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REVISED MINIMUM AGE OF CERRO COLORADO CRATER,
PINACATES VOLCANIC FIELD,
NORTHWESTERN SONORA

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INTRODUCTION

The Pinacates volcanic field is a major geologic feature of northwesternmost Sonora (Figure 1). A small portion of this field extends across the international border into southwestern Arizona. This area comprises one of the most inhospitable portions of the Sonoran Desert, and only a few scientific explorations have ever been conducted in the area. Major reconnaissance expeditions were conducted into the area at the beginning of this century by a group from the Carnegie Institution Desert Laboratory (MacDougal, 1908, Hornaday, 1908) and by Lumholtz (1912). A good summary of the work presented prior to the last decade is included in Ives (1964).

This region is of great importance in light of the recently developing ideas which have revolutionized geologic thinking. The notion that western North America has somehow overridden the East Pacific Rise, and the concept that the San Andreas Fault System is a major transform fault connecting two or more axes of sea-floor spreading, carry far-reaching implications for the solution of geologic problems in Sonora, Arizona, and elsewhere in the Southwest. The Pinacates comprise the largest volcanic field in the southern Basin and Range Province, and they are clearly one of the youngest features of this type anywhere in western North America. These factors, combined with the many unique qualities of the maars in the area, warrant extensive further studies in the Pinacates region. Although the volcanism may have begun in this area during latest Tertiary time, most of the surface features in the area are almost certainly Quaternary in age.

The Pinacates volcanic field has the general form of a large shield volcano, on which are superimposed numerous cinder cones, lava flows and other features generally associated with basaltic volcanism. The most noteworthy geological features of the area are the many large low-rimmed craters, several of which are more than one kilometer in diameter. These craters are very different from more common volcanic features familiar to most geologists. Although Jahns (1959), Ives (1964) and others consider these craters to be calderas, Galbraith (1959) cites an unpublished interpretation by Shoemaker that these craters are the surface expressions of diatremes (Shoemaker, 1953). The Schwabian tuff pipes (Cloos, 1941) are cited as analogous structures, and an eruption observed by Mueller (1956) is thought to represent the kind of event which produced these structures. Contemporary usage applies the name "maar" to such craters.

