

July 10, 2017

Dear Secretary Zinke,

We appreciate this opportunity to provide the perspective of the American Geosciences Institute (AGI) regarding the Department of the Interior's review of certain national monuments designated or expanded since January 1996 under the Antiquities Act. We have previously submitted comments that refer only to the Bears Ears National Monument in Utah. This submission provides additional comments regarding some of the other National Monuments and Marine National Monuments that are currently under review.

AGI is a nonprofit federation of 51 geoscientific and professional societies that represent more than 250,000 geologists, geophysicists, and other Earth scientists. Founded in 1948, AGI provides information services to geoscientists, serves as a voice for shared interests in our profession, plays a major role in strengthening geoscience education, and strives to increase public awareness of the vital role the geosciences play in society's use of resources, resilience to hazards, and the health of the environment.

The American Geosciences Institute strongly encourages you to preserve the Craters of the Moon, Grand Staircase-Escalante, Hanford Reach, Mariana's Trench, Mojave Trails, Organ Mountains-Desert Peaks, and Rio Grande del Norte National Monuments. We believe that the continued protection of these National Monuments will preserve their scientific, historic, and cultural legacy for the benefit of all Americans, and for the education and enjoyment of future generations to come. We specifically want to draw your attention to some of the significant geologic features at the following National Monuments.

Craters of the Moon National Monument (Idaho)

Craters of the Moon holds unusual scientific value because of the diversity of exquisitely-preserved volcanic features within a relatively small area, and contains the youngest and most geologically diverse section of basaltic lava terrain found on the Eastern Snake River Plain. Its central feature is the Great Rift, a remarkable volcanic landscape with an array of geologic features, such as exposed fissures, lava fields, lava tubes, craters and cinder cones. The landscape was formed by eruptions that started 15,000 years ago. The most recent activity occurred just 2,100 years ago, and eruptions are likely to continue in the future.

Craters of the Moon also has a 7-mile loop road and several trails that provide easy access to a range of stunning volcanic features, and offers countless opportunities for hiking, camping, cross-country skiing, wildlife viewing, and backcountry travel. The National Monument provides scientific, educational, and interpretive opportunities for the public to foster an understanding and appreciation of the volcanic geology and associated natural phenomena.

Grand Staircase-Escalante National Monument (Utah)

The Grand Staircase-Escalante National Monument includes a spectacular range of landforms and geological features, including fossils, canyons, folds, badlands, waterfalls, sedimentary structures, petrified wood, arches, springs, and dinosaur footprints. Fossil excavations in the Grand Staircase-Escalante region have yielded more information about dinosaurs and the Earth system during the dinosaur era than almost anywhere else in the world. Since its designation, 20 new species of dinosaurs have been discovered within the monument's boundaries. Without its protected status as a National Monument, the unique geological treasures of the Grand Staircase-Escalante area are highly vulnerable to disruption and destruction.

Hanford Reach National Monument (Washington)

The Hanford Reach National Monument contains the only remaining free-flowing section of the Columbia River in the state of Washington. The sediments comprising the White Bluffs, a major landmark in the National Monument, contain evidence of the last major geologic event to shape the region — a series of Ice-Age floods, the largest of which had ten times the flow rate of all the world's modern rivers combined, making them what may have been the largest floods to have ever occurred on Earth. These fast-moving floodwaters eroded the rocky land across eastern Washington and deposited massive mounds of sediment in areas of calmer water. These rocks preserve fossils of mammoths, rodents, lizards, frogs, turtles, fish, rabbits, ground sloths, mastodons, camels, horses, zebras, and other creatures that were left behind by the cataclysmic floods.

Hanford Reach also contains an extensive record of human occupation, with diverse cultural resources that tell the story of how people have utilized the landscape. The deep historic context is reflected through approximately 720 archaeological sites associated with tribal activity, and approximately 650 archaeological sites associated with the early American settlers, which have been recorded in the area. Archaeological remains of military sites associated with the Manhattan Project and Cold War landscape are also scattered throughout the National Monument.

Mariana's Trench Marine National Monument (Northern Mariana Islands)

The Mariana's Trench Marine National Monument protects more than 1,000 miles of the Mariana Trench, as well as approximately 95,200 square miles of submerged lands and waters around some of the northern Mariana Islands. The Challenger Deep, which lies just outside the monument area in the Mariana Trench, is the deepest known point in the ocean, with points lying some 36,000 feet below sea level.

We are only beginning to explore the wonders of the deep oceans and the role that these deep waters play in the balance of nature. The Mariana's Trench National Monument supports unusual life forms in some of the harshest conditions imaginable. Only in recent years have scientists visited the realm of the monument, observing previously unknown biological,

chemical, and geological wonders of nature, and the close interactions between submarine volcanic vents, highly acidic water at boiling temperatures, and very unusual life forms designed to withstand these physical conditions.

The Volcanic Unit of the National Monument contains three areas of active undersea mud volcanoes and thermal vents. The U.S. Fish & Wildlife Service reports that the Champagne vent, found at the NW Eifuku volcano, produces almost pure liquid carbon dioxide, one of only two known sites in the world. A pool of liquid sulfur at the Daikoku submarine volcano is unique on Earth—the only other known location of molten sulfur is on Io, a moon of the planet of Jupiter. The submerged caldera at Maug is one of only a few places where photosynthetic and chemosynthetic communities are known to coexist, enabling scientists an opportunity to look into the future and ensure continuation of coral reef communities.

These world-class features are so exciting and unique that they deserve full protection. Modern advances in technology and engineering are leading explorers and scientists to discover fantastic new species and habitats as they attempt to bridge this final frontier into the deep-sea environment. The preservation of Mariana’s Trench is crucial to understanding the intrinsic linkages between the deep sea and surface waters, and to the links between volcanic activity and life forms in extreme environments.

Mojave Trails National Monument (California)

The Mojave Trails region has been a focus of geological research for decades. This unique landscape hosts a stunning diversity of lava flows, mountains, sand dunes, and bajadas, and other geologic features. Its 550-million-year-old fossil beds contain brachiopods, mollusks, echinoderms, and algal bodies that are of great interest to paleontologists. The mountains of the Mojave Trails include several significant geologic formations. Seismologists have studied this area for insight into the Earth’s plate tectonics, faulting (fracturing in rock formation), and magmatism (volcanic activity). Volcanologists have also studied a number of young volcanoes and their associated lava flows in the area. Additionally, the monument protects irreplaceable historic resources, including ancient Native American trading routes, World War II-era training camps, and the longest remaining undeveloped stretch of the iconic U.S. highway known as Route 66.

Organ Mountains-Desert Peaks National Monument (New Mexico)

Organ Mountains-Desert Peaks hosts a wide range of fascinating and well-exposed geologic features. Kilbourne Hole, for instance, is an internationally-known example of a maar volcano. The volcano erupted about 45,000 years ago in a violent steam explosion when rising magma came in contact with groundwater, creating a shallow crater that extends over a mile in diameter. Perhaps the most unique aspect of Kilbourne Hole is that it contains fragments of Earth’s mantle that were expelled by the volcanic eruption. These rock and mineral fragments provide geologists with a rare opportunity to directly measure properties of Earth’s deep interior, and are materials of significant interest to amateur geologists and other visitors. Due to

its unique nature and resemblance to craters on the moon and Mars, Kilbourne Hole is one of few training grounds used by NASA astronauts, including those participating on some of the Apollo missions, and is intimately tied to the history of America's spaceflight program.

The long, diverse, and storied history of this landscape is not surprising given its striking geologic features and the ecological diversity that they harbor. In 1928, a nearly complete mummified shasta ground sloth – a pale yellowish animal roughly the size of a modern black bear – was discovered within a pit of the extinct shield volcano called Aden Crater. The discovery drew international attention, and subsequent studies of the ground sloth have helped geoscientists understand how the American southwest emerged from the last Ice Age.

The Organ Mountains, another fascinating geologic feature of the monument, contain the remnants of a 36-million-year-old fossil magma chamber that generated a supervolcano eruption. The Organ Mountains are one of the few places in the United States where rocks from both the erupted and nonerupted components of a caldera system are exposed together. The geology of the mountain range has helped volcanologists understand the processes that generate catastrophic caldera eruptions, such those that characterize the most recent geologic history at Yellowstone National Park. Most of the Organ Mountains are located on White Sands Missile Range, Fort Bliss, and private citizen property. The only access to the geology of this area is via the National Monument.

Rio Grande del Norte National Monument (New Mexico)

Rio Grande del Norte is one of the iconic landscapes of New Mexico. The Rio Grande, which is the fifth longest river in all of North America, carves a dramatic gorge through the heart of the monument. Few people live in this area due to the harsh volcanic terrain, yet it provides exceptional opportunities for geological research, solitude, and recreation. NASA astronauts since the Apollo program have repeatedly used this area for field exercises because of its striking geology and resemblance to geologic features on the moon. Although there are more than two dozen extinct volcanoes in the park, the northern part of the National Monument contains two spectacular examples of composite volcanoes: the andesitic Cerro de La Olla and the dacitic Ute Mountain. These volcanoes, plus a number of other volcanic features and nearly 140 geothermal water springs, result in the stunningly beautiful and geologically intriguing landscape which is adored by local visitors and tourists from around the world.

Other National Monuments with significant geological features:

In addition to the National Monuments mentioned above, we respectfully request that you take full account of the geological and other features in these National Monuments as you complete your study. The Basin and Range (Nevada), Gold Butte (Nevada), Grand Canyon-Parashant (Arizona), and Vermilion Cliffs (Arizona) National Monuments, for example, all have spectacular landscapes with culturally and scientifically important geological features.

On behalf of a quarter-million geoscientists, we ask you and the Department to strongly consider the benefits to be gained for the American public by maintaining the boundaries of these prized National Monuments in order to in order to preserve and protect their natural resources of immense scientific, historic, and cultural value. The rich geologic history present at the Craters of the Moon, Grand Staircase-Escalante, Hanford Reach, Mariana's Trench, Mojave Trails, Organ Mountains-Desert Peaks, and Rio Grande del Norte National Monuments, among many other important protected areas in the United States, captures the collective imagination and interest of millions of professional and amateur geoscientists, and serves as an inspiration to people of all ages.

Respectfully submitted,



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