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PRECAMBRIAN GEOLOGY OF THE SAIS QUARTZITE QUARRY, NORTHEAST SOCORRO COUNTY

A. J. BUDDING AND DAN J. HARTMAN[1]

New Mexico Institute of Mining and Technology, Socorro

INTRODUCTION

The Sais quarry is located some two miles north of Blue Springs store on U.S. Highway 60, adjacent to the Atchison, Topeka, and Santa Fe Railway main line from Belen to Clovis; it lies in the foothills of the Manzano Mountains near Abo Pass. The quarry has been operated by and for the A. T. & S. F. Railway producing crushed rock (quartzite) to serve as railroad ballast and for surfacing of station platforms. At the time of writing, the quarry has been inoperative for the last few years.

In view of the extensive quarrying operations and the resistant nature of the bedrock, excellent outcrops make possible a detailed examination of the Precambrian rocks. The southern part of the Manzano Mountains has been the subject of investigation by J. T. Stark et al., his work has been published as Bulletin 34 of the New Mexico Bureau of Mines and Mineral Resources. The geological map and cross sections, accompanying this bulletin, show the areal distribution and regional structural relationships of the lithologic units, discussed in this paper. In this connection, mention should also be made of the work of Stark and Dapples on the Los Pinos Mountains, south of the Sais quarry, and of the work of Reiche on the North Manzano Mountains. These three publications provide information on the eastern border of the Rio Grande trough in northeast Socorro County, and western Torrance County.

Within the quarry, the rocks are quartzites and schists of Precambrian age. A threefold division is recognizable in the northwest-dipping sequence, consisting from bottom to top of the Sais Quartzite, the Blue Springs Schist, and the White Ridge Quartzite (fig. 1). These units can be traced north into the Manzano Mountains where they are part of the eastern limb of a large syncline, or synclinorium, in the Precambrian rocks.

SAIS QUARTZITE

The lowest Precambrian unit in the quarry is the Sais Quartzite, which is the principal rock excavated. Outside the quarry, this unit forms a prominent ridge, paralleling the strike. The Sais Quartzite is bounded on the southeast by the Montosa thrust fault, which brings the quartzite in contact with Pennsylvanian strata. To the northwest, the Sais Quartzite is overlain by the Blue Springs Schist, and a gradational contact exists.

In the quarry, the Sais Quartzite is a white to light gray rock, with a yellow weathered surface. Near the Montosa fault, darker yellow and red colors predominate, presumably as a result of alteration of iron-bearing minerals by waters percolating along the fault plane. In the northeast and southwest corners of the quarry, where the walls exhibit a cross section of the Sais Quartzite, the alteration of massive quartzite beds with thinner schistose layers is well displayed. The schistose layers have a pale green color and show a well-developed cleavage, at a slightly smaller dip angle than the layering in the quartzite.

Examination of thinsections of these two types of quartzite, the massive and schistose, reveals a close similarity of the two. Quartz, in interlocking grains, makes up more than three-fourths of the rock, and sericite forms almost all the rest, with some magnetite and chlorite, and accessory constitutents, such as apatite, zircon, and tourmaline. In the massive quartzite, the quartz grains average about 0.3 mm in size. They are separated either by selvages of sericite or by aggregates of minute quartz grains. In the latter instance, the rock exhibits a mortar structure. Many of the larger quartz grains are abundantly filled with inclusions. In the schistose quartzite, none of the larger quartz grains is present, all quartz having been recrystallized, frequently in lens-shaped, multigrain aggregates. The sericite flakes, instead of forming felty clusters or selvages between the quartz grains, now show parallel orientation. Sericite is a slightly more common rock constitutent, and tourmaline is more abundant.