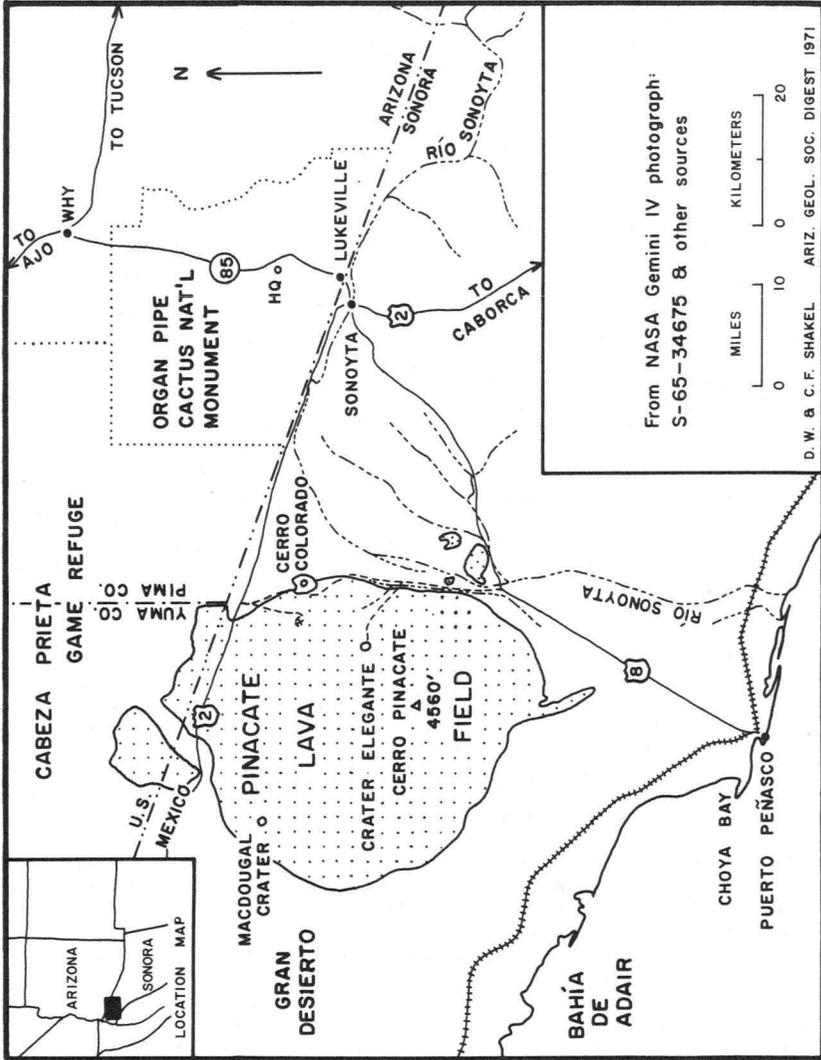


Figure 1.--A Generalized Map of the Pinacates Region.

Cerro Colorado is the most accessible of these craters in the Pinacates region. It lies just beyond the northeast margin of the volcanic field and is some eight kilometers south of Mexico Highway 2. In 1959, R. H. Jahns presented a detailed geologic map of Cerro Colorado and it is reproduced here as Figure 2. Although Jahns used the term "caldera" for these craters, he does state that Shoemaker's diatrema model seems appropriate for the crater at Cerro Colorado (Jahns, 1959, p. 182). More recently he has written that it now seems appropriate to characterize Cerro Colorado as a maar feature rather than a caldera (Jahns, 1971, personal communication).

The first recorded visits by non-native peoples to this region were by Father Eusebio Kino, the famous Jesuit missionary who was so much a part of the history of the Sonoran Desert region. It is known that Father Kino visited the Pinacates region on several occasions early in the eighteenth century and geologists are fond of noting that he readily attributed the various features of this region to volcanism at a time when trained "geologists" in Europe still believed that basalts were rocks of sedimentary origin (Ives, 1942).

Compared with the other craters in the region, Cerro Colorado is very distinctive because of the large, rounded mound of reddish-orange tuffaceous materials that is built up along the southern edge of the crater. This hill rises about a hundred meters above the surrounding plain and it is this "red hill" which gave the crater its Spanish name. Under conditions of moderately good visibility this hill is a readily visible landmark which can be seen from many miles around. On clear days it is especially noticeable from the rim of Crater Elegante, some eleven kilometers southwest of Cerro Colorado.

It seems well-established that Father Kino and his associates visited several features of the Pinacates region, reportedly including Crater Elegante (Bolton, 1919, vol. I, p. 187, see footnote). He climbed several of the higher peaks of the region and knew the highest portions of the Pinacates as the "Sierra de Santa Clara." There is, however, no positive evidence that he saw Cerro Colorado during these sojourns. During the present century some authors have taken this to suggest that Cerro Colorado was formed subsequent to Kino's presence in the region and is a feature of very recent origin (Ives, 1956; 1964).

During late 1969, a party of graduate students from the Geology Department at the University of Arizona visited several parts of the pinacates region and camped near the northwestern rim of the crater at Cerro Colorado. Several types of materials indicative of aboriginal habitation were discovered while encamped there. These included numerous potsherds, several fragments of bone and mollusk shells, and a single projectile point. More than a hundred potsherds were collected from the surface--most of these potsherds were collected by Mr. Roger Weller.

Many of these potsherds were examined by the second author of this report. They are mostly non-distinctive fragments of undecorated brown ware, of paddle and anvil manufacture. These are probably of Yuman origin, and represent both Tumco Buff and Topoc Buff types. The only time-diagnostic sherds collected were three adjoining fragments of a buff pottery with a red line decoration. These were identified as probably Sacaton Red-on-Buff, a product of the Hohokam culture which dates from about 900 A.D. to about 1100 A.D. (Gladwin, et al., 1938).

