The Kneeling Nun, Santa Rita, New Mexico

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She kneels peacefully overlooking rolling hills and meadows partially covered with juniper and piñon pine forest surrounding a modern open-pit copper mine. But things have not always been so placid here for violence of nature was her creator and may well signal her demise. She has also been witness to violence of another kind—that of human conflict. If she could only talk, we could learn much of what has transpired beneath her regal gaze for uncounted millennia; but alas, she is only stone, and everyone knows that stones do not talk—or do they?

"She," of course, is the rock monolith at Santa Rita in southwest New Mexico, one of the most famous natural landmarks in the American Southwest, that today we call the Kneeling Nun (Fig. 1). Known by at least three different names, she has suffered something of an identity crisis (Fig. 2). How old is the "nun?"; how was it created?; has it always appeared as it does now?; will it remain the same in the future? Answers to these questions follow.

Birth of the "nun"

The Kneeling Nun is composed entirely of a single volcanic unit. The ash-flow tuff or ignimbrite was formed about 34 m.y. ago during a cataclysmic pryoclastic eruption centered in the southern Black Range, northeast of Santa Rita. Several hundred cubic miles of magma were frothed from the top of a large pluton by exolution of dissolved gases, broken to small ash and pumice as gas expansion exceeded magma ductibility, and carried upward into a gigantic eruption column perhaps similar to that observed during the eruption of Mount St. Helens. Continued eruption overloaded the column and the hot incandescent material cascaded down to form hot ground-hugging, gravity-controlled gas-and-particle slurries, which carried the material away from the eruption site. These slurries were partly fluidized by the gas and fine material, and therefore they became very mobile and travelled long distances (tens of miles) at high velocities (tens of miles per hour). At that time they were a far cry from the friendly rocks we observe today in the Santa Rita area.

Approximately 400 ft of Kneeling Nun Tuff were deposited in the Santa Rita area (Elston et al., 1975; Giles, 1967, 1968), approximately 9 mi from the nearest part of the Emory cauldron vent source. The material was deposited originally as loose ash, but intense heat and weight of overlying material quickly welded the mass together to form dense rock throughout most of its thickness. Shrinkage fractures propagated from top and bottom of the sheet-like deposit as the welded mass cooled, resulting in the nearly vertical joint-bound columns that we see today. Thus, both the "nun" and the lesser known "altar" are large composite columns that were formed in this manner; groups of columns and numerous other joint-bound blocks are clearly visible in the cliffs (Fig. 3). Weathering processes have altered the appearance of the lower column to the present figure-like profile that has exerted a mystical affect upon man through the ages.

A long history of folklore

Legends abound that date from about the late 18th century regarding the monolith. The Kneeling Nun is uncannily reminiscent of a clad, kneeling figure even from close range. The Apache Indians surely had legends of their own about the figure although none are known to these authors. Early Spanish explorers are said to have noted "the reluctance of the . . . Apaches to camp in the vicinity (of the Kneeling Nun) despite the excellent vantage point into the valley below" (Anon., 1968). True or not, it seems reasonable to assume that the superstitious Apaches were well aware of the imposing human-like monolith and avoided it accordingly.

Spanish legends about the Kneeling Nun are steeped in religion and invariably refer to a "young nun" (Sister Teresa, Sister Rita, or Raquel Mendoza de Alarcorn, depending on the source) stationed at a local Indian mission who falls in love with a handsome Spanish soldier. She is ultimately outcast for her "sins," and, stricken with grief, she climbs the mountain on a stormy day to pray. At sunrise the following day the local people are stunned to observe her pious, kneeling figure eternally cast into stone.

The Sierra del Cobre

The Kneeling Nun has watched silently over another spectacular attraction at Santa Rita—the copper deposit, known to the Spanish as the Sierra del Cobre and today as the Chino mine. The Apaches apparently had been working the deposits of easily mined native copper for some generations when the location was reportedly disclosed to Spanish officer Colonel Jose Manuel Carrasco by an Apache Chief with whom Carrasco had become friendly (Fig. 4; Anon., 1884, p. 4; Rickard, 1923, p. 754). It is unlikely that the Indian foresaw the consequences of his action. Carrasco, who is said to have had first-hand knowledge of other great copper deposits such as the one at Rio Tinto, Spain, immediately recognized the great potential of the Sierra del Cobre (Sully, 1916, p. 135) and proceeded to legitimize his claim under the Spanish legal system. Carrasco soon convinced his friend, a wealthy Chihuahua merchant called Don Francisco Manuel Elguea, to obtain a concession from the Spanish government to the deposit. The result was the Santa Rita del Cobre grant, the first document bequeathing title, and with it Elguea was soon mining the deposit on a relatively large scale and supplying his government with metal for coinage. By 1804 he is said to have extracted 1,000 mule loads of 14 arrobas each (1 arroba = 25 lbs) of "extraordinarily rich ore" (Garcia, 1965, p. 5). Today the Chino mine is one of the world's great copper producers with a total production since Spanish occupation that exceeds 7 billion lbs (NMBMMR file data).

