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Stratigraphic Studies of the Gilmore City Formation at Rutland, Iowa

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Abstract. An interesting relationship between the beds of limestone and dolomite in a quarry and at outcrops along the Des Moines River near Rutland, Iowa, is described. In the quarry a composite of 11 feet of limestone-dolomite-limestone is exposed, whereas at an outcrop along the river 300 feet northeast the dolomite is absent and 12 feet of limestone is exposed. These beds of limestone and dolomite have been referred to the St. Louis formation uncomformably overlying Gilmore City limestone. The author proposes that the dolomite represents an area of late diagenetic alteration within the Gilmore City formation.

During a study of the stratigraphy of the Gilmore City formation, the author observed an interesting relationship between the beds of limestone and dolomite in a quarry. This quarry is located one mile south of Rutland in the NW¼ SE¼, Sec. 29, T. 92 N., R. 29 W., Humboldt County, Iowa. The relationship is shown in Figure 1*a*, in that at A and B the limestone-dolomite sequence is present, but at C only limestone occurs. These beds were previously studied at outcrops along the Des Moines River near Rutland by Van Tuyl (1921) and by Laudon (1931, 1933) and were referred to the St. Louis formation unconformably overlying Gilmore City limestone. The above mentioned quarry was not in operation when their studies were made.

DISCUSSION

In Figures 1*a* and 1*c*, the traverse from A to C illustrates a fairly level bedrock surface, as well as comparable thickness of the exposure at A, B, and C. The lithology is similar at points A and B, and in descending order consists of light to dark gray lithographic, slightly oolitic limestone; brown, saccharoidal to coarsely crystalline dolomite and dolomite-limestone "breccia"; and light gray, oolitic to pisolitic limestone. The limestone at C consists of light gray, oolitic to pisolitic, fossiliferous limestone containing numerous inclusions of clear calcite. The oolitic-pisolitic texture of the limestone at each point strongly suggests Gilmore City limestone. In correlating the beds, the lowermost unit of limestone is similar at A, B, and C, and the uppermost bed of limestone contains enough clots of oolites at A and B to correspond to the same unit at C.

The problems to be solved are where does the dolomite pinch out

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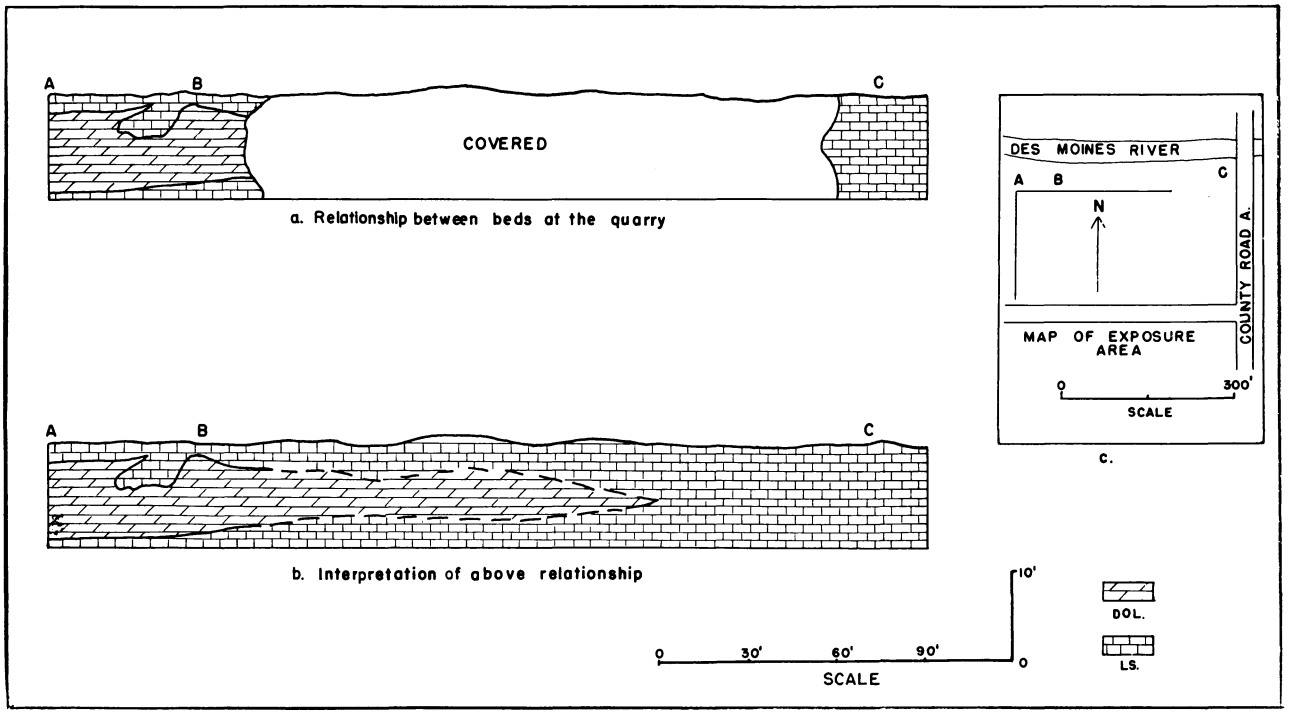

Figure 1. Relationship of the beds at the quarry, and the interpretation of this relationship.

between B and C, and what is the reason for its disappearance? Unfortunately, the area between B and C is covered and the actual contact cannot be observed. To answer the latter question four possibilities might be considered: (1) a fault, (2) an unconformity, (3) a facies change during deposition, or (4) late diagenetic alteration. From the studies made and the evidences seen, the author is in favor of the last possibility.

Many characteristics of late diagenetic dolomite discussed by Fairbridge (1957) have been observed in these dolomites and are as follows:

1. Clear-cut primary bedding features that are sometimes cut across by the dolomitic boundaries.

2. Unaltered country rock that may be entirely surrounded by coarsely crystalline dolomite.

3. The almost, but not complete, obliteration of primary structures such as fossils, oolites, ripple marks, etc.

4. Coarsely crystalline dolomite that passes laterally out into nonodolomitized limestone.

One of the examples