GEOLOGY

OF THE

LION MOUNTAIN QUADRANGLE

by

Glenn R. Osburn

T. Matthew Laroche

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Geologic quadrangle maps for the Socorro-Magdalena area, Socorro County, New Mexico

Several hundred square miles of detailed geologic mapping have now been completed on the volcanic rocks of the northeastern Mogollon-Datil volcanic field in the Socorro-Magdalena area. Most of this mapping has been available since completion as New Mexico Bureau of Mines and Mineral Resources open-file reports consisting of individual thesis maps and accompanying texts. Over the years, however, the stratigraphic nomenclature has changed to the point that comparison between these individual maps is difficult. Several publications are currently being prepared to help resolve this stratigraphic confusion. The first of these is Stratigraphic Chart 1 which will present the current stratigraphic nomenclature in its entirety and provide a glossary and other correlation aids to relate this nomenclature to previously used names. This map-sheet size chart should be available during 1982.

Concurrent with the preparation of Stratigraphic Chart 1 (Osburn and Chapin, 1982), the thesis maps are being compiled in quadrangle format and made available under the umbrella of open-file 139. Each quadrangle will be assigned a suffix letter (such as 139 a) and will be available separately. An explanation and, in many cases, a short text will be available with the map. Nomenclature and map symbols for widespread units will be standardized. The mapping within these areas, while generally excellent, is not all of uniform quality, particularly in the treatment of Quaternary units. Additionally, most quadrangles have unmapped portions, usually in areas of extensive basin-fill alluvium.

Initially, the maps will be compiled as they are and unmapped portions will remain. As time becomes available, holes will be filled in and problem areas field checked and upgraded. Obviously any errors in geology will remain and it is inevitable in recompiling this much geology that drafting errors will be made. A short note describing the known problem areas and the amount of checking that has been done will be included with each quadrangle. We ask you, the users of these maps, to notify us of any problem areas that you might find. Please send us a note as to the exact location and nature of the problems and we will make every effort to field check and correct them.

Thank you for your help.

C. E. Chapin
G. R. Osburn

Table of Contents

Physiographic and Geologic Setting 1

Previous and Present Work 2

Acknowledgements 7

Stratigraphic Units 7

Quaternary Alluvial Deposits 15

Human Habitation 16

Structure 18

Economic Geology 19

Bibliography 21

Map Explanation 27

List of Figures

Figure 1. Vista of Lion Mountain from the southwest iii

Figure 2. Location map showing major geographic features and available geologic mapping for the Lion Mountain quadrangle and surrounding area. 3

Figure 3. Generalized structural map for the area surrounding the Lion Mountain quadrangle. 6

Figure 4. Photomicrograph of the andesite of Lion Mountain showing the tabular nature of the plagioclase phenocrysts. . 13

Figure 5. Photographs of wind scoured rock on top and west side of Lion Mountain. 17

Figure 1: Vista of Lion Mountain from the southwest. Foreground is a small hill made up of the andesite of Lion Mountain overlying the South Canyon Tuff. Piedmont deposits, largely covered by blow sand, separate this hill from the main mass of Lion Mountain. On Lion Mountain, the northern mesa is composed entirely of South Canyon Tuff. The gentle slopes are underlain by the crystal-poor lower member and the cliffs are composed of the slightly more crystal-rich upper member. The lower member is more densely welded than the upper but less resistant because it is more intensely jointed, whereas the upper member is fairly massive. The South Canyon dips slightly to the south and forms the lower slopes of the southern hills; the tops of these hills are made up of the andesite of Lion Mountain.

PHYSIOGRAPHIC AND GEOLOGIC SETTING

The Lion Mountain quadrangle mainly occupies the slope between the Gallinas Mountains on the east and White Lake of the Plains of San Agustin on the west. Lion Mountain is a large and prominent landform (see Figure 1); otherwise the area consists of low hills separated by alluvial slopes covered with blow sand. All of the quadrangle falls within land controlled by the HH Ranch (north) or the Montosa Cattle Company (south); the foremen of these ranches should be consulted for permission before entering. Fair access is provided by the North Lake Road which extends northwest from U. S. highway 60 through the quadrangle and by numerous woodcutters roads within the areas of National Forest. Abundant blow sand makes 4 wheel drive necessary on many of these roads.

Geologically much of the area is dominated by White Lake Basin (Weber, 1980) , piedmont-slope deposits graded to it, and blow sand derived from it. These deposits, which occupy at least 60 percent of the quadrangle, were not studied in detail during this study. R. W. Weber of the New Mexico Bureau of Mines and Mineral Resources is currently completing a study of shorelines and lacustrine deposits of Lake San Augustin on a regional basis and a report of this study should soon be available.

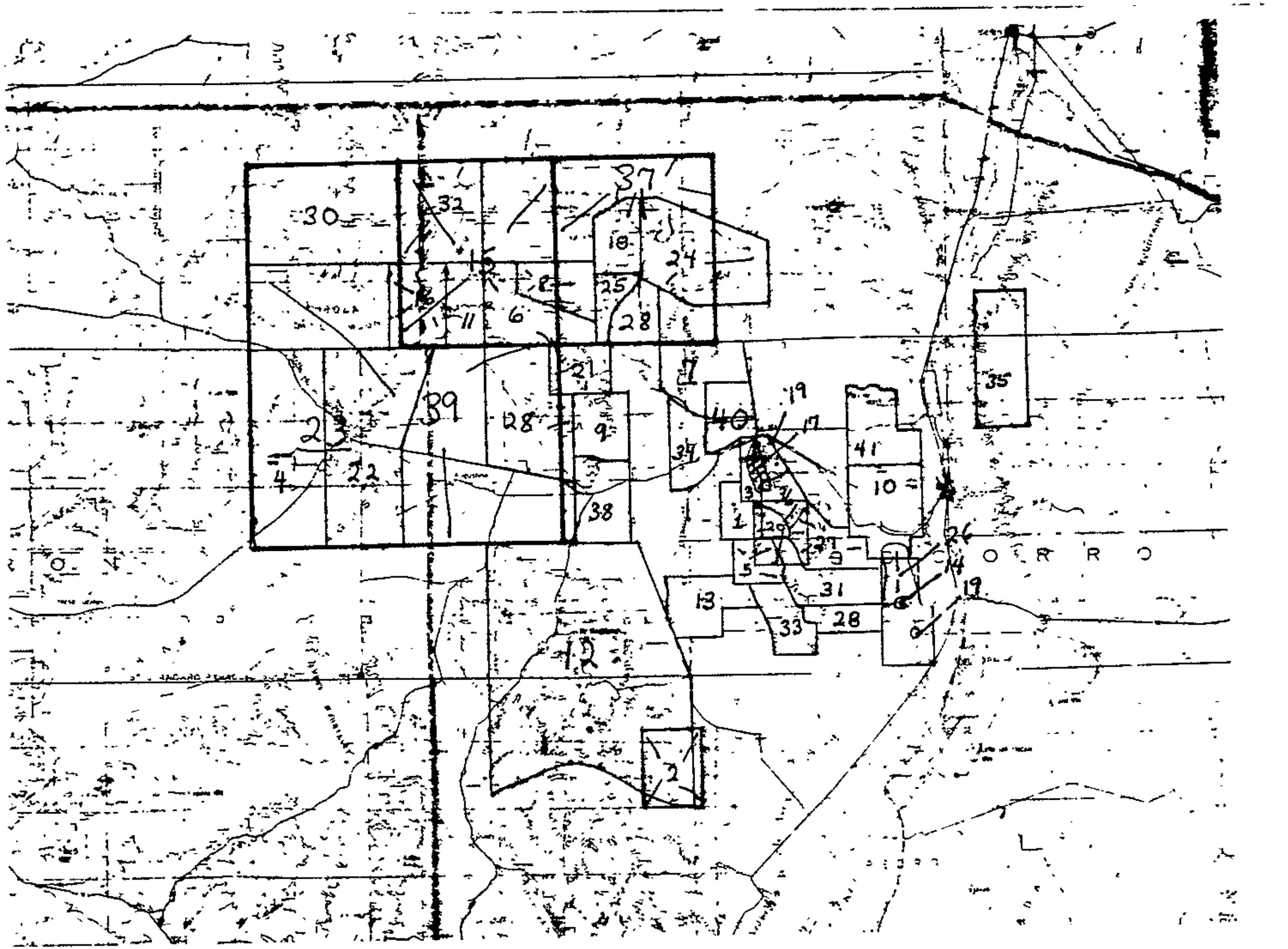
The Lion Mountain quadrangle occupies part of a slightly deformed block within the complexly faulted terrain along the southern edge of the Colorado Plateau. Figure 2 shows major geographic features and the available geologic mapping for the surrounding area; figure 3 shows a generalized synthesis of the structural geology of the surrounding area.

