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GEOLOGY OF THE CENTRAL ORGAN MOUNTAINS DONA ANA COUNTY, NEW MEXICO

by
THOMAS G. GLOVER
University of Texas at El Paso
El Paso, Texas 79968

INTRODUCTION

The Organ Mountains (Fig. 1) are located in mid-eastern Dona Ana County, New Mexico, 13 mi (20 km) east of Las Cruces. The mountain range encompasses about 150 sq mi and is bounded on the north by the San Andres Mountains and on the south by the Franklin Mountains. Maximum elevations in the district are above 8,900 ft, with overall relief in excess of 4,000 ft. Climate and vegetation are typical of this part of the southwestern United States, and rainfall averages about nine inches per year.

K. C. Dunham (1935) established the basic geologic framework of the Organ Mountains and prepared a detailed description of past operations in the Organ Mining District. No major work has been published on the Organ Mountains since that time.

This paper is a progress report; field work in the area will not be completed until late 1975. The final results will be included in a thesis to be submitted to the Department of Geological Sciences of the University of Texas at El Paso as a requirement for the Master of Science degree in geology.

GENERAL GEOLOGIC SETTING

The San Andres, Organ, and Franklin Mountains form a long north-trending mountain chain along the eastern edge of the Rio Grande basin. East of the Organ Mountains is the Tularosa Basin and west of the mountains are the Jornada del Muerto plains and Mesilla Valley.

The northern half of the Organ Mountains is composed of gravels and alluvium of Tertiary-Quaternary age, volcanic rocks and intrusions of Tertiary age, Paleozoic sedimentary rocks, and granite of Precambrian age. Multiple quartz monzonite intrusions of the Organ Mountain batholith are the dominant rock types exposed. Rocks flanking the western slopes of the range were faulted and uplifted by the quartz monzonite intrusions. The Organ Mining District is located at the northern edge of the mountains where Stage 3 of the batholith is the dominant rock type. The Stage 3 intrusion is probably the source of Pb-Cu-Ag-Au-Zn mineralization in the mining district (Dunham, 1935). Ore deposits are localized in the Paleozoic sedimentary rocks and the Stage 3 quartz monzonite. Movement of the ore-bearing fluids was probably controlled by fault and fracture systems in the area. Total mineral production from the Organ Mining District was in excess of $2.5 million.

Figure 1. Central Organ Mountains east of Las Cruces, New Mexico. East View.

The southern half of the Organ Mountains may represent a partially exposed cauldron of middle Tertiary age (W. R. Seager, personal communication, 1975). Cueva Rhyolite, and Soledad Rhyolite fill the cauldron and dip toward the center of the structure. Seager suggests that Bishop Cap, Tortugas Mountain and the structurally high Paleozoic rocks in the central Organ Mountains may define the cauldron margin, and that fluorspar deposits in these areas may be related to the margin (see articles by Seager and McAnulty, this guidebook).

STRATIGRAPHY

Hueco Formation

Dunham (1935) originally classified the sedimentary rocks that flank the western slopes of the Organ Mountains as the Magdalena Series (Pennsylvanian). Kottlowski and others (1956) and Kottlowski (1960) reclassified these rocks as the Hueco Formation (Permian). Preliminary fossil identification places the top two-thirds of this sequence in the upper Wolfcamp Series (D. V. LeMone and R. Simpson, personal communication, 1975).

The oldest rocks exposed in the central Organ Mountains are of Permian age (Fig. 2, 3). Since the lower one-third of the formation lacks fossils and is baked and altered, its age is difficult to determine; possibly it is Pennsylvanian. However, similarities in lithology with other Hueco deposits in Dona Ana County suggest a probable Permian age. The lower contact of the section is with a Tertiary intrusion. The Hueco Formation consists of approximately 3,300 ft of thin interbedded limestone, silty limestone, sandstone, shale, and claystone that strike northwesterly and dip 35 degrees S to vertical. Thin-bedded limestone makes up the greater part of the sequence and seldom exceeds 10 ft in thickness. Beds vary greatly in character throughout the sequence, ranging from coarse-grained to fine-grained. Chert is abundant and occurs in nodules or beds. Fossils are absent in the lower one-third of the sequence, but are present in most other parts of the formation. The most common groups present are brachiopods, crinoids, corals, bryozoans, cephalopods, gastropods, and fusulinids.