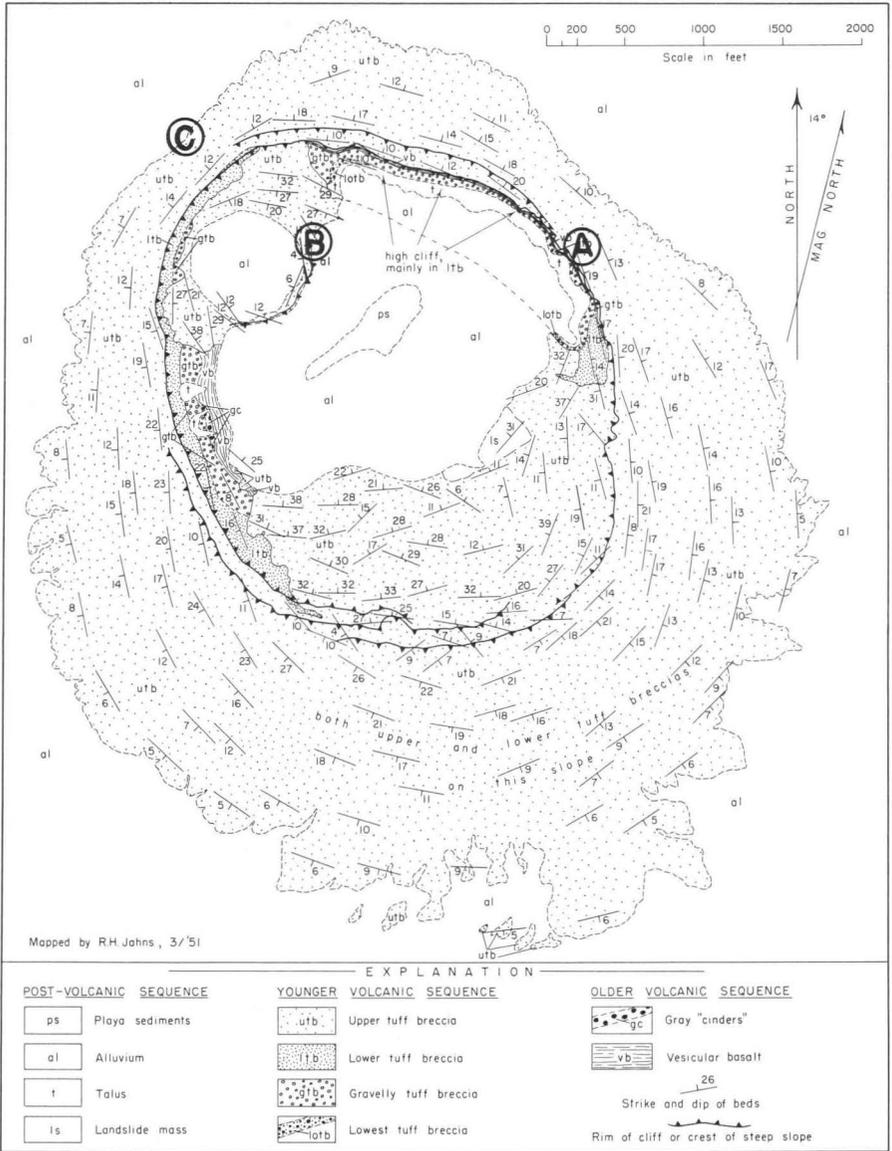


Figure 2.--Geologic Map of Cerro Colorado Crater, Showing Potsherd Locations Described in Text. Map by R. H. Jahns (1959), Reproduced with Permission.

In several papers by Ives (1935a; 1956; 1964) there are references to certain beds of volcanic ash and some potsherds contained within these deposits. Ives (1956, p. 221) states that ash beds "under the wash from Cerro Colorado crater...are identical in appearance, composition, and stratigraphic position with those 15 miles away at the foot of the main Pinacate Peaks." He goes on to report that potsherds have been found in this ash at Tinaja de Emilia and at Papago Tanks, located respectively some 20 and 25 kilometers southwest and west of Cerro Colorado. Ives states that these sherds are virtually indistinguishable from modern Papago pottery and, alluding to tree-ring and radiocarbon dates from other areas (no references given), concludes that these sherds are not more than 1000 years old. Materials from the vicinity of Sonoyta (some 50 kilometers east) are mentioned in a later report by Ives (1964, p. 40) as corroborative evidence for the maximum age of this ash.