PREVIOUS AND PRESENT WORK

Several geologic studies have previously been completed in the area surrounding the Lion Mountain quadrangle; these studies consist of two published reconnaissance maps (Willard and Givens, 1958; and Givens, 1957) and several unpublished detailed thesis maps. These individual studies are shown on figure 2. The reconnaissance mapping is of very limited use because of more recent changes in the method for dividing volcanic stratigraphic units. Studies in surrounding areas that were of particular importance to this project were thesis by Chamberlin (1974) and Laroche (1981), in the central and northern part of the Gallinas Peak quadrangle respectively, and Harrison (1980) and Coffin (1981) in the Dog Springs quadrangle to the northwest. Givens (1957) provided the only mapping of the area due north of the Lion Mountain quadrangle. The only mapping used in compiling the Lion Mountain quadrangle is by Osburn and Laroche. Generalized boundaries for quaternary units were mapped from aerial photographs or were modified after soil mapping by the U. S. Soil Conservation Service (Job 35902, sheet 44).

Figure 2. Location map showing major geologic features and available geologic mapping for the area around the Lion Mountain quadrangle. The numbers refer to the table below. The abbreviations used are: NMIMT-New Mexico Institute of Mining and Technology; NMBMMR-OF-New Mexico Bureau of Mines and Mineral Resources open-file report; USGS-U.S. Geological Survey; UNM-University of New Mexico; UTEP-University of Texas at El Paso; UTA-University of Texas at Austin; UA-University of Arizona; CU-University of Colorado; CSM-Colorado School of Mines; M.S.-Masters thesis; Ph.D.-Doctoral Dissertation; in prep-in preparation.

1.	Allen, P.	1979	NMIMT (M.S.)
2.	Atwood, G.	in prep.	UNM (M.S.)
3.	Blakestad, R.B., Jr.	1977	CU (M.S.)
4.	Bornhorst, T.J.	1976	UNM (M.S.)
5.	Bowring, S.A.	1980	NMIMT (M.S.)
6.	Brouillard, L.	in progress	NMIMT (M.S.)
7.	Brown, D.M.	1972	NMIMT (M.S.)
8.	Cather, S.M.	1980	UTA (M.S.)
9.	Chamberlin, R.M.	1974	NMIMT (M.S.)
10.	Chamberlin, R.M.	1980	CSM (Ph.D.)
11.	Coffin, G.	1981	NMIMT (M.S.)
12.	Deal, E.G.	1973	UNM (Ph.D.)
13.	Donze, M.A.	1980	NMIMT (M.S.)
14.	Gentile, A.L.	1957	NMIMT (M.S.)
15.	Givens, D.B.	1958	NMBMMR-Bul. 58
16.	Harrison, R.W.	1980	NMIMT (M.S.)
17.	Iovinetti, S.	1977	NMIMT (M.S.)
18.	Jackson, R.A.	1979	NMBMMR-OF
19.	Kent, S.	1980	NMBMMR-OF
20.	Krewedl, D.A.	1974	UA(Ph.D.)
21.	Laroche, T.M.	1981	NMIMT (M.S.)
22.	Lopez, D.A.	1975	UNM (M.S.)
23.	Lopez and Bornhorst	1979	USGS Map I-1092
24.	Massingill, G.E.	1978	UTEP (Ph.D.)
25.	Mayerson, D.L.	1979	NMIMT (M.S.)
26.	Miesch, A.T.	1956	NMBMMR Circular 38
27.	Osburn, G.R.	1978	NMIMT (M.S.)
28.	Osburn, G.R.	1978-81	NMBMMR-OF
29.	Osburn and Laroche	1982	NMBMMR-OF
30.	Osburn, J.C.	in progress	NMBMMR
31.	Petty, D.M.	1979	NMIMT (M.S.)
32.	Robinson, B.	1981	UTEP (Ph.D.)
33.	Roth, S.J.	1980	NMIMT (M.S.)
34.	Simon, D.B.	1973	NMIMT (M.S.)
35.	Spradlin, E.J.	1976	UNM (M.S.)
36.	Sumner, W.	1980	NMIMT (M.S.)
37.	Tonking, W.H.	1957	NMBMMR-Bul. 41
38.	Wilkinson, W.H., Jr.	1976	NMIMT (M.S.)
39.	Willard and Givens	1959	NMBMMR-GM-5
40.	Chapin, C.E.	in progress	NMBMMR
41.	Chamberlin, R.M.	1980	NMBMMR-OF