Interfingering of Abo red beds occurs in the upper part of the formation. The thickness of the Abo red beds seldom exceeds 4 ft, and they are composed of unfossiliferous red-brown claystone. Baking of some of the beds leaves the Abo as a bleached, dense, hornfelsic rock.

Love Ranch Formation

A conglomerate along the western front of the Organ Mountains was first described by Dunham (1935) as a basal conglomerate overlying the Paleozoic sedimentary rocks. Kottlow-

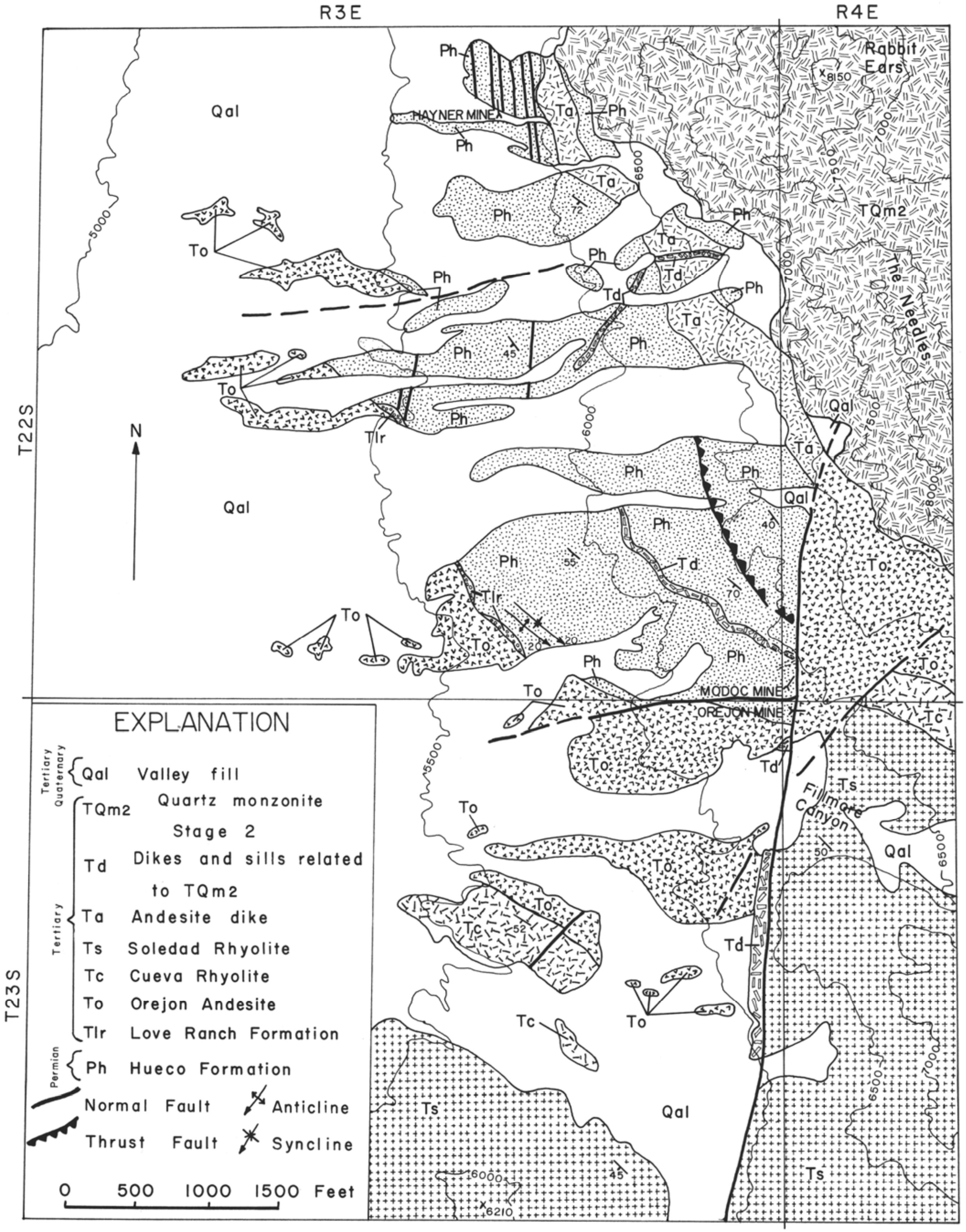

Figure 2. Geologic map of the central Organ Mountains.

