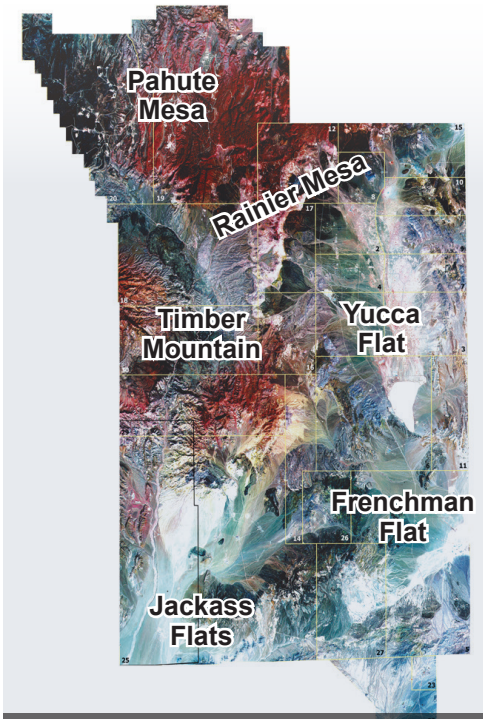
NEVADA NATIONAL NNSS SECURITY SITE

Nevada National Security Site Geology



Satellite image of the NNSS topography.

Introduction

The Nevada National Security Site (NNSS) occupies approximately 1,355 square miles (approximately 867,000 acres) in southern Nevada, making it one of the largest restricted-access areas in the U.S. 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 diverse geologic terrain of the NNSS contributes significantly to the safety and security of the NNSS as a site for experimentation, testing, training and demonstration for defense systems and advanced high-hazard operations.

A Varied Landscape

The topography of the NNSS is an example of contrasts. Pinyon- and juniper-covered mountain ranges are separated by linear valleys and broad flat basins dominated by creosote bush and sage. The NNSS contains three principal valleys in its eastern and southern portions: Frenchman Flat, Yucca Flat and Jackass Flats; and four principal highlands in the western and northern portions: 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.

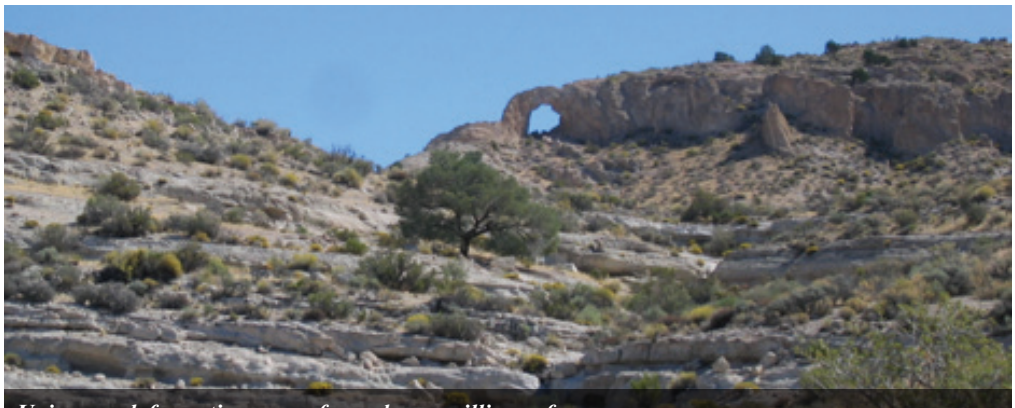
Surface drainages for Yucca and Frenchman Flats, located in the eastern portion of the NNSS, are closed-basin systems that drain onto dry lake beds in each valley. The remaining portions of the NNSS drain generally to the southwest and north through water-carved channels and dry stream beds that carry water only during intense or persistent precipitation. There are no continuously flowing streams at the NNSS.

Millions of Years in the Making

The topography at the NNSS is the result of millions of years of dynamic geological activity. The oldest rocks exposed at the NNSS consist of marine origin, which deposited between approximately 600 and 300 million years ago. During this time, more than 30,000 feet of limestone, dolomite, shale, siltstone and sandstone deposited in the NNSS region.

Between 100 and 250 million years ago, these rocks were intensely deformed by compressional tectonic forces resulting in severe folding and faulting. At the NNSS, this deformation was generally directed eastward and was so extreme that some beds were overturned to an upside-down position. In some areas, older rocks were thrust up and over younger rocks along low-angle faults spanning miles in length.

One hundred million years ago, after the compressional deformation, molten rock rose up thousands of feet through the sedimentary rocks, forming deep-seated, steep-sided intrusive domes. The molten material cooled and solidified as granite, which is now exposed at two main sites in the northern portion of the NNSS.



Unique rock formations were formed over millions of years.

Mountain ranges and desert basins allow for a variety of landscape at the NNSS.

For the next 80 million years, the NNSS region was likely a mountainous plateau exposed to extensive erosion because almost no rocks of this time period are currently present at the NNSS. This changed dramatically approximately 15 million years ago when intense explosive volcanism began along the western margins of the NNSS. For the next 6 million years, multiple volcanic eruptions, many categorized as super eruptions with more than 240 cubic miles of erupted material, blanketed the NNSS with thick deposits of volcanic ash and lava. The four principal highlands of the NNSS are erosional remnants of these violent eruptions. Beneath Pahute Mesa, more than 13,000 feet of volcanic material accumulated in a volcanic collapse crater.

Ten million years ago, during the waning stages of explosive volcanism, the eastern and southern portions of the NNSS began extending in a general east-west direction. This tectonic stretching created numerous north- to northeast-trending high-angle faults. Displacement along the larger of these faults resulted in the formation of down-dropped structural basins that now form the principal valleys along the eastern and southern portions of the NNSS. As the basins subsided, thick accumulations of eroded volcanic and sedimentary rock debris from the surrounding highlands were shed into the basins. This alluvial debris is now more than 3,000 feet thick in some portions of the basins. Basin subsidence and alluvial disposition are still active at the NNSS today.

Hydrogeology

Groundwater under the NNSS varies from approximately 450 feet in the southern part of the NNSS to over 2,300 feet in the north. The complex geology of the NNSS results in complex hydrogeological conditions. Permeable rock layers that permit groundwater flow are complexly interlayered with more impermeable layers that act as barriers to groundwater flow. Extensive faulting across the NNSS has offset these layers hundreds of feet, further complicating groundwater flow paths. Groundwater beneath the NNSS generally flows south and southwest towards discharge areas at Oasis Valley, Ash Meadows and Death Valley.

Conclusion

The geology of the NNSS is complex and varied, the result of hundreds of millions of years of geologic processes that created diverse terrains and produced a variety of rocks with a wide range of mineralogy and physical properties. This topographic and geologic diversity provides a variety of favorable settings for conducting diverse experiments vital to national security. Its arid climate, deep water table and closed hydrographic basins are important factors in stabilizing residual surface contamination from atmospheric testing and considered positive environmental attributes for existing radioactive waste management sites.

National Nuclear Security Administration

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