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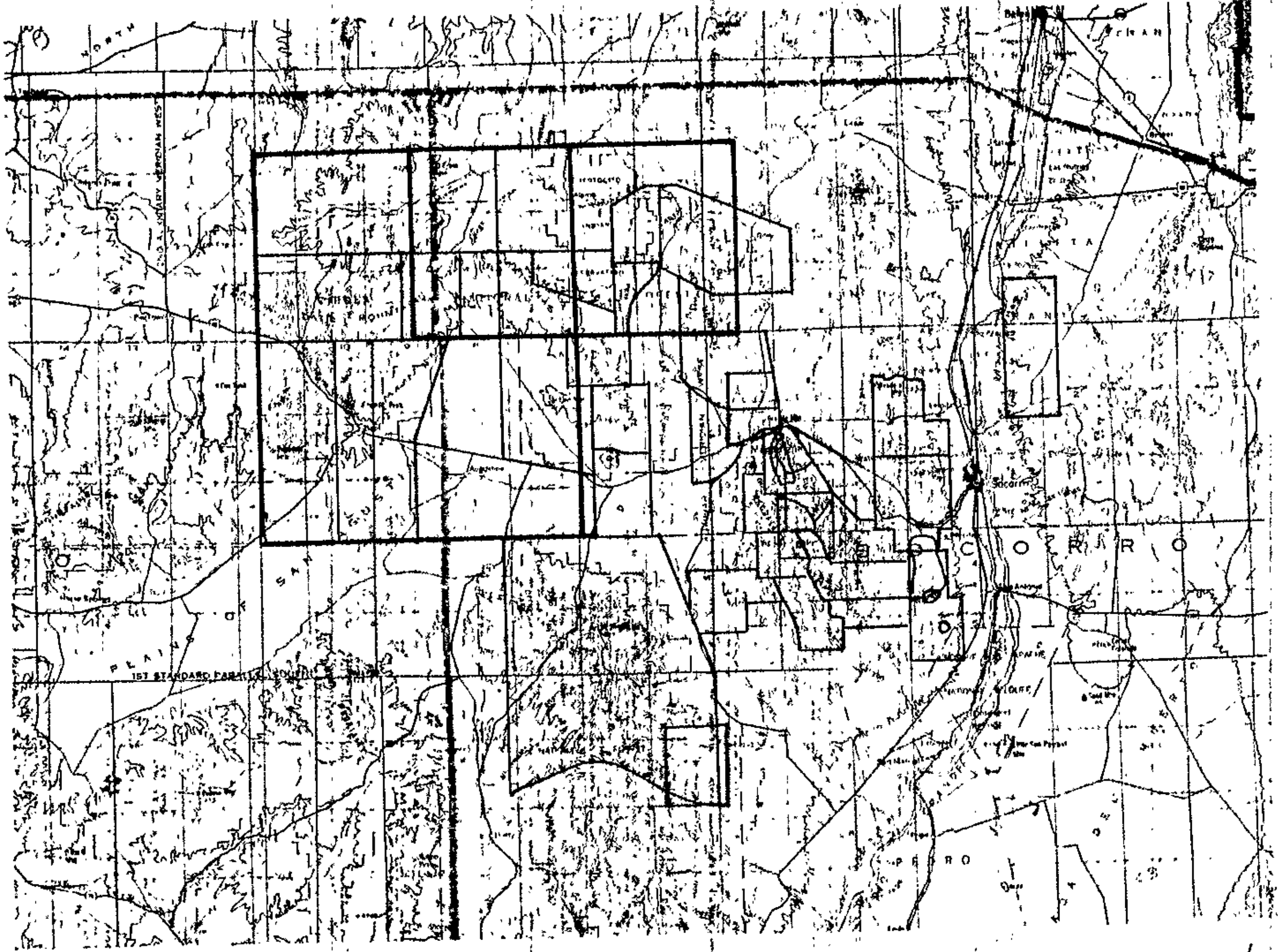
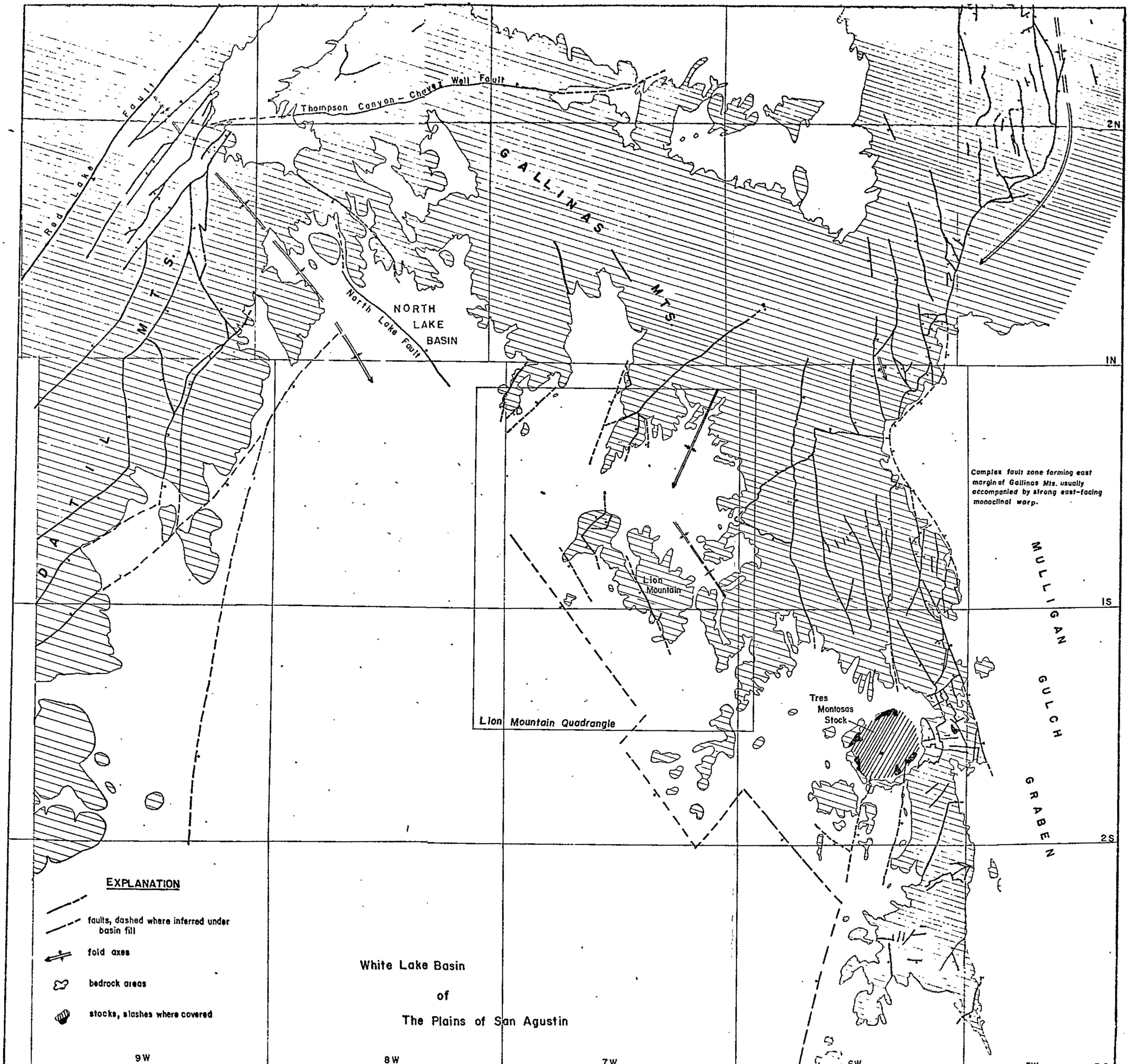


Bob Osburn has original
if you need better copy.

Figure 3. Map of the area surrounding the Lion Mountain quadrangle showing bedrock areas, plutons, faults and fold axes. All of bedrock areas shown are Tertiary volcanic and sedimentary rocks except for small areas in the northeastern and northwestern parts. Clearly shown in the fault patterns are the complex fault zones along the eastern side of the Gallinas Mountains and along the Red Lake fault and the structurally simpler block between. All folds shown on this map affect mid-Tertiary rocks and thus cannot be Laramide in age. Other folds entirely within Cretaceous rocks just off the northern edge of this compilation may be either Laramide or mid-Tertiary in age.



Red Lake Fault
Thompson Canyon - Chavez Well Fault
GALLINAS MTS.
DATIL MTS.
NORTH LAKE BASIN
North Lake Fault
Lion Mountain
Lion Mountain Quadrangle
Tres Montosas Stock
MULLIGAN GULCH GRABEN
Complex fault zone forming east margin of Gallinas Mts. usually accompanied by strong east-facing monoclinal warp.
2N
1N
1S
2S
3S
9W
8W
7W
6W
5W
EXPLANATION
faults, dashed where inferred under basin fill
fold axes
bedrock areas
stocks, slashes where covered
White Lake Basin
of
The Plains of San Agustin

ACKNOWLEDGEMENTS

The authors are indebted to several people whose efforts and support have greatly improved this publication. We owe a major debt to the many workers who have established the stratigraphic base which made this mapping much easier and especially to Dr. C. E. Chapin who supervised the Magdalena Project since its inception. Individual studies and workers are detailed on Osburn and Chapin, 1982. We would like to thank Pete Evans and Johnny McKinley for allowing us access to the private land of the HH Ranch and the Montosa Cattle Company respectively. The New Mexico Bureau of Mines and Mineral Resources financially supported this mapping. Ralph Wilcox of the U. S. Soil Conservation Service provided copies of soil maps for the area.