AGE	FORMATION	DOMINANT LITHOLOGY	APPROXIMATE MAXIMUM EXPOSED THICKNESS (ft)
Quaternary Tertiary	Valley Fill	Fan deposits and slope colluvium. Unsorted and strong weathering effects.	200
Oligocene	Organ Mountain Batholith	Quartz monzonite Stage 2. Buff colored rock that forms the central core of the mountains.	Intrusion
Oligocene?	Miscellaneous Dikes and Sills	Buff colored latite porphyry and quartz latite porphyry rocks possibly related to the Organ Mountain Batholith.	Intrusion
Early Tertiary	Andesite Dike	Dark porphyritic andesite dike. Plagioclase phenocrysts and a fine-grained ground mass.	Intrusion
Oligocene?	Soledad Rhyolite	Gray to purple-gray, porphyritic flows and tuffs. Forms cliffs and steep slopes.	2,500 +
Oligocene?	Cueva Rhyolite	Massive white rhyolite tuff; cryptocrystalline ground mass; calcite and white mica abundant.	250
	Unconformity		
Eocene?	Orejon Andesite	Brown to purple andesite-latite boulder conglomerates and breccias, tuffaceous mudstones, and andesite-latite flows.	1,200
	Unconformity		
Early Tertiary	Love Ranch Formation	White conglomerate derived mostly from the Hueco Formation. Schist, gneiss, granite, and quartzite present in the upper part of the unit.	50
	Unconformity		
Permian	Hueco Formation	Thin bedded limestones, silty limestones, sandstones, shales, and claystones. Fossils found in the upper two-thirds of the unit.	3,300

Figure 3. Sedimentary, volcanic, and igneous rocks of the central Organ Mountains, New Mexico.

ski and others (1956) described and tentatively correlated the formation with Love Ranch Formation in the San Andres Mountains.

An angular unconformity of 10° to 20° separates the Love Ranch Formation from the underlying Hueco Formation. Kottlowski and others (1956) consider the deposit to be early Tertiary in age and Seager and others (1971) believe the deposit to be formed by erosion of Laramide structures. The conglomerate occurs as thin tongues ranging in thickness from 0 to 50 ft.

The conglomerate consists of about 50 percent cobbles and boulders, both angular and rounded, derived mostly from the underlying Hueco Formation. Fragments of schist, gneiss, quartzite, and granite are present in the upper part of the unit. The matrix is white to gray calcareous sandstone and siltstone.

Orejon Andesite

The type locality for the Orejon Andesite is at the Orejon Mine in the mouth of Fillmore Canyon (Fig. 2). The Palm Park Formation in northern Dona Ana County probably is time equivalent to the Orejon Andesite (Seager, personal communication, 1975). An andesite sequence similar to the Palm Park was dated by the K-Ar method at 43 m.y. (Kottlowski and others, 1969). Both the Love Ranch Formation and the Hueco Formation are unconformably overlain by Orejon Andesite.

The Orejon sequence is composed of approximately 1,200 ft of andesite-latite boulder conglomerate and breccia, tuffaceous mudstone, and andesite-latite flows which range in thickness from a few inches up to 75 ft. The lithology of many of the deposits suggests laharic origin. The conglomerate and breccia contain boulders up to several feet in diameter and are characteristically poorly sorted. The matrix consists of grains of plagioclase, quartz, vitric ash, and rock fragments less than 1 mm in size. The thin-bedded mudstone and flows have the same basic composition as the conglomerate and breccia matrix, but are well sorted.

The basal unit of the Orejon Andesite is distinctive white tuff. The formation was mapped separately by Dunham (1935), but I consider it to be part of the Orejon sequence.

