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PREVIEW

**STRATIGRAPHY AND STRUCTURE
OF THE
QUATERNARY MALPAIS MAAR VOLCANO,
DONA ANA COUNTY,
NEW MEXICO**

**by
RICHARD OWENS PAGE**

THESIS

**Presented to the Faculty of the Graduate School of
The University of Texas at El Paso
in Partial Fulfillment
of the Requirements
for the degree of
Master of Science
in Geology**

UNIVERSITY OF TEXAS AT EL PASO

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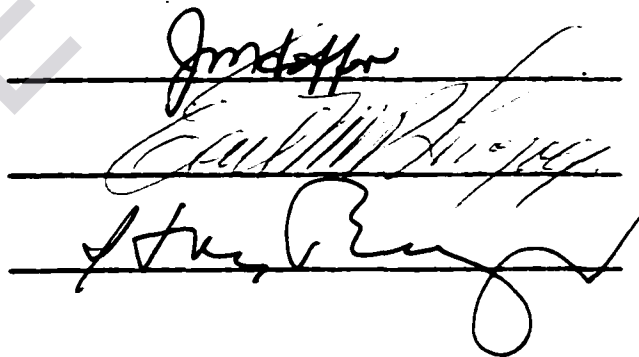
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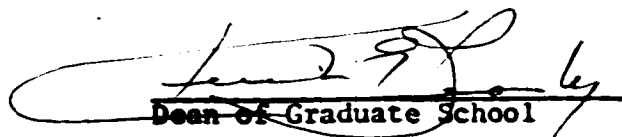
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APPROVED:


Three handwritten signatures are written on three horizontal lines. The first signature is 'J. M. D. H.', the second is 'C. M. H.', and the third is 'H. B. H.'.


A handwritten signature is written on a horizontal line. Below the line, the text 'Dean of Graduate School' is printed.

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ABSTRACT

Malpais maar volcano is a Quaternary tuff ring, formed by the phreatomagmatic eruption of basaltic magma in the Potrillo Volcanic Field, south-central New Mexico. The maar vent is essentially a conical (?) crater, quarried in underlying formations by steam explosions. The crater is 4100 feet (1250 m.) in diameter, approximately 1400 feet (430 m.) in depth, and is outlined by a low rim of bedded ejecta.

Bedded tuffs, including ash (tuff), lapilli tuff, and tuff-breccia, surround the crater. The tuffs were deposited by base-surge to vertical eruption clouds. Sedimentary structures in the tuffs include dunes, ripples, current cross-bedding, plane parallel laminae, and plastically deformed beds under bombs and blocks. Two horizons in the underlying strata (Pleistocene sands and Tertiary sediments), probably both contained water which entered the vent. This appears to be indicated by the composition of accidental ejecta in the tuffs.

Arcuate, major joints in the tuffs are oriented tangential and perpendicular to the maar rim in outer flank beds, and parallel and perpendicular to slope direction on the sides of cones adjacent to the maar. They appear to reflect the topography of the surface on which the tuffs were deposited. Minor joints in the tuffs appear to be shrinkage phenomena due to desiccation.

During the course of eruption of Malpais maar, water was excluded from the vent, and the maar crater was nearly filled with a cinder cone and flow complex. Dikes intruding the maar rim represent the closing volcanic activity. Flows and dikes in the study area are alkaline olivine basalt (Potrillo Basalt).

Reconnaissance of four other maar volcanoes in the Potrillo Volcanic Field, plus research at Malpais maar, indicates that differences in vent form and tuff stratigraphy, between these maare, may be the result of differences in the underlying strata.

PREVIEW

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INTRODUCTION

Location and Extent of Study Area

The area of investigation is in the West Potrillo Mountains of south-central New Mexico. It centers on Malpais maar volcano, southwestern Dona Ana County, New Mexico (Fig. 1), approximately 1.5 miles (2.5 km.) north of the international border, and 45 miles (72 km.) west of El Paso, Texas. The maar volcano was named for a nearby station on the abandoned Southern Pacific Railroad grade.

The study area encompasses approximately 6.5 square miles (16.8 km.²), including Malpais maar and its products, and the surrounding cinder cones and flows. Reconnaissance was also undertaken of four other maar volcanoes in the region: Kilbourne Hole; Hunts Hole; Potrillo Maar; and Mt. Riley maar.

Previous Investigations

Malpais maar was discovered in the summer of 1971, during reconnaissance of the West Potrillo Mountains (Hoffer, 1971). The area was again visited during December, 1971, by the Apollo XVII astronauts as part of their training program in geology (Hoffer, 1971). Malpais maar is mentioned by Hoffer (in press), and the primary features of Kilbourne and Hunts Holes and Potrillo Maar have been described (Lee, 1907; Darton, 1933; Dunham, 1935; Reiche, 1940; Shocmaker, 1957; Reeves and DeHon, 1965; DeHon, 1965).