STRATIGRAPHIC UNITS

All rocks within the Lion Mountain quadrangle are Tertiary volicanic or volcaniclastic rocks. Most of the volcanic rocks exposed here are ash-flow tuffs of regional extent and lava flows from local vent areas. The regional units are described on Stratigraphic Chart 1 (Osburn and Chapin, 1982) and a brief lithologic summary of each is given on the map explanation.

The oldest rocks exposed in this quadrangle are andesite lavas and breccias of the Spears Formation which occur in one small outcrop area in the northeast corner of the quadrangle.

These lavas and sediments interfinger regionally with other rock types, mainly volcaniclastic sedimentary rocks, tuff breccias and ash-flow tuffs, which are not exposed within this quadrangle. This package of rocks is collectively termed the Datil Group (see Chapin and Osburn, 1982, Osburn and Chapin, 1982). The Datil Group is overlain regionally by five separate ash-flow tuff units which are from oldest to youngest the Hells Mesa Tuff, lower and upper members of the La Jencia Tuff, the Lemitar Tuff, and the South Canyon Tuff (see Osburn and Chapin, 1982). Four of these five units are found within this quadrangle; the Lemitar Tuff is not present.

The Hells Mesa Tuff occurs in a few areas along the northern edge and in the central part of the quadrangle. It is moderately to densely welded and approximately 500 feet thick in the one area where both the base and the top are exposed. The Hells Mesa is overlain by both the upper and lower members of the La Jencia Tuff. The two members of the La Jencia tuffs are separated by a complete welding break but not by sedimentary rocks or andesitic lavas as they are to the east in the Gallinas Mountains. A period of erosion separated these two tuffs to the northwest (Harrison, 1980; Coffin, 1982) and relationships in the northwest corner of this quadrangle suggest that the upper La Jencia Tuff occurs here in a paleovalley. Considerable variability in the degree of welding and density occur within the lower La Jencia Tuff within this quadrangle. The lower member is densely welded and contains lineated pumice in exposures in the east-central part of the quadrangle. To the west and northwest, the unit becomes more variable texturally. Locally, the lower member may contain lithophysal zones containing vapor-phase minerals (such as hematite and pseudobrookite) and welding reversals, cooling breaks, and a considerable proportion of poorly to moderately welded material. The pumice are sometimes lineated even within the punky, apparently poorly welded, intervals.

The upper La Jencia tuff is moderately to densely welded throughout and appears to be thicker in a plaeovalley in the northwest corner of the quadrangle. The basal, very crystal poor part of the upper La Jencia Tuff grades upward into a moderately crystal-poor, pumiceous interval with large open pumice filled with vapor phase quartz and feldspar.

The Lemitar Tuff, which would normally occur above the La Jencia Tuff, is missing throughout the Gallinas Mountains except in one small exposure in a paleovalley in the Gallinas Peak quadrangle to the east of this map area. The Lemitar Tuff is very thick in the San Mateo Mountains to the south of the Lion Mountain quadrangle, thus its absence here, well within the reach of its outflow sheet, suggests the existence of a topographic barrier at the time of its eruption. The time of development of this inferred barrier corresponds fairly well with a period of folding and paleovalley development proposed, by Harrison (1980), to follow deposition of the lower La Jencia Tuff in the eastern Datil Mountains.

Two different units overlie the upper member of the La Jencia Tuff in separate parts of the Lion Mountain quadrangle. These are the La Jara Peak Basaltic Andesite together with intercalated sedimentary rocks of the Popotosa Formation, and the rhyolite of Pinon Well. The La Jara Peak comprises thin flows of aphanitic to slightly porphyritic basalt and basaltic andesite. The interbedded Popotosa sedimentary rocks are made up mainly of conglomeratic sandstones with minor sandstones and mudstones. Many of the conglomeratic intervals contain clasts similar to the rhyolite of Pinon Well and to La Jara-Peak basaltic andesites. These sedimentary rocks are exposed in only a few outcrops in the east-central part of the quadrangle near Antelope Flats.

Farther south, in the southeast corner of the quadrangle near Deep Well, the rhyolite of Pinon Well occupies this same stratigraphic interval and no La Jara Peak lavas or Popotosa conglomerates are found. The rhyolite of Pinon Well, here informally named after exposures in the Gallinas Peak quadrangle, is petrographically a quartz-latitic to rhyolitic lava flow, or series of flows, which underlies the South Canyon Tuff and apparently lies above the upper La Jencia Tuff, although this relationship is nowhere clearly exposed. These rhyolitic lavas are glassy to lithoidal and sparsely porphyritic, containing 1 to

3 percent sanidine phenocrysts. Spherulitic devitrification textures, including globular spherulites with well-developed skins, are common. A vent area for these rhyolites is not clearly exposed; however, several areas of steep foliation present in exposures along the eastern edge of this quadrangle, and the western edge of the adjoining Gallinas Peak quadrangle, are suspected to be vents. Local deposits of tuff breccia occur within this zone of steep foliation, just off the eastern edge of the Lion Mountain quadrangle. Locally, in the southernmost Lion Mountain quadrangle and the adjoining parts of the Arrowhead Well quadrangle to the south, poorly to moderately welded ash-flow tuffs of similar lithology underly the rhyolite of Pinon Well.

The South Canyon Tuff overlies, and apparently thins onto, the rhyolite of Pinon Well. The South Canyon Tuff varies from 650 feet, or more, on Lion Mountain and at Antelope Flats to less than 300 feet where it overlies the rhyolite of Pinon Well. The South Canyon Tuff within this quadrangle consists of a lower, thick, crystal-poor member overlain by, and welded to, a thinner, moderately crystal-rich member; both contain quartz and sanidine phenocrysts with traces of biotite and sphene, and have quartz/sanidine ratios of approximately one. The lower member is gray to pink, densely welded, and forms a colluvium of small plates during weathering. The upper member is white to tan, moderately welded and typically stands as cliffs. The lower member is several hundred feet thick in the Lion Mountain area;

the upper member is only about one hundred feet thick. These thicknesses are anomalous compared to thicknesses of the South Canyon Tuff in the Magdalena Mountains, Lemitar Mountains, and the Joyita Hills where the upper member is much thicker than the lower, but similar to the occurrence in the northern Jornado del Muerto basin where only the lower member is present.

A thick sequence of porphyritic andesitic lavas overlies the South Canyon Tuff as the uppermost volcanic unit in the Lion Mountain area. These lavas are here named the andesite of Lion Mountain after the excellent exposures which cap these hills. The andesitic lavas are known to occur from Lion Mountain eastward for about 6 miles to near the center of the Gallinas peak quadrangle and southward at least to U. S. Highway 60. The quarry from which crushed rock was obtained for the V.L.A.(Very Large Array radio telescope) is in these andesites (sec. 36, T. 2 S., R. 7 W.).