Cueva Rhyolite

The type locality for the Cueva Rhyolite is at the mouth of Fillmore Canyon. A tilted sequence of rhyolite tuff striking N 58° W and dipping 55° S has been weathered out, and an Indian dwelling at the base of the monolith bears the name La Cueva. Seager (personal communication, 1975) believes the Cueva Rhyolite to be coeval with at least part of the Bell Top Formation (Oligocene) found in the Sierra de las Uvas, Dona Ana County. Radiometric K-Ar dates of 34 and 35 m.y. have been established for the tuff 5 member of the Bell Top (Clemons and Seager, 1973).

The Cueva Rhyolite disconformably overlies the Orejon Andesite, and the two are distinguished on the basis of composition and color. The type section is approximately 250 ft thick.

The formation is a massive white rhyolite tuff. It has a cryptocrystalline groundmass with bands of pale brown glass. Near the base of the formation, the groundmass has a purplish tint. Calcite and white mica are abundant and large boulders of rhyolite up to 2 ft in diameter occur in the upper part of the formation.

Soledad Rhyolite

Most of the rock exposed in the southern Organ Mountains is the Soledad Rhyolite. The formation is composed of more than 2,500 ft of rhyolite tuff and lava flows (Dunham, 1935). Part of the Bell Top Formation in the Sierra de las Uvas may be about the same age as the Soledad Rhyolite (Seager, personal communication, 1975) in spite of a K-Ar date of 25 m.y. reported for the Soledad (Seager, 1973). Radiometric K-Ar dates of 34 m.y. and 35 m.y. have been established for the tuff 5 member of the Bell Top Formation and 26 m.y. for the overlying Uvas Basaltic Andesite.

The Soledad Rhyolite lies conformably on the Cueva Rhyolite. However, distinction between the two is obvious, as the Cueva Rhyolite is white and the Soledad Rhyolite usually has a purplish tint. Individual units in the sequence range from 50 ft up to possibly 500 ft.

The flows and tuffs are porphyritic and range in color from gray to purple. The groundmass is coarse and has a spongy texture. Common minerals present are quartz, potash feldspar, biotite, cristobalite, and plagioclase. Compressed pumice, vitric ash, and other rock fragments are also locally abundant.

INTRUSIVE IGNEOUS ROCKS

Andesite Dike

A large andesite dike cuts the Paleozoic sedimentary rocks and parallels the Stage 2 quartz monzonite intrusion. The dike is more than 400 ft thick in some areas and is approximately 4,000 ft long. Emplacement of the mass may be associated with the uplift of the region during early Tertiary time.

The dike is a dark-colored porphyritic andesite. It is composed of 20 to 50 percent plagioclase, 5 to 20 percent hornblende and biotite, and up to 10 percent potash feldspar. Phenocrysts of plagioclase are equigranular and average 2 mm in length. The groundmass is very fine grained and cut by veinlets of pyrite and chalcopyrite. Accessory minerals are epidote, magnetite, hematite, sphene, quartz, pyrite, and chalcopyrite. Alteration is moderate to very strong.

Organ Mountain Batholith

The highest and most impressive group of peaks in the Organ Mountains have a multiple silicic intrusion at their core (Fig. 1). The batholith forms the Organ Needles, Rabbit Ears, Baylor Peak, and Sugarloaf Peak. It is a northwest-trending areal exposure of approximately 60 sq mi and a vertical exposure of more than 1,500 ft.

Only Stage 2 of the three stage intrusion is exposed in the west central Organ Mountains. The intrusive cuts the Paleozoic sedimentary rocks, the Orejon Andesite, and the andesite dike. Many blocks of both the andesite dike and the Orejon sequence, some up to 20 ft in diameter, are found as xenoliths in the batholith. The intrusive contact is usually very distinct and easily recognized in the field.

The exact age of the Stage 2 intrusive has not been determined, but the Stage 3 intrusion in the Organ Mining District has been dated radiometrically at 27 m.y. (Kottlowski and others, 1969).