A look into the future

The Kneeling Nun has changed in appearance during geologic and recent time. Earthquakes are doubtless the major geologic hazard that have affected the "nun," but simple weathering has also taken its toll. Although the Kneeling Nun has remained virtually unchanged during the 20th century (a fact that is highly significant given the daily blasting activity at the Chino mine), a notable event did occur in 1885. According to the Silver City Enterprise (June 26, 1885) ". . . about thirty feet of the Kneeling Nun at Santa Rita has tumbled down. For years past this has been a prominent landmark in southern New Mexico. A small portion of the needle still remains but cannot be seen at so great a distance as of old." Unfortunately, no pre-1885 photos or sketches are known to be extant so then-and-now comparisons are not possible. Two years later on May 3, 1887, the Santa Rita area was severely shaken, along with the rest of southwestern New Mexico and southeastern Arizona, by the Sonoran earthquake. The epicenter of the earthquake was about 170 mi southwest of the Kneeling Nun and its magnitude was estimated at 7.2

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FIGURE 4—Artist's impression of an Apache Indian Chief disclosing the location of the Sierra del Cobre, within view of the Kneeling Nun, to Spanish Officer Col. Jose Manuel Carrasco in about 1800. In fact, the Chief may have only described the location. In any case, Carrasco's knowledge of the deposit initiated development of one of the world's truly great copper mines. Courtesy of Ward Ballmer, Kennecott Minerals Co., Chino Mines Division.

FIGURE 1—One of the most famous natural landmarks in the American Southwest, the Kneeling Nun has stimulated the imaginations and superstitions of people for generations, and it is likely to do so for many more. Sketch by E. O. Nielson, courtesy of Rio Grande Historical Collections, Boise papers, New Mexico State University, Las Cruces.

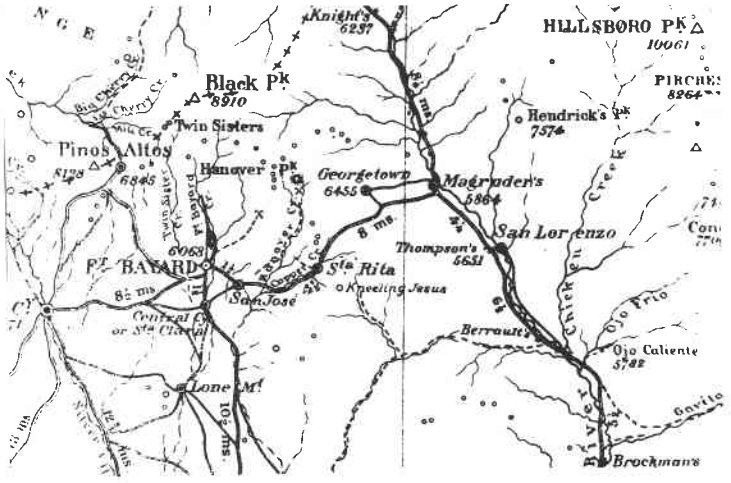

FIGURE 2—In addition to the currently accepted name, the landmark has also been called the Kneeling Virgin and Kneeling Jesus (see name on map above). The cliff itself was named Ben Moore or Old Ben Moore by Brevet Major W. H. Emory "after my personal friend, the gallant Captain Moore, of the 1st. dragoons" (Emory, 1848, p. 97). Map is from *Outline map of part of southwestern New Mexico*, by Lt. George M. Wheeler, Survey west of the 100th meridian, advanced copy subject to revision; courtesy of William T. Worthington.

FIGURE 3—Megacolumns of vertically jointed Kneeling Nun Tuff form the "nun," the "altar," and cliffs at Santa Rita, New Mexico. Seismic activity and weathering have produced the immense boulder field surrounding the monolith. NMBMMR photo by R. W. Eveleth, 1984.

on the modified Mercalli scale (DuBois and Smith, 1980, p. 7). Moreover, L. C. Graton, who was at Santa Rita in 1914 studying secondary enrichment, reported "there is a tradition of an earthquake which resulted in [obliterating] a rich mine over to the north or northeast of the present (open-pit) working" (Graton, 1914, p. 2). Earthquake damage to underground mine workings is usually slight; the greatest damage is done at the surface. Thus, it is implied that the quake was an intense one. Graton's quake may or may not have been the Sonoran quake, but, in either case, it is significant that no damage to the Kneeling Nun was noted.

There is no doubt, however, that many previous events have modified both the Kneeling Nun and the cliffs behind as evidenced by the extensive boulder field that surrounds and extends far downslope from both the "nun" and the "altar." Most cliffs in fact degrade into rubble without forming pinnacles. So what is special here? First, the Kneeling Nun Tuff was pervasively broken into vertical columns by cooling. Megacolumns formed first and these were further jointed internally as cooling progressed. Both the "nun" and the "altar" (Fig. 5) are probably megacolumns that have either been erosionally isolated or separated from the cliff and moved downslope. The central question in either case is: why do they stand? The authors suggest that it is because the columns are rooted in the surrounding talus much like fence posts, and they further speculate that the "nun" is now moving slowly downslope with the surrounding talus. Note that the joint surfaces in the "nun" tilt at an angle compared to those in the in-place cliff (Fig. 3).