Ives (1956, p. 221) states that "Cerro Colorado crater is not older than the major ash deposits, which are, in turn, younger than any major lava flow at Pinacate." In other words, this ash is either associated with the formation of Cerro Colorado or the potsherd-containing ash was deposited prior to the formation of Cerro Colorado. This potsherd evidence, combined with a Papago legend that seems to describe a great volcanic eruption "not long before" the time of Father Kino, induces Ives to set circa 1000 A.D. as the earliest age of formation for Cerro Colorado. Ives also notes that the deposition of an ash such as he describes must have occurred prior to the establishment of permanent Hispanic settlements in the area. Otherwise, such an event would surely have been recorded in the early historical records of the area. He concludes that the latest this ash could have been deposited is about 1650 A.D. Ives sets 1800 A.D. as the latest time the crater could have been formed, based on the earliest known reports of its existence (Ives, 1956, p. 223).

The potsherds reported in this paper appear to establish circa 1100 A.D. as a minimum age for the formation of Cerro Colorado, Ives' ash beds notwithstanding. In addition, the placement of these sherds suggests that the rocks presently exposed at the crater were essentially the same outcrops that were exposed when prehistoric peoples occupied this area.

Sherds were found along the rim of the crater, and within the crater as well. One of the fragments picked up along the rim at location A lay directly on an erosion surface which has truncated beds of "upper tuff breccia" dipping northeastward at about 15°. Some fifteen sherds, apparently all from the same pot, were found near the lower end of a gully that leads down into the interior of the crater (location B). At this location the gully is cut into beds of "upper tuff breccia" which dip at a moderate angle toward the center of the smaller sub-crater, shown on Jahn's map in the northwest portion of the main crater.

The greatest number of potsherds were collected over an area of several hundred square meters, at location C indicated in Figure 2. This location is about one hundred meters down-slope from the northwest rim of the crater. Some of these sherds were found lying directly on the unit Jahns (1959) calls "upper tuff breccia," but most lay on the clayey materials which Jahns' map shows as "alluvium" (see Figure 2).

Most of the brown-ware sherds are not diagnostic with regard to time: according to Schroeder (1958), Tumco Buff dates from "pre-900 A.D. to post-1400 A.D. (?)" and Topoc Buff dates "post-1150 to (?)." But the Sacaton Red-on-Buff fragments are thought to date from a 200-year period near the beginning of the present millenium and are critical in placing a minimum age on the crater. These sherds were found at location C, that is, on alluvial materials that presumably are among the youngest materials in the area. Thus these sherds are certainly younger than any of the lithologic units involved in the formation of Cerro Colorado. It also seems likely that much erosion has occurred at Cerro Colorado prior to the presence of the people who left these artifacts. Extrapolations based on the apparent lack of major physiographic changes since that time suggest that the age of the crater may be measured as tens of thousands of years, instead of less than a thousand years old as previously believed.

Much rumor, legend and cursory observation of facts has been incorporated into the literature concerning this region. For example, volcanism was reported to have occurred in the area during the 1930's (Ives, 1935b; 1942), but so far there has been no positive identification of any site associated with this "event." Some of the uncertainty regarding the more recent volcanism in the area could be ended if geologists and anthropologists who enter the area would be more attentive to the specific occurrences and specific locations of archaeological materials with respect to the various volcanic formations present in the area.

The authors are indebted to Mr. Robin Holcomb and Mr. William Butler for assistance in locating several of the bibliographic materials for this report. It was Mr. Butler who called our attention to the painted sherds which later proved to be time-diagnostic. The field party comprised Mr. Thomas Earl, Mr. William Butler, Mr. Roger Weller, and Mrs. D. W. Shakel, in addition to the first author of this report. All of the aforementioned persons made constructive criticisms of this report.

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