The andesites of Lion Mountain are dark gray to purple and typically contain from 5 to 25 per cent total phenocrysts consisting predominantly of plagioclase, with minor pyroxene, magnetite, and biotite. The plagioclase phenocrysts are large (> 5 mm) and are often partially to well aligned parallel to flow directions. These large tabular phenocrysts give the rocks a distinctive texture (see figure 4). Similar rocks in other areas have been termed "turkey track andesites" where there is only a

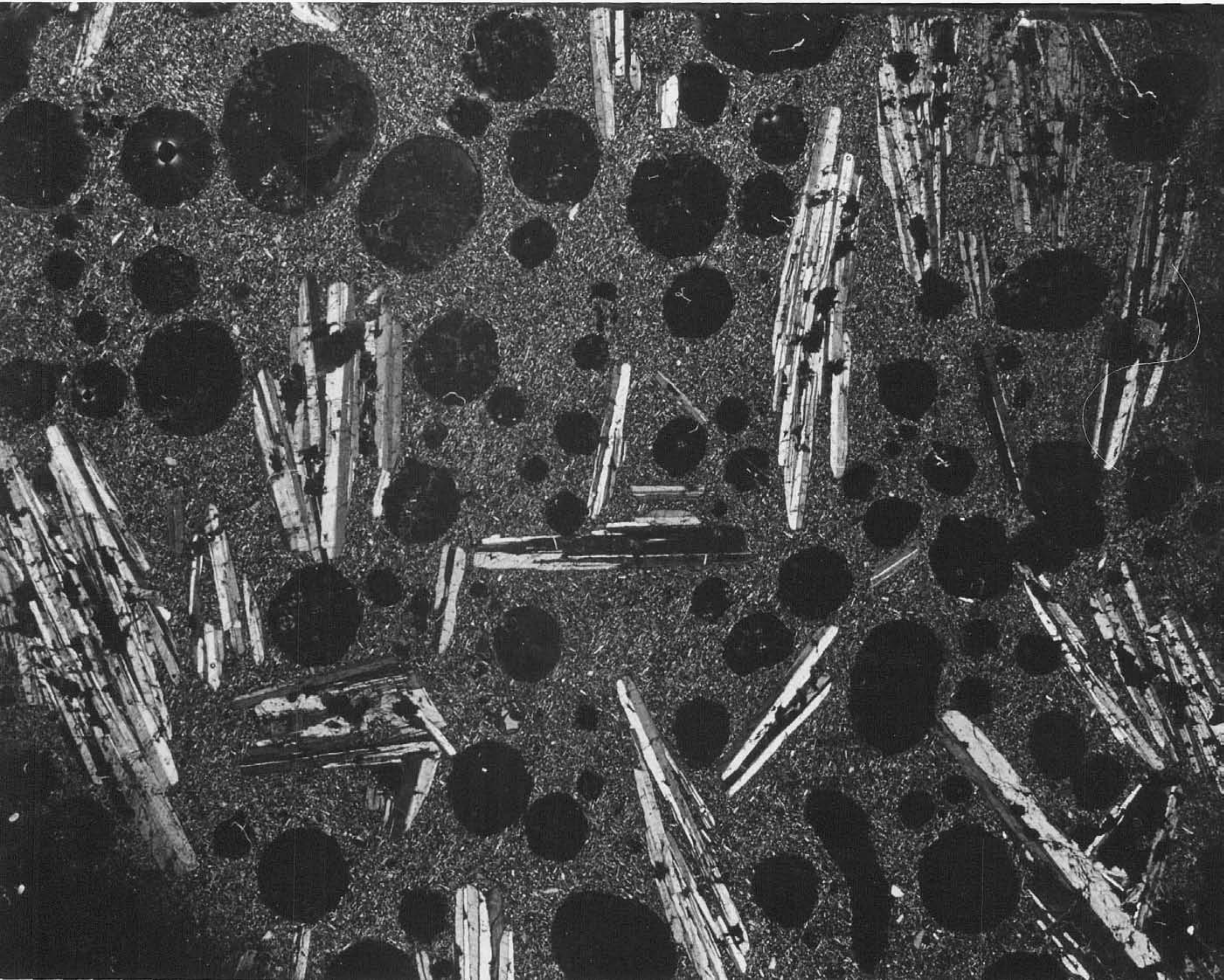


Figure 4. Photomicrograph of the andesite of Lion Mountain showing the typical large plagioclase phenocrysts within a fine-grained groundmass of plagioclase microlites and ferromagnesian minerals. Pyroxene and magnetite phenocrysts are difficult to distinguish from the smaller of the dark round vesicles.

weak alignment of plagioclase phenocrysts, or "platy-plagioclase andesites" where the phenocrysts are strongly aligned. These andesites are as much as 600 feet thick on Lion Mountain and two or more flows can be separated locally. Exposures are not sufficient, however, to readily allow mapping of individual flows throughout the area. In general, the base of a flow will be relatively phenocryst poor, dense, and platy; whereas, the tops are highly porphyritic and usually quite vesicular.

One possible vent area for the andesite of Lion Mountain is defined in the extreme east-central part of the map (Plate 1) by steep foliation and a surrounding zone of reddish alteration (oxidation?). Additionally, two small porphyritic dikes of similar texture and mineralogy intrude the lower La Jencia Tuff in the north central part of the quadrangle; several more dikes, some of which are moderately wide (20 ft, 5 m), are found just off the southeastern corner of this quadrangle in the Gallinas Peak and Tres Montosa quadrangles. A vent area for the eastern portion of these lavas was also defined in the central Gallinas Peak quadrangle (7914 hill) by Chamberlin, (1974, his "andesite of Landavaso Reservoir"). Lineation directions taken on flattened and elongated vessicles were used to indicate last-movement transport directions for many areas; however, these have not yet outlined any vent areas. These strongly porphyritic lavas were probably fairly viscous and several vent areas are likely for an outcrop area of this size. Other undiscovered vents , particularly under Lion Mountain, may exist in addition to the ones described above.

The lavas within the eastern half of the area described above were previously miscorrelated by Chamberlin (1974) with the andesite of Landavaso Reservoir (Simon, 1973). Similarly isolated outcrops, located a few miles south of U. S. highway 60 and west of Gray Hill, may be the andesite of Lion Mountain rather than the andesite of Landavaso Reservior as thought by Wilkinson (1976). These two andesite units, although petrographically quite similar, are now known to be separated stratigraphically by two regional ash-flow tuffs and by a time interval of at least 3 m.y.

QUATERNARY ALLUVIAL DEPOSITS

Quaternary, and perhaps latest Tertiary, alluvial deposits cover about 60 perent of the Lion Mountain quadrangle. These deposits were divided into lake basin, piedmont slope and aeolian sand deposits for this study. A more complex stratigraphy related to the lakes on the plains of San Augustin is present within these deposits; however, the pervasive blow-sand deposits made mapping even these three simplistic units difficult. A more detailed treatment was beyond the scope of this mapping.

Interesting surface textures have been eroded into the older volcanic rocks on the windward side of hills by sand blown from the San Augustin Lakes (see Figure 5). These windward rocks are usually pitted and, on the top of Lion Mountain, grooved parallel to the dominant wind direction. In several areas on Lion Mountain, these grooved outcrops gave a fairly consistent direction of about N60 to 65 E away from the old Lake basins (see Plate 1). Falling dunes on the east and northeast sides of the larger hills confirm this direction of transport.

HUMAN HABITATION

Several well-known Indian ruins, such as those at Gallinas Springs, are present in the area around the Lion Mountain quadrangle. In addition, abundant evidence of other sites and randomly distributed tools were seen during this study. Most of these sites were small, consisting of the rubble of one- to three-room rock houses widely spaced as if the population were dispersed rather than communal. They are usually located on the northeast sides of hills in positions protected from the southwest wind. Larger buildings consisting of from five to fifteen rooms were seen in at least two places. Ruins are present in the eastern half of the Lion Mountain quadrangle, as far west as the east side of Lion Mountain, and in the western half of the Gallinas Peak quadrangle. If more than a few of

Figure 5. Series of photographs showing the wind scoured rocks found on the tops of the higher hills of Lion Mountain. Photograph A is taken looking west along the strike of the grooving toward the plains of San Augustin to the west. The plains contained several Pleistocene lakes from which the aeolian sand was derived. Photograph B shows the grooved face of a southwest-facing cliff located just down the west side of the hill from Photograph A. The eraser is about 6 inches long and points north (left). Photograph C shows a spectacularly grooved rock face on a south-facing slope near the site of Photograph A (compass point to the north). Photograph D shows scour grooves crossing the flow foliation of the andesites at a high angle. The flow foliation is defined by elongate and flattened vesicles which are common in the andesite of Lion Mountain. Azimuths taken on the long dimensions of these vesicles gave last-movement transport directions; however, these data were seemingly too erratic to help locate vents.