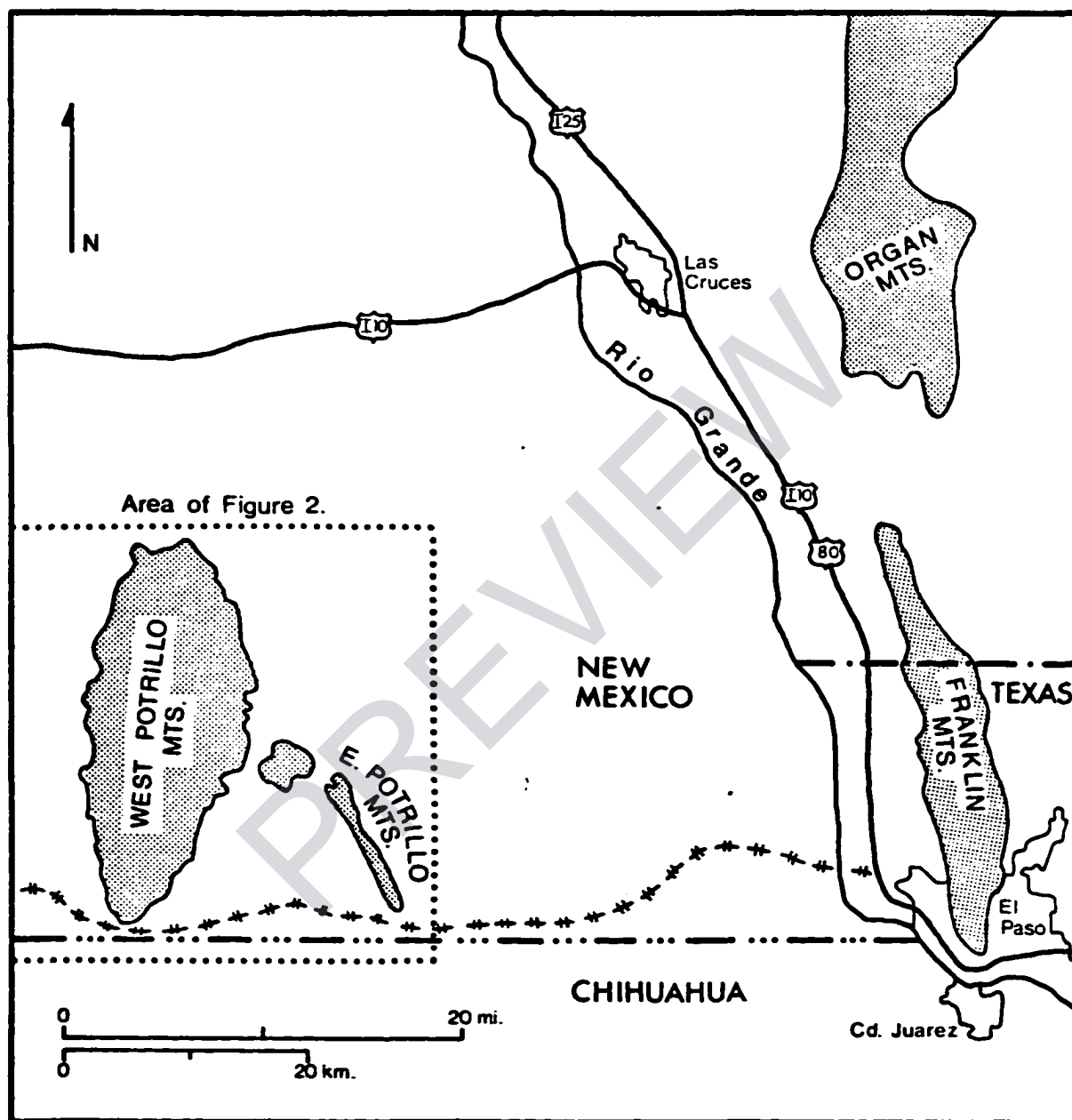


Figure 1. Index map of south-central New Mexico.

Purpose and Methods of Investigation

There are three objectives of this investigation:

1. construct a detailed map of Malpais maar;
2. describe the maar deposit;
3. define the eruptive history of the maar and the surrounding area.

Approximately fifteen weeks were spent in the field in reconnaissance, detailed mapping, and sample collection. An aerial photograph, scale 1:36,000, was obtained from the New Mexico Bureau of Mines and Mineral Resources, from which an enlargement, scale 1:8220, was made by R. M. Metcalfe Co., Inc., El Paso, Texas. The aerial photograph (uncorrected for distortion) served as the base map over which a field map was constructed on mylar acetate. The report map, scale 1:8220, was prepared from the field copy on an additional mylar overlay.

Topographic profiles for cross sections were taken from a United States Geologic Survey topographic map (Mt. Riley, New Mexico, 1929; scale 1:62,500), and enlarged to the report map scale.

Basalt flows and dikes were sampled at numerous, widely spaced intervals, to provide an adequate characterization of the petrography. Stratigraphic sections were measured in the tuffs and sampled at key horizons. Thin sections were constructed and analyzed with a petrographic microscope.