Microscopic examination of the Stage 2 intrusion reveals that the rock borders in composition between quartz monzonite and granite. It is buff-colored, medium-grained, equigranular, and moderately altered. The quartz monzonite contains 45 to 60 percent potash feldspar, 15 to 25 percent plagioclase, 20 to 25 percent quartz, 2 to 3 percent amphibole, and less than 1 percent biotite. Alteration products are chiefly magnetite, calcite, sericite, and kaolinite. Zoning of the plagioclase is very conspicuous and albite and Carlsbad twinning are usually well developed.

Miscellaneous Dikes and Sills

Two small dikes and a sill cut formations along the western front of the range. All have the same general composition and appear to be related to the Stage 2 quartz monzonite. However, none of them are found in direct contact with the batholith.

Thickness of the sill is approximately 6 ft and its exposed length is in excess of 1,400 ft. It crops out northwest of the Modoc Mine in the Hueco Formation. The sill is latite porphyry, consisting of 60 percent plagioclase and 30 percent potash feldspar. Phenocrysts of plagioclase are equigranular and average 1.5 mm in length. The groundmass is fine-grained. Accessory minerals are biotite, magnetite, and zircon. The rock is moderately altered.

A large dike is located in the main north-trending fault south of the Modoc Mine. It is more than 100 ft thick and has a strike length of at least 2,300 ft. The dike is in contact with the Hueco Formation, Orejon Andesite, and Soledad Rhyolite. If the dike is part of the Stage 2 quartz monzonite, a relative age between the batholith and the Soledad Rhyolite is indicated. No other contact between the Soledad Rhyolite and the batholith is seen in the Organ Mountains (Dunham, 1935). The dike is quartz latite porphyry, consisting of 40 percent plagioclase, 35 percent potash feldspar, and 18 percent quartz. Phenocrysts of plagioclase are equigranular and average 2 mm in length. The groundmass is fine grained. Accessory minerals are biotite, zircon, and magnetite. Alteration is moderate to strong.

Tertiary-Quaternary Valley Fill

Fan deposits and slope colluvium along the western front make up the major valley fill units. Up to several hundred feet of alluvium is present, generally thickest in alluvial fans where pebbles and boulders are rounded and show strong weathering effects.

STRUCTURE

Faulting in the central Organ Mountains is of two basic types: high-angle normal faults and small thrust faults. Both types represent faulting related to emplacement of the batholith. Major trends of the high-angle normal faults are north, northeast, and east-west.

A small anticline and syncline in the Hueco Formation are located west of the Modoc Mine. Formation of these structures may have occurred prior to emplacement of the batholith.

MINERALIZATION

Fluorspar and lead minerals are probably the only economic minerals concentrated in commercial-size deposits in the central Organ Mountains. Minor amounts of chalcopyrite and silver occur in the area. The age of mineralization for the fluorspar and lead deposits is probably mid-Tertiary.

Most of the known fluorspar in the area is on the Hayner claims, where it occurs in at least eleven nearly parallel vein and fracture zones striking N 20° E and dipping 55° to 70° E. The No. 1 Vein is a bedding plane vein which dips 45° to 60° W. The veins are in a belt of fractured, mildly distorted, and partly metamorphosed limestone and shale of the Hueco Formation. Fluorspar also occurs in veins in the andesite dike. East of the andesite dike is a section of limestone in contact with the quartz monzonite in which several narrow veins of fluorspar occur. Fluorspar is found along both the east and west contact of the andesite dike all the way from the Hayner Mine to the Modoc Mine. Ore ranges from coarse to fine grained and ranges in color from white to deep wine to apple green. Gangue minerals include barite, calcite, and quartz. Quartz was the first mineral deposited, followed by alternate depositions of calcite and fluorite. Only 400 tons of fluorspar have been produced to this date.

The lead minerals, principally galena, occur as small replacement bodies in the Hueco Formation at the Modoc Mine. Mining between 1879 and 1905 produced ore valued at about $200,000 (Dunham, 1935). The Modoc deposit was classified as pyrometasomatic by Dunham (1935). It is adjacent to the large north-trending fault in the area. Galena is the only ore mineral, and it is essentially non-argentiferous. Gangue minerals include chlorite, andradite, specular hematite, epidote, and quartz.

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