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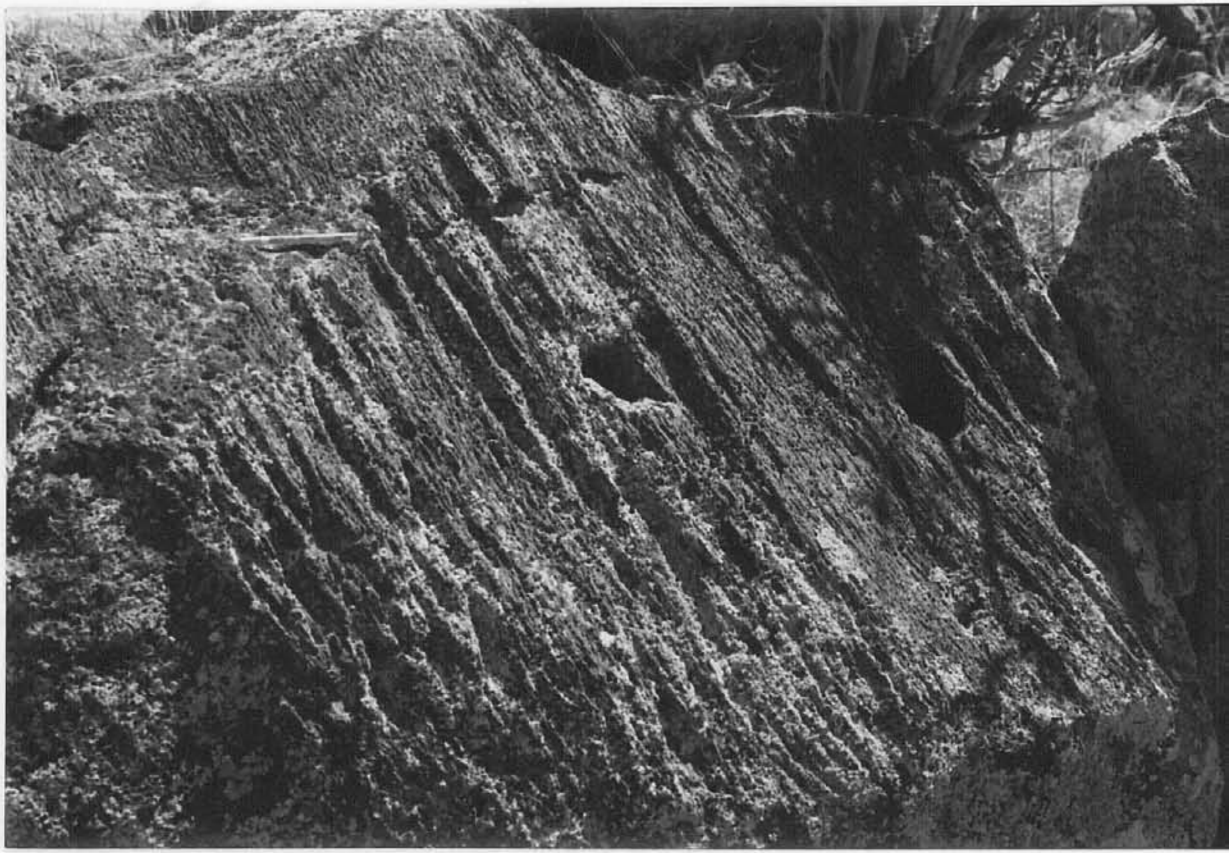

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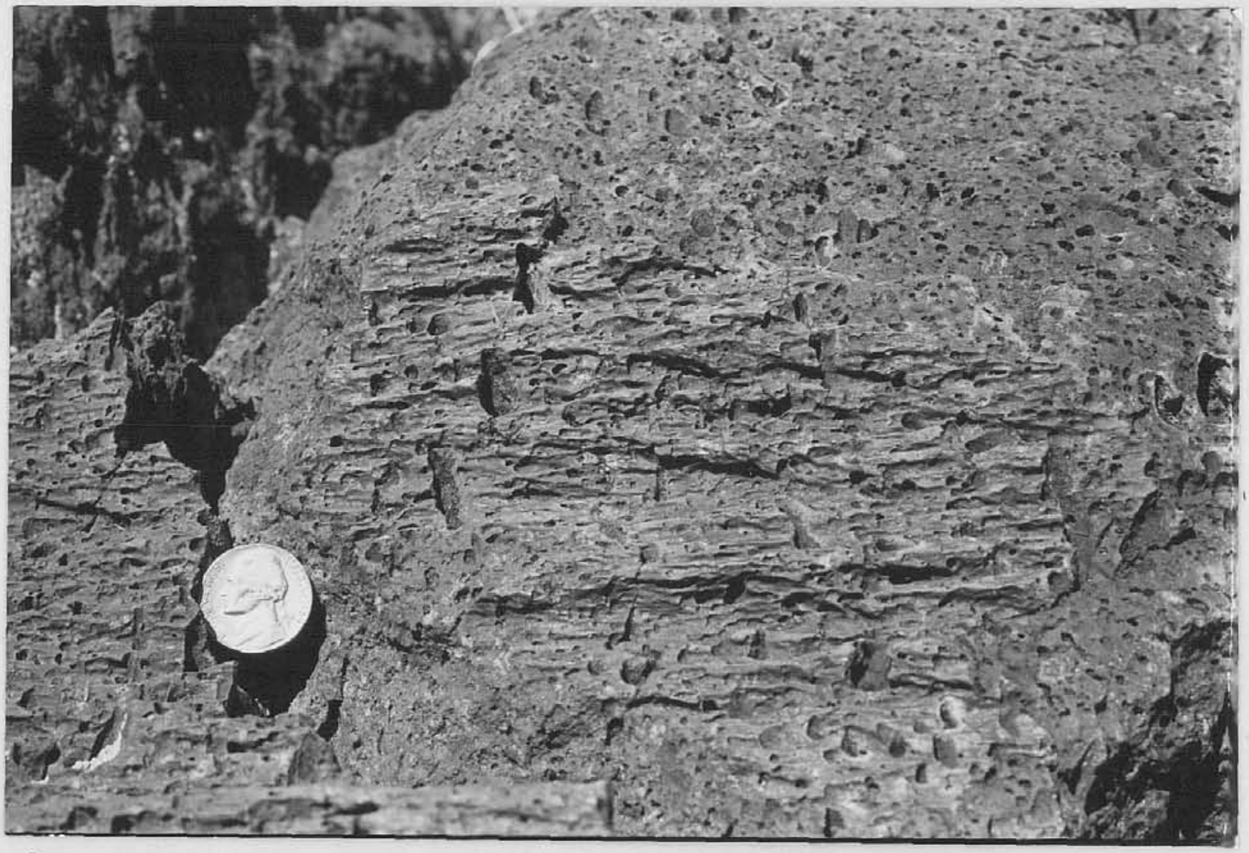

D

C

these were occupied at any given time, a considerable population is indicated. Wetter climatic conditions were probably required to support this population since dry-land farming is probably not possible under present climatic conditions and no natural water sources sufficient for irrigation were seen.

Ruin locations were recorded on field sheets, but were not compiled onto the final map to help prevent site destruction. These site locations can be provided by the senior author for legitimate archeological studies.