The Sais Quartzite is the metamorphosed equivalent of an impure, slightly argillaceous sandstone, perhaps with a ferruginous cement. The different appearance of the massive quartzite beds and the schistose layers must have been brought about by

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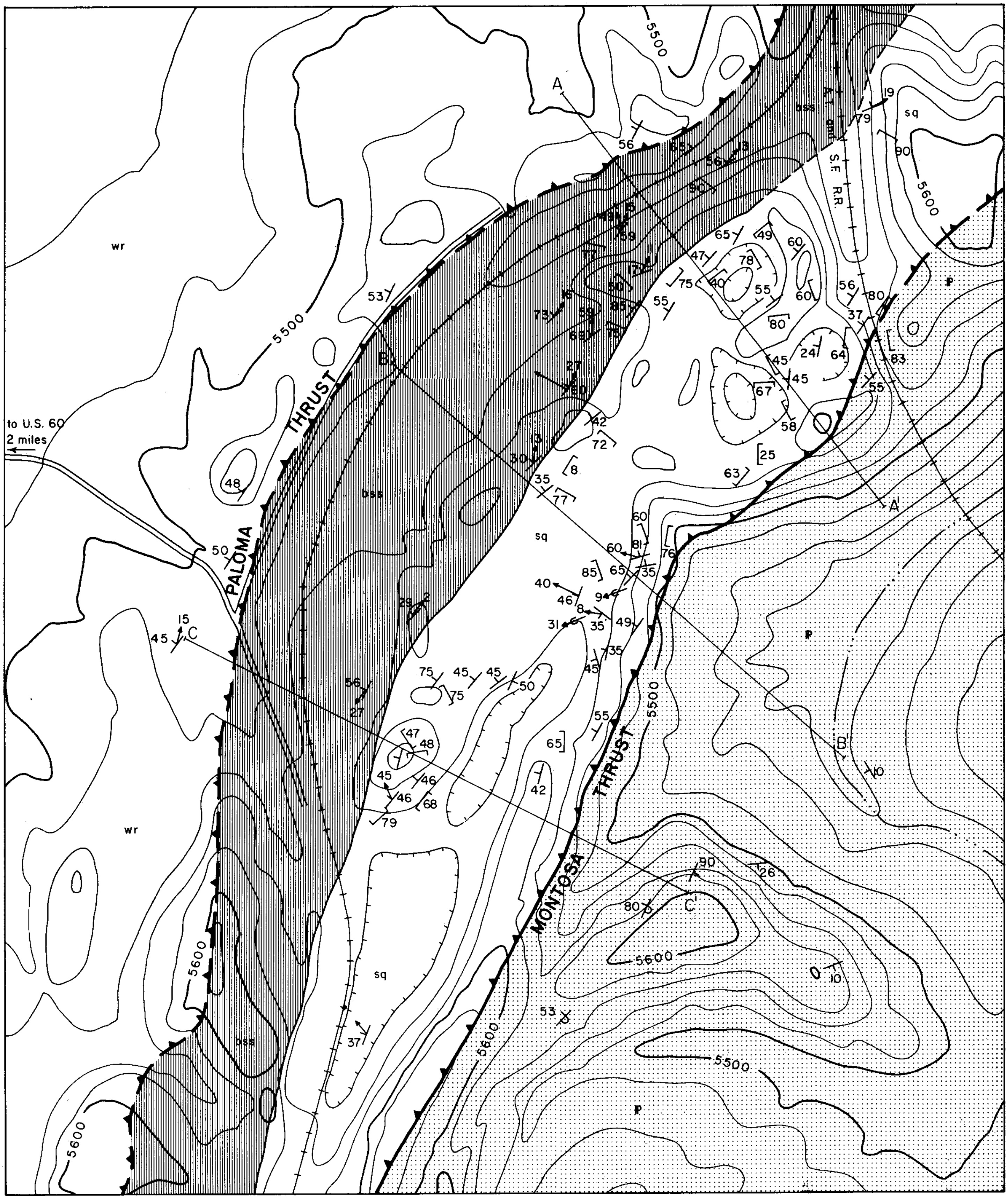

FIGURE 1
Geologic map of the Sais Quarry.

slight differences in initial composition of the sediment, but it has been accentuated during deformational processes.

The approximate thickness of the Sais Quartzite in the quarry is 500 feet. The lower contact of this unit is not exposed; elsewhere in the Manzano Mountains, as much as 2000 feet of quartzite has been reported (Stark, 1956).