Perhaps the "altar," now slightly separated from the cliff, may continue to move downslope and eventually provide a new figure as the "nun" erodes through the ages (Fig. 6). The talus, of course, is fairly stable in the southwestern climate, and movement is very slow so, if the above speculations are correct, many generations will pass before anyone witnesses the birth of a new "nun." Quite a tale for rocks that cannot talk!

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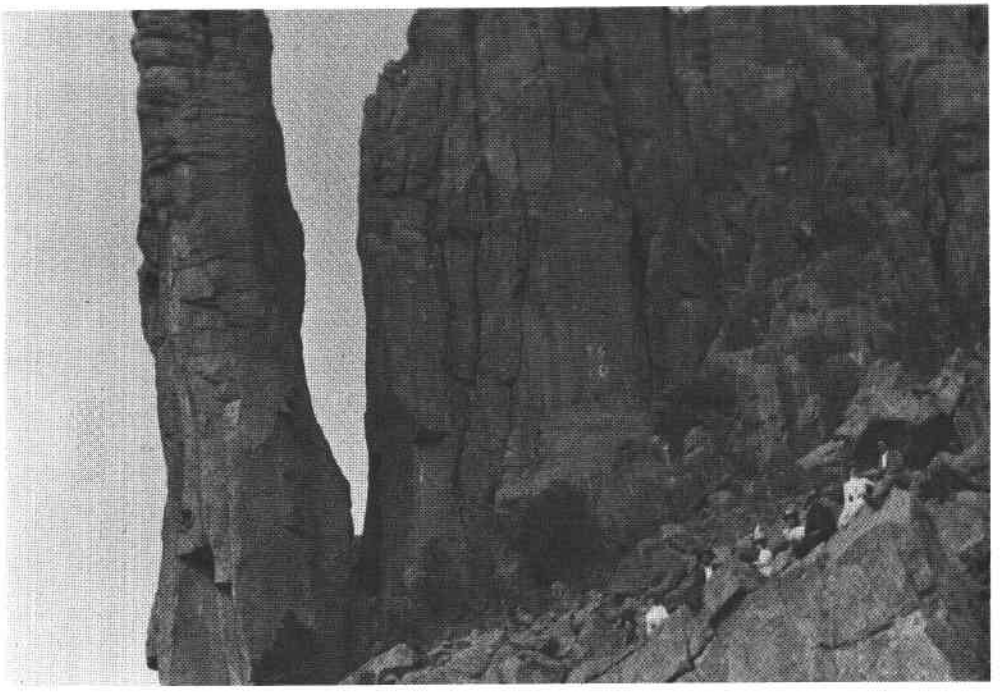

FIGURE 5—A nattily dressed group of hiker/picknickers poses near the "altar," about 1910. The gap between the altar and the cliffs is clearly exposed in this view. Photo courtesy of Silver City Museum, Harlan Collection.

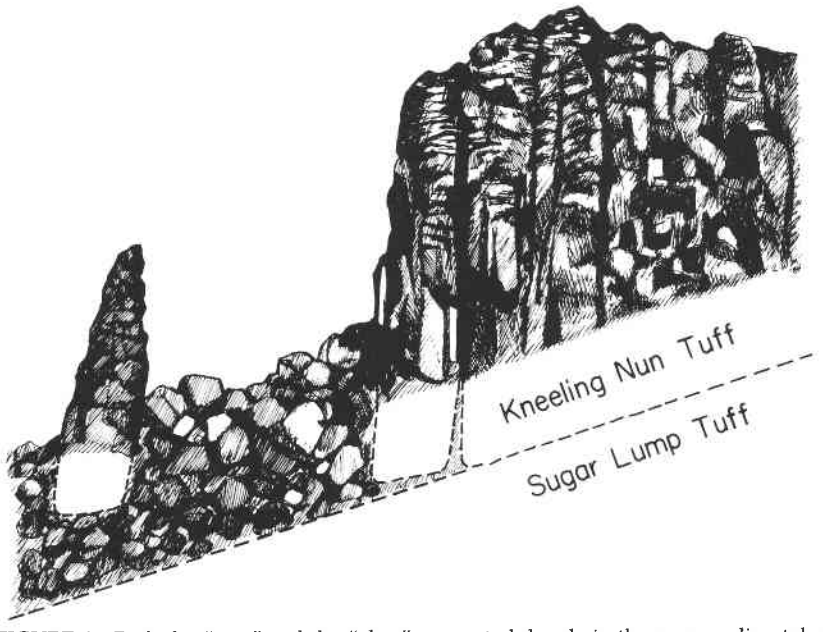

FIGURE 6—Both the "nun" and the "altar" are rooted deeply in the surrounding talus much like fence posts. The "nun" and perhaps the "altar" are moving slowly downslope along with the surrounding talus. Sketch by Linda Wells-McCowan.

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