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Pre-Cambrian rocks of the San Juan Basin

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PRE-CAMBRIAN ROCKS OF THE
SAN JUAN BASIN

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Pre-Cambrian rocks crop out in large and small patches in the uplifts on nearly all sides of the San Juan Basin. The largest areas of outcrop are in the Zuni Mountains, on the south side, the Nacimiento Mountains, on the east side, and the southwestern San Juan Mountains, on the north side of the basin. A very small outcrop of pre-Cambrian quartzite occurs in the Defiance Uplift on the west side of the basin.

In the Zuni Mountains the rocks consist principally of granite, metarhyolite (Wood 1941, pp. 32-33), granite porphyry, granite gneiss, schist, and some diorite and amphibole (Lindgren, Graton, and Gordon 1910, pp. 136 and 142). Some of the granite is tourmaline bearing. The pre-Cambrian occupies the central part of a northwesterly-trending faulted domal uplift. The foliation trends in several directions, but according to Clay T. Smith it is principally west-northwest.

The pre-Cambrian rock of the Nacimiento Mountains is dominated by red granite although granite gneiss, and dark-gray to black basic rocks occur locally (Renick 1931, p. 12; Lindgren, Graton, and Gordon 1910, p. 28). Pre-Cambrian quartzite crops out boldly along the north side of the Rio Brazos gorge in the Brazos Uplift which bounds the Chama re-entrant of the San Juan Basin along the northeast border.

The pre-Cambrian rocks along the north side of the basin are the most diverse and yet the best known. They have been mapped in some detail in the Needle Mountains, Engineer Mountain, and Silverton folios of the U. S. Geological Survey. The mapping of the pre-Cambrian rocks of this area was extended in the work of Cross and Larsen (1935) and they write an excellent summary of the pre-Cambrian rocks of the southwestern corner of the San Juan Mountains. More than 45 units have been recognized. The rocks are especially diverse in the Needle Mountains quadrangle, the center of which lies in the lofty and rugged peaks about 25 miles northeast of Durango, Colorado.

The principal divisions of these rocks are thought to contain representatives of both Proterozoic and Archeozoic time. They are as follows:

Granitic rock (Algonkian)
Needle Mountains group (Algonkian)
Irving greenstone (Algonkian)

Ancient schist and gneiss (Archean)

The ancient schist and gneiss are highly metamorphosed and probably include rocks of very different ages. They are a metamorphic complex that was derived from rocks ranging from granite to gabbro in composition. Intrusive and extrusive types as well as some originally clastic sedimentary rocks occur in the complex.

The Irving greenstone is a large mass of little to much metamorphosed igneous rocks which appear to have been principally volcanic and andesitic in composition.

The Needle Mountains group is a conformable series of generally mildly metamorphosed clastic sedimentary units which originally consisted dominantly of dark shale and sandstone. The group is extensively exposed in the Needle Mountains and in Uncompahgre Canyon south of Ouray (Kelley 1946). The rocks are now chiefly quartzite, phyllite, and mica schist. The group is at least 11,000 feet thick. The lower part of the group is known as the Vallecito conglomerate which contains pebbles of greenstone and schist in the lower part, and quartzite, jasper, hematite, and magnetite in the upper part. The upper part is known as the Uncompahgre formation.

The ancient schist and gneiss, the greenstone, and the Needle Mountains group are all extensively intruded by granitic rocks. Only slightly less than half of the pre-Cambrian terrane of the San Juan Mountains is made of the granitic rocks, which include principally plutonic rocks ranging from granite to gabbro and many dikes of pegmatite and aplite. All of them show little or no metamorphism.

As additional mapping of the pre-Cambrian areas of New Mexico is done, it will undoubtedly become apparent that the diversity of rock types known in the San Juan Mountains is widely distributed. For most of New Mexico as well as the pre-Cambrian areas surrounding the San Juan Basin representatives of the four principal lithologic divisions made are present. Regardless of the age assignment within the pre-Cambrian, it is quite probable that the rock divisions of greatest areal extent on the basement of the San Juan Basin are granitic rocks (45 per cent), schist and gneiss (30 per cent), quartzite and phyllite (15 per cent), and greenstone (10 per cent). Such a rough estimate may have some significance for possible influence of the pre-Cambrian complex upon gravity and magnetic measurements. However, greater differences