STRUCTURE

The Lion Mountain quadrangle is fairly simple structurally compared to the rest of the Socorro-Magdalena area. It occupies an area of gentle dip and low topography between the Gallinas Mountains and the White Lake basin. Within this area, rocks vary in attitude from flat lying to fairly gently dipping (dips up to about 15 degrees) and only a few faults are present. Two fault trends, N. 45 to 60 W. and N. 20 to 45 E., dominate and almost all faults are downthrown to the west toward the San Augustin basin. Both trends of faults are thought to be contemporaneous since, in several areas, a fault of one trend can be seen to turn onto the other trend.

The rocks within this quadrangle are gently folded in addition to being faulted. These folds consist of broad open synclines and one possible anticline. The fold axes generally parallel either of the two fault trends (see Figure 3), and are thought to have formed more or less contemporaneously with the faults.

The age of the folding and faulting within the Gallinas and Datil Mountains is not well estabished. Harrison (1980) demonstrated that at least part of the folding and uplift in the eastern Datil Mountains occurred between lower and upper La Jencia Tuff time (about 30 m.y.b.p.). Other faults and folds in his area and in the Lion Mountain quadrangle are younger than the South Canyon Tuff (~26 m.y.) and the andesite of Lion Mountain (undated). No younger age constraint is available for these faults except that they do not cut surficial alluvial deposits. One young, probably quaternary, fault does cut basin-fill sedimentary deposits just off the northwestern corner of the Lion Mountain quadrangle. This fault, the North Lake fault, appears to have created the small basin that formed North Lake.

ECONOMIC GEOLOGY

A few areas of alteration, possibly containing mineral deposits, are known from the Tres Montosas and Gallinas Peak quadrangles to the east of this area (Chamberlin, 1974;

Wilkinson, 1976; Laroche, 1980) and from the Indian Mesa and Dog Springs quadrangle to the northwest (Givens, 1957; Harrison, 1980; Coffin, 1981). Little alteration or other evidence for mineralization was seen within the Lion Mountain quadrangle during this study. One small area of oxidation reddening occurs in the first andesite hills south of Antelope Flats in the east-central part of the quadrangle. This area has been explored by a number of shallow prospect pits but no evidence of mineralization except reddened rock and minor calcite was observed in these pits. This oxidation is thought to be related to a small vent for part of the andesite of Lion Mountain and is probably not related to mineralizing fluids. Small areas of silicification were seen along a few of the faults in the north-central part of the quadrangle, but none of these was large or contained any obvious mineralization. Some economic potential may also exist for sediment-hosted uranium deposits within the lake basin sediments in the west half of the quadrangle.

Since the Lion Mountain quadrangle is situated on an outflow area peripheral to the main part of the Mogollon-Datil volcanic field, and is not known to contain cauldrons or major intrusions, a significant potential may exist for discovery of oil and gas in Mesozoic or Paleozoic rocks beneath the volcanic cover. See Chapin and others (1979) for a discussion of the oil and gas potential of the Riley-Puertecito area to the northeast of the Lion Mountain quadrangle.

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EXPLANATION

Quaternary Deposits

[Q] Quaternary Alluvial Deposits (Cross Sections Only) in the Lion Mountain area consist of bolson deposits related to the White Lake Basin of Pleistocene Lake Agustin and blow sand derived from this basin.

[Qa] Basin floor alluvium and very low gradient piedmont and valley deposits graded to present basin floor. Different morphologies were not separated because of their gradational nature.

[Qs] Blow Sand (0-50 ft, 15 m) Various types of sand dunes on basin floor, sheet sands on piedmont slopes and bedrock areas, and falling dunes on the lee (east and northeast) sides of hills. Scoured and grooved bedrock indicates a sand transport direction of approximately N 60 E. Map symbol often shown above symbol for unerlying deposits where these are known

[Qp] PIEDMONT SLOPE AND PEDIMENT DEPOSITS: Bolson deposits consisting of piedmont slope gravels throughout much of the area and a pediment surface on the western side of Lion Mountain. Almost all areas are now covered by several feet to several tens of feet of [Qs].

[Qtc] TALUS/COLLUVIUM: Active or stabilized talus slope deposits and surficial rock debris. Shown only where geologic information obscured.

Tertiary Volcanic and Sedimentary Rocks

[Tlm] Andesite of Lion Mountain (0-700 ft, 200 m) ANDESITIC LAVA FLOWS: Dark gray to black, coarsely porphyritic, dense to vesicular andesite lavas comprising several flows on Lion Mountain. Exposures extend several miles to the east to the central Gallinas Peak quadrangle. Flows contain from 10 to 25% total phenocrysts consisting of plagioclase, biotite, pyroxene, and magnetite. Several dikes (Tad) of a similar lithology are also present.

[Tpu] Popotosa Formation, upper member (0-100 ft., 30 m.) SEDIMENTARY ROCKS: Poorly exposed intervals with surface lag indicating unerlying sandstones and conglomerates.

[Tsc] South Canyon Tuff 26 m.y.(0-650 ft, 200 m) ASH-FLOW TUFFS: Simple to compound cooling unit of quartz-rich, one-feldspar rhyolite tuff. Lower member of light-gray to brownish-gray, crystal-poor (1-4%) tuff and an upper member of medium-gray to purple-gray, moderately crystal-rich (15-25%) one-feldspar tuff with abundant chatoyant sanidine and euhedral quartz. The two members are mapped together. Source unknown.

[Tlp] La Jara Peak Basaltic Andesite (0-180 ft, 55 m) BASALT TO BASALTIC ANDESITE LAVA FLOWS: Gray to brown, vesicular, aphanitic to slightly porphyritic lavas. Flows usually thin and interbedded with sedimentary rocks of the Popotosa Formation described below. Lavas typically contain a few percent plagioclase and red oxidized ferromag phenocrysts.

[Tp] Popotosa Formation (0-100 ft., 30 m) HETEROLITHIC SEDIMENTARY ROCKS: Conglomerates, sandstones, and local mudstones which intertongue with the thin flows of La Jara Peak Basaltic Andesite. Usually red to buff in color and occur as obscured colluvial outcrops. Coarser sediments contain clasts of [Tpw].

[Tpw] Rhyolite of Pinon Well (0-500 ft, 150 m) RHYOLITE LAVAS: Light-brown to pink, phenocryst-poor, flow-banded rhyolitic lavas which commonly have abundant spherulitic devitrification textures. Extends from South Well in the Gallinas Peak quadrangle several miles southwest to the northeastern part of the Arrowhead Well quadrangle. Contains 1 to 4% sanidine phenocrysts.

[Tju] La Jencia Tuff [New Name] (0-450 ft, 75m) ASH-FLOW TUFFS: upper member: Lt.-gray, moderately welded, crystal-poor, pumiceous, rhyolite ash-flow tuff. Overlies with angular unconformity units as old as the Spears Formation (Dog Springs quadrangle) and thickens locally in paleovalleys. Contains 1 to 3% sanidine phenocrysts and trace amounts of quartz, biotite, clinopyroxene, and plagioclase. Probably correlative with "Vicks Peak Tuff" which was erupted from the Nogal Canyon cauldron in the southern San Mateo Mountains.