BLUE SPRINGS SCHIST

Lying conformably above and to the west of the Sais Quartzite is a greenish gray schist unit known as the Blue Springs Schist. A gradational zone of quartzite and schist, as much as 50 feet wide, exists at the contact. Within the schist, quartz veins form stringers and pods, which vary in length and thickness. In some outcrops, the quartz veins make up 20 percent of the surface area.

The predominant rock type is a garnetiferous albite-chlorite-sericite schist, containing quartz 60% sericite 20%, chlorite 10%, albite 5%, garnet 3%, and magnetite and hematite 2%. The quartz grains, which average 0.1 mm in size, form granoblastic bands of interlocking crystals, while the micaceous minerals show a strong orientation, parallel to the schistosity. The garnet, which is of a spessartite-rich variety, forms poikiloblastic porphyroblasts up to two millimeters in size. The shape of the garnet crystals, and the orientation of lines of inclusion, mostly quartz, indicate rotation during the growth of the mineral. Accessory constituents are apatite, tourmaline, and rutile.

Several directions of lineation can be recognized in the outcrops of the Blue Springs Schist. The most prominent direction, trending north-northeast and plunging either north-northeast or south-southwest, consists of closely spaced corrugations of about two millimeters wavelength. A second set, not so common as the first, trends northwest and is younger. The wavelength of the second set is measurable in centimeters.

About 250 feet of Blue Springs Schist is present in the area.

WHITE RIDGE QUARTZITE

The slopes of the foothills to the west of the quarry are covered with white quartzite pebbles, weathered out from the White Ridge Quartzite. According to Stark (1956), the Paloma Thrust fault separates the White Ridge Quartzite from the Blue Springs Schist in the vicinity of the Sais quarry. He recorded a thickness of about 2000 feet for this formation in the Manzano Mountains.

PENNSYLVANIAN ROCKS

East of the Montosa thrust fault, rocks of Pennsylvanian age crop out in the form of limestones and sandstones. The thrusting has overturned the beds adjacent to the fault. East of the Sais quarry, a "thrust syncline" in the Pennsylvanian beds is well exposed.

STRUCTURE AND METAMORPHISM

Precambrian deformation and metamorphism have been decisive factors in shaping the mineralogical and structural features of the rocks in the Sais quarry. Low-grade metamorphism of arenaceous and argillaceous sediments has formed the quartzites and schists of the Precambrian sequence.

The north-northeast-trending lineation, with its shallow plunge, seems to be closely related in space to the syncline of the same trend, which is such a characteristic structure of the Precambrian part of the South Manzano Mountains. The Precambrian rocks, exposed in Sais quarry, are part of the eastern limb of this syncline.

In Figure 2, three cross sections have been drawn, from north to south, AA′, BB′, and CC′. These cross sections have been arranged in accordance with the plunge of the north-northeast lineation. In this manner, AA′ occupies a position which is structurally higher than, for instance, cross section BB′. The vertical separation of the cross sections is determined from the expression

vertical separation = horizontal distance between cross sections x tangent of average plunge between cross sections.

In combining the three cross sections in this manner, minor structures can be traced in depth.

The Montosa thrust fault is a post-Pennsylvanian, probably Laramide feature. Its trend, parallel to the Precambrian syncline on the west slope of the South Manzano Mountains, and its location, coinciding approximately with the steep east flank of this syncline, indicate that Precambrian structures have had a pronounced influence on the development of this fault. Rather than a flattening of this fault with depth, as shown in Stark's cross sections (1956), the authors would like to offer the possibility of this fault being vertical or steep reverse in the Precambrian basement and curving to a shallower dip in a higher level of the crust, where basement and sedimentary cover are in contact.