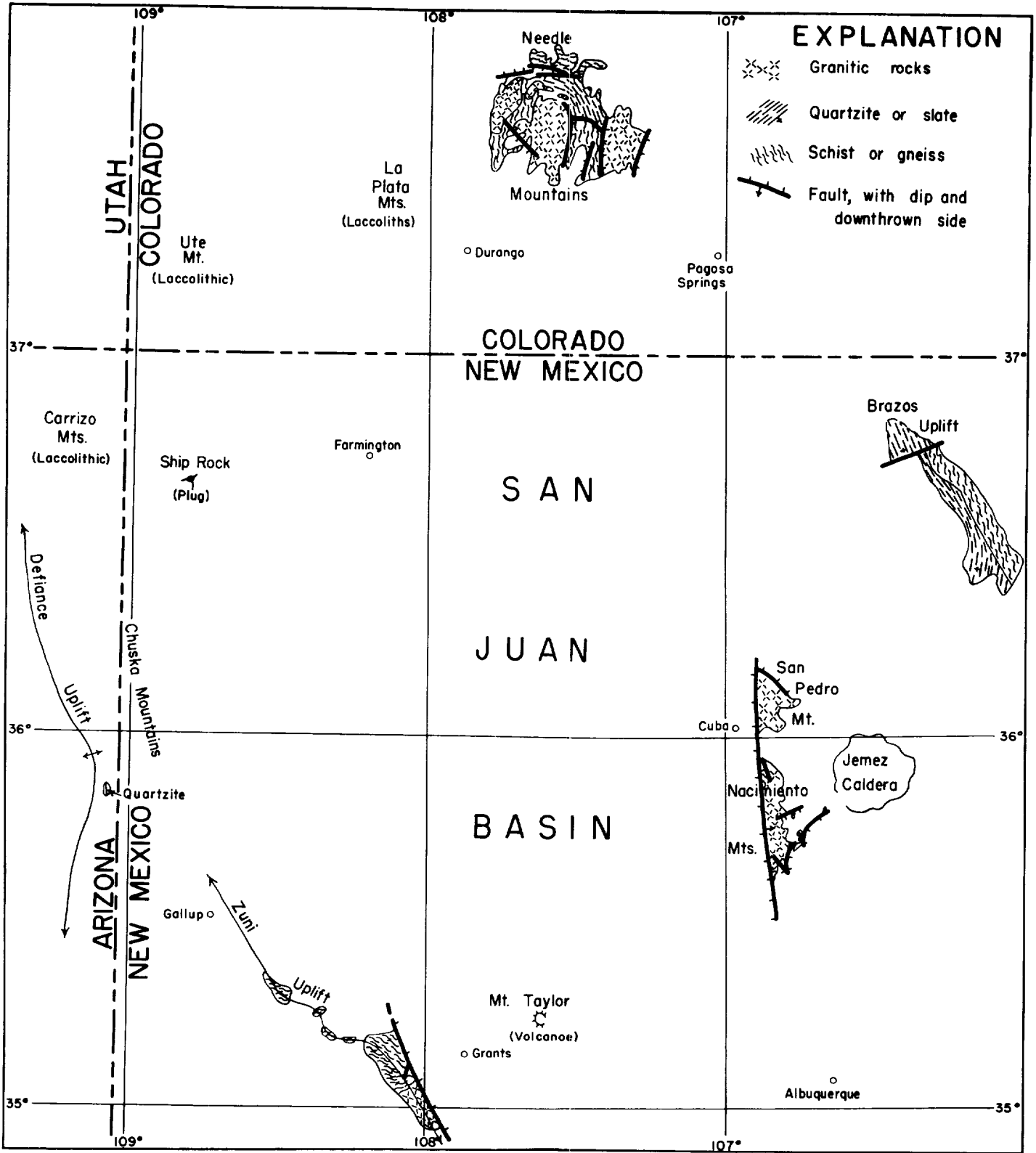
of density and magnetic susceptibility may exist in some places within the above divisions than in others. It is expectable that the areal extent of these differences within the major divisions might be relatively small.

The composition and physical nature of the pre-Cambrian is receiving greater attention in

petroleum geology because of (1) their influence upon geophysical measurements, (2) the importance of distinguishing the pre-Cambrian in cuttings from the immediately overlying sedimentary rocks, (3) the possible control of pre-Cambrian structure upon overlying structure, and (4) the effect that the pre-Cambrian surface has had upon the composition and texture of the overlying sediments.

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OUTCROP OF PRE-CAMBRIAN ROCKS AROUND THE SAN JUAN BASIN