[Tjl] lower member: Multiple-flow, compound cooling unit of moderately to densely welded, crystal-poor, rhyolite ash-flow tuffs. Usually very densely welded regionally but commonly poorly to moderately welded here. Contains lineated pumice in all but the poorest welded intervals. Contains 3-7% sanidine phenocrysts and minor amounts of small rounded quartz phenocrysts; traces of biotite, plagioclase, clinopyroxene, sphene and magnetite are also present. A thin interval of South Crosby Peak Formation, [Bornhorst, 1976] (0-20 ft, 6 m) is present in some areas but is mapped with the base of the lower La Jencia Tuff. The South Crosby Peak consists of light-colored, bedded and reworked lithic rich, poorly welded tuffs which contain about 10 percent total phenocrysts consisting of sanidine (7%), plagioclase (2%), biotite(1%), quartz (~1%), and traces of pyroxene and hornblende. The lower La Jencia Tuff was erupted from the interconnected Sawmill Canyon and Magdalena cauldrons in the central Magdalena Mountains.

[Thm] Hells Mesa Tuff: [Deal, 1973; Simon, 1973] 33 m.y. (0-800 ft, 245 m outflow; >3000 ft, 900 m cauldron) ASH-FLOW TUFFS: Simple cooing unit of pink to reddish-brown, densely welded, crystal-rich, quartz-rich, two-feldspar, rhyolitic tuffs. Pumice foliation typically indistinct in outcrop except near the base and top. Unit is zoned from quartz-free quartz-latite at base to quartz-rich rhyolite; abrupt increase in quartz occurs 10 to 25 feet above base. Erupted from Socorro cauldron located in the Magdalena, Socorro, and Chupadera mountains.

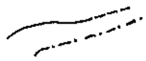
[Td] Datil Group (Cross-Sections only; Chapin and Osburn, 1982, Osburn and Chapin, 1982) Includes all rocks stratigraphically above the Baca Formation and below the Hells Mesa Tuff or its temporal equivalent.

[Tsu] Spears Formation upper member (300+ ft, 90 m) BASALTIC-ANDESITE LAVA FLOWS AND BRECCIAS: Brown to gray basaltic-andesite flows containing of pyroxene and smaller plagioclase phenocrysts; homolithic flow breccias and mudflow breccias often present between lava flows. Member completely eroded near Three Log Spring Canyon, just north of northeast corner of quadrangle before deposition of the overlying Hells Mesa Tuff.

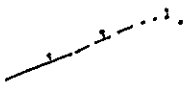
Tertiary Intrusive Rocks

[Tad] ANDESITIC DIKES: (to 20 ft., 6 m. wide) Thin, coarsely porphyritic, dark gray to purple, mafic dikes containing 10 to 25 per cent total phenocrysts consisting of abundant plagioclase and sparse pyroxene and magnetite. Very similar to petrographically, and probably comagmatic with, the andesite of Lion Mountain.

SYMBOLS



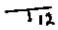
geologic contact, dashed where approximate, alternating dots and dashes indicate a contact inferred from equivocal data.



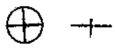
fault, dashed where approximate, dotted where covered, bar and ball on downthrown block.

shear zone with no provable stratigraphic offset

gravity slide block

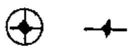


strike and dip of bedding or compaction foliation in ash-flow tuffs



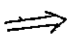
horizontal and vertical bedding

strike and dip of flow foliation in lavas and intrusions.



horizontal and vertical foliation

flow lineation in flow-banded ash-flow tuffs and lavas



lineation direction of wind scoured rock areas

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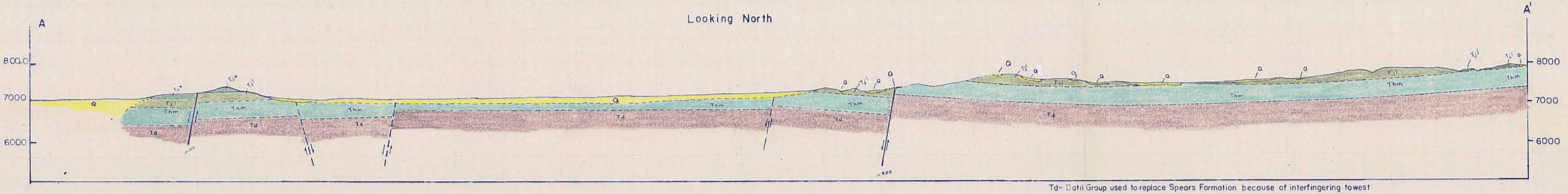
PLATE 1

GEOLOGY OF THE LION MOUNTAIN QUADRANGLE

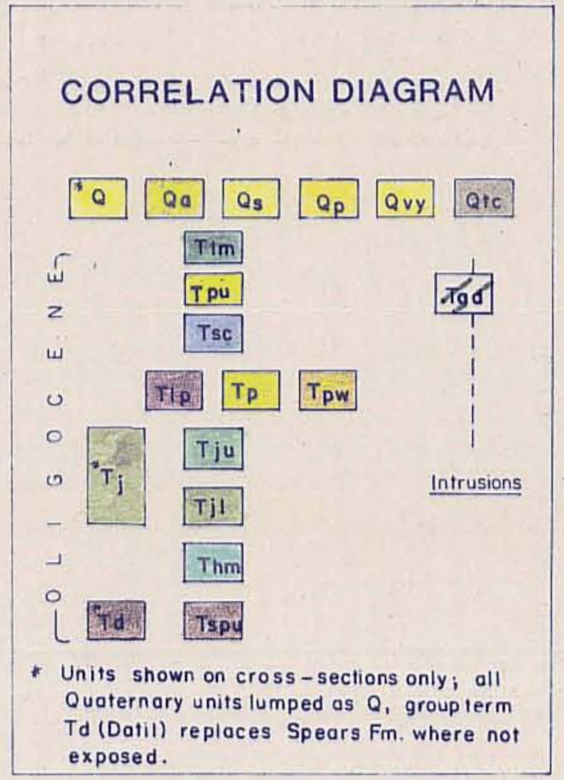
by
G.R. Osburn and T.M. Laroche
1981

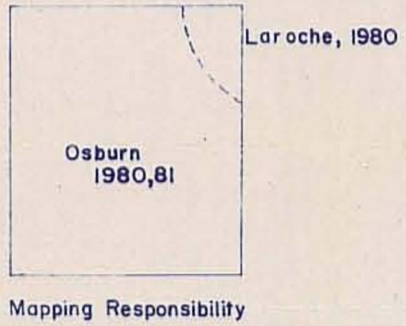


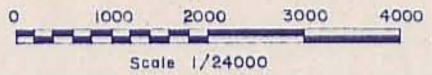
Td- Datil Group used to replace Spears Formation because of interfingering to west

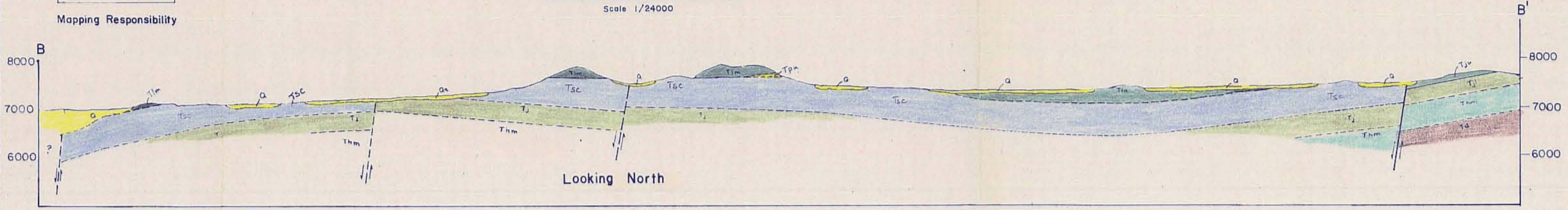
GEOLOGIC CROSS SECTIONS

NO VERTICAL EXAGGERATION









(OPEN FILE REPORT 139b)

(Osburn and Laroche, 1982) PLATE 2

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PLATE 2