinities from celestial and human-related ones. Ecodaimons include rain, cloud, and water daimons as well as tree daimons, flower daimons, Underworld daimons, and other spirits of the ecological environment. My terms with the prefix “eco-” have broader and more literal meanings than the unfamiliar adjective “chthonic,” which means “of the Earth” and typically refers to the subsurface, particularly the Underworld.

As explained in my book, an ecodaimon is responsible for a site-specific natural feature. Each locale has its own set of ecodaimons. A water-well in the city of Athens, for example, is ruled by the nymph Diogenia, a daughter of the nearby river god Cephissus. Diogenia does not live anywhere else in Greece because her allotted prerogative is a specific waterbody in a specific geographic locale—in this case, a freshwater spring in Athens.

In contrast to an ecodaimon with a localized prerogative, an ecodeity rules a categorical dominion not limited to a single place. Ecodeities are the overarching global gods of the atmosphere, lands, waters, seas, and earthly spaces underground and underwater. For example, Zeus rules the sky over Anatolia just as he rules the sky over mainland Greece, each of the

Greek islands, and every other landmass. Gaia is the goddess of all parts of the foundational Earth. Poseidon rules earthquakes, all the seabeds and physical seas, and the seas' water–land interfaces. Amphitrite rules all the marine fisheries and the seas' biological productivity. Hades rules the Underworld realm occupied by souls of the human dead. Oceanus and his sister Tethys are worldwide freshwater gods.

The minor local ecodaimons and major global ecodeities collectively comprise the ecotheon, which is the assemblage of spirits and gods who rule the ecological earthly environment. The Greek pantheon is comprised of the ecotheon aggregated with the many gods of the celestial sky, the human situation, and abstractions.

### **GREEK KARST AND HYDROMYTHS**

Much of Greek mythology is hydromythology. Many hydromyths are set in karstic terrains. In this book, I focus on karstic hydromyths and provide my own interpretations in the context of basic hydrology and hydrogeology. A few of my proffered interpretations include the following.

- When a deer hunter chased a deer into a karst lake in ancient Stymphalus, a sudden dislodging of the sinkhole debris plug caused the lake to drain so rapidly that the hunter and his prey were helplessly sucked down in the whirlpool.
- When ancient residents of Dion, a seaport city in coastal Pieria, observed that the surface river named Helicon had been rerouted underground via karstic dissolution, the residents derived a story to explain why the river sank at that particular location and then resurged a few kilometers away to flow into the Aegean Sea as the River Baphyra.
- When mythographers told stories of the Danaids, the territorial dispute between Poseidon and Hera, Poseidon's dewatering of Argos, and Poseidon's love of Amydone, they were providing figurative descriptions of the karst terrains of Arcadia and Argolis.
- When ancient Greek geographer Pausanias attested to long-distance, freshwater-bearing passages through seabeds, he was reasonably speculating based on his knowledge of terrestrial karst systems in coastal areas.

- When ancient mythographers described certain lakes as “bottomless,” they were referring to deep, water-filled karstic structures that defied human exploration and therefore were believed to have no definable lower boundary.
- When Archaic Greeks envisioned physical Tartarus (later used synonymously with “Hell”), they probably were inspired by deep karstic sinkholes which, when conceptually extrapolated, became the extremely deep subterranean Tartarean source from which all waters derive and to which all waters eventually drain.
- When Archaic Greeks described Tartarus (Hell) as the inescapable prison for enemies of the ruling gods, they demonstrated their familiarity with karstic features, whereas the Romans would later reconceptualize Hell as a volcanic place of fire and fumes.
- When Argive hero Amphiaraus fell into a chasm during the Seven Against Thebes battle, he fell into a major sinkhole collapse triggered by an earthquake.

Some of my other conjectures are not directly related to karst, but involve environments that include karst.

- When mythographers wrote about a fiery battle between Hephaestus and the River Scamander near the Troad’s Mount Ida, they probably were describing a volcanic event, possibly a magmatic one.
- When the hero Heracles killed the monstrous Hydra in karstic Lake Lerna, but later was killed by the poison extracted from her corpse, he succumbed to the ravages of a necrotizing skin infection.
- When Homer compared natural stains on coastal cave rocks to purple ribbons, he was envisioning the appearance of a warp-weighted loom outfitted with murex-dyed purple threads.
- When Ovid wrote about coral “turning to stone,” he was using a physical analogy to describe the biological decay of a living Mediterranean red coral that exposed the coral’s hard inner skeleton.

- When Ovid wrote that the cave of the River Achelous was “diapered with murex,” he was comparing Nature’s ornamentation of the rock-face with architectural diapering.

And finally, when the Argonauts were stranded in coastal Libya, I propose that they were situated not in Tunisia but in the southeastern Gulf of Sirt (Sidra) in Libyan Cyrenaica. I surmise that the now-extinct Lake Tritonis may have been located in or near the ancient equivalent of today’s Bight of Brega near the modern port of Marsa Brega. Perhaps Lake Tritonis approximately coincided with a sabkha feature predating today’s Sabkha Ghuzayyil, which in ancient times could have been a coastline depression rather than an inland one.

### ACKNOWLEDGEMENTS

Many thanks go to Fiona Raven ([www.fionaraven.com](http://www.fionaraven.com)), who designed the cover and interior pages, prepared the printer-ready manuscript, and shepherded the book through printing. Cartographer Craig Asquith ([www.craigasquith.co.uk](http://www.craigasquith.co.uk)) developed the seven maps. Laura Shelley ([www.shelleyindexing.com](http://www.shelleyindexing.com)) crafted the detailed index. Calligrapher and lettering artist Eliza Holliday ([www.letterist.com](http://www.letterist.com)) designed the publishing logo.

The front-cover photograph was taken by Nikos Mavris, an avid kayaker and webmaster of a kayaking site, [www.TEAMadara.com](http://www.TEAMadara.com). The bilingual website provides information on river segments in Greece that remain relatively wild and free-flowing. The website also hosts a page (Greek River Friends) which posts news about river conservation. In 2007 four hundred people signed a petition to protect forty of the best whitewater rivers in Greece from dams. Besides the ongoing construction of dams for hydroelectricity and irrigation, Greek rivers continue to be threatened by pollution, sedimentation, and pumpage for water supply.

The back-cover photograph was taken by Dave Bunnell, editor of *NSS News*, the monthly magazine of the U.S.-based National Speleological Society. Dave is a professional photographer specializing in images of caves and caving. He maintains an educational website that features his cave photography. The Virtual Cave site is at [www.goodearthgraphics.com/virtcave](http://www.goodearthgraphics.com/virtcave).

Many thanks go to my family for their love and support. Thanks to friends for their interest, advice, and assistance.

Special appreciation goes to University of Indianapolis English professor David Noble, whose teaching skills inspired me to pursue writing and editing. Guidance from University of Indianapolis professor emeritus William Gommel (Earth and Space Sciences) led to my first environmental job and a career in environmental science. Encouragement from professional Indiana geologist Judith Beaty gave me confidence to pursue new challenges.

Cindy Clendenon  
September 2008