The Laramide deformation may have created a different tectonic style in the Precambrian basement, as compared with the sedimentary cover. Be-

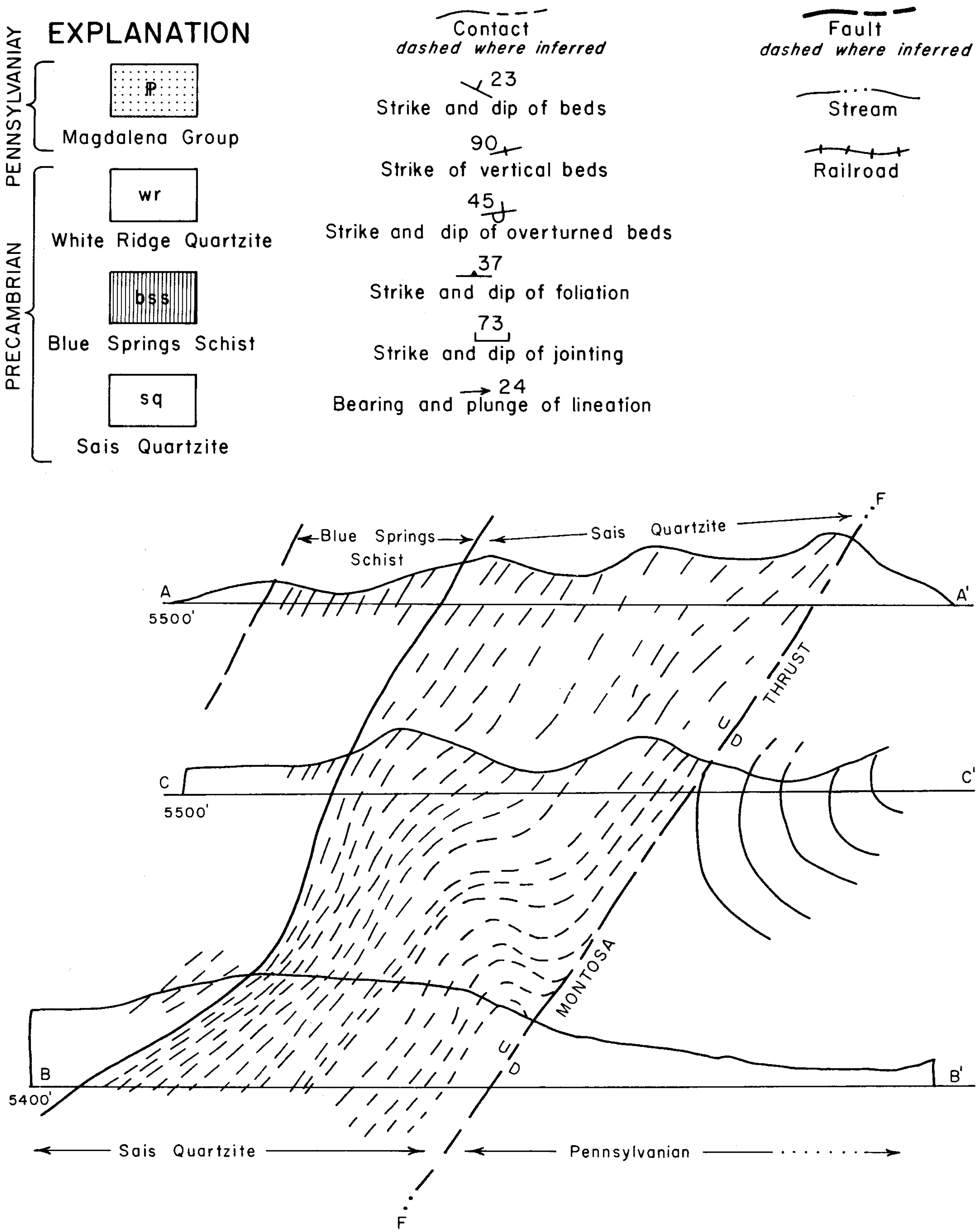

FIGURE 2

Geologic cross-sections of the Sais Quarry, and explanation for figure 1.

cause of the presence of both elements in the vicinity of the Sais quarry, further detailed structural investigations of this area, and of the vicinity of the Montosa thrust fault in general, would seem to be promising.

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