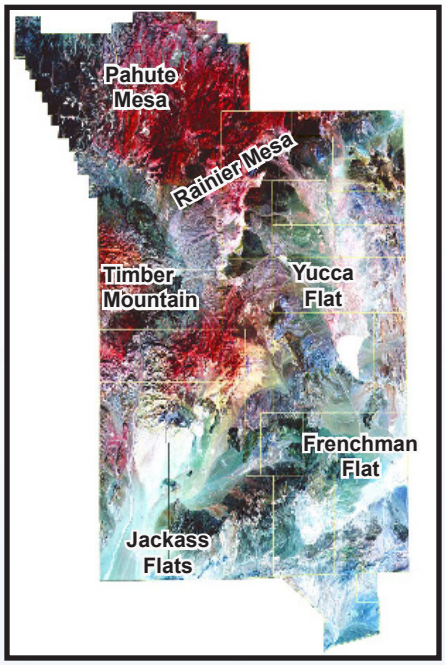
Nevada National Security Site

Nevada National Security Site Geology



Satellite image of the NNSS topography.

Introduction

Larger than the state of Rhode Island, the Nevada National Security Site (NNSS) occupies approximately 1,375-square miles (approximately 880,000 acres) in southern Nevada, making it one of the largest restricted-access areas in the United States. The NNSS is surrounded by approximately 6,500 square miles of federal land used for the U.S. Air Force Nevada Test and Training Range, and the Desert National Wildlife Refuge. Located approximately 65 miles northwest of Las Vegas, the NNSS is vast, remote, and inaccessible to the public.

The unique geology of the NNSS provides a safe and secure site for experimentation, testing, training, and demonstration for defense systems, and advanced high hazard operations.

Millions of years in the making

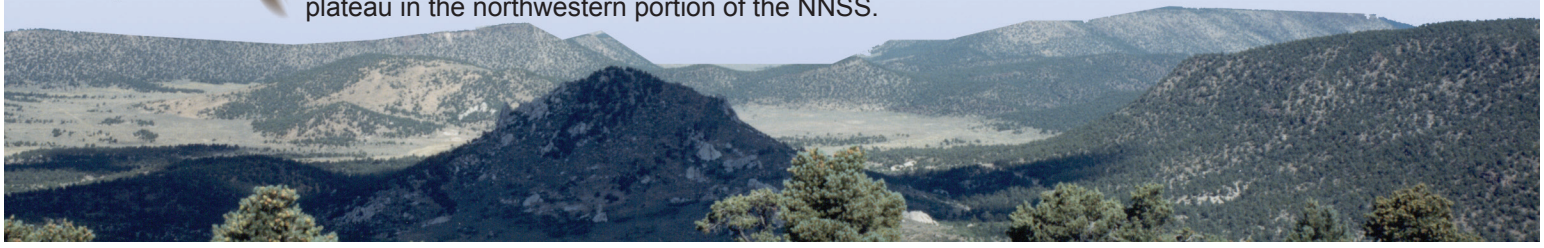
The NNSS terrain is varied. From mountain ranges to desert basins, the topography is a result of millions of years of tumultuous geological activity. The NNSS is located in the south central part of the Great Basin region, which is defined by terrain texture, internal stream drainage, geologic structure and history. The topography of this region is characterized by north northeast-facing mountain ranges separated by broad, linear valleys as found in the eastern portion of the NNSS. It is composed of a series of ridges, valleys, and mesas formed by volcanic activity.

Unique rock formations such as this one in the northwestern part of the NNSS were formed over millions of years.

The earliest major geologic units exposed on the NNSS are sediments deposited during the Paleozoic Era, approximately 500 million years ago. It was during this time that approximately 30,000 feet of sedimentary and carbonate rock was deposited in the NNSS region.

During the Mesozoic Era, approximately 100 million years ago, these rocks were folded and thrusted forming part of the moutainous terrain through the NNSS. It was during this era that the Control Point Thrust and the Mine Mountain Thrust appeared. These thrust faults were accompanied by intrusions of large quantities of molten rock rising through the crust, represented by the Climax, Twin Ridge, and Gold Meadows stocks on the NNSS.

A major period of volcanism began in the central portion of the Great Basin approximately 40 million years ago and spread outward over time. A complex of six vocanic calderas, five of which overlap, was active along the western portion of the NNSS between 16 and six million years ago. Ash flow that erupted from these depressions exceeds 15,000 feet in thickness beneath Pahute Mesa, a volcanic plateau in the northwestern portion of the NNSS.



Faults created between 17 and 14 million years ago in southern Nevada resulted in uplift and subsidence, resulting in the present-day system of mountain ranges and topographically closed basins at the NNSS. Alluvium (sedimentary material deposited by flowing water) and colluvium (material accumulated at the foot of a slope from gravitational forces) from the mountain ranges have filled the basins to depths in excess of several hundred feet.

Mountain ranges and desert basins make for a varied NNSS landscape.

Topography

As a result of these millions of years of geologic activity, the NNSS topography is an example of contrasts. Mountain ranges are separated by linear valleys and broad flat basins. The NNSS contains three principal valleys: Frenchman Flat, Yucca Flat, and Jackass Flats; and four principal highlands: Pahute Mesa, Rainier Mesa, Timber Mountain, and Shoshone Mountain. Elevations at the NNSS range from 3,000 to 4,000 feet in the south and east valleys; and from 5,500 to 7,300 feet toward the northern and western boundaries.

Surface drainages for Yucca and Frenchman Flats, located on the east side of the NNSS, are closed-basin systems that drain onto the dry lake beds, or playas, in each valley. The remaining area on the western side of the NNSS drains through water carved channels and dry stream beds that carry water only during intense or persistent precipitation. There are no continuously flowing streams on the NNSS.

Hydrogeology

Depths to groundwater under the NNSS vary from approximately 450 feet in the southern part of the NNSS to more than 2,300 feet in the north. In the east, the water table is generally found in the alluvium and volcanic rocks above an underground layer of rock on sand that contains water, which is called an aquifer. The aquifer is characterized by regional flow from a recharge area in the north and east, towards discharge areas at Ash Meadows and Death Valley. In the western portion of the NNSS, the water table occurs predominantly in volcanic rock and moves in a southerly direction toward Oasis Valley, Crater Flat, and/or western Jackass Flats.

Conclusion

The geology of the NNSS is complex and varied. Yet, the remote location, geology, and deep water table of the NNSS provided a favorable setting for conducting and supporting experimentation vital to national security. Its arid climate and closed hydrographic basins are factors in stabilizing residual surface contamination from atmospheric testing, and are considered positive environmental attributes for existing radioactive waste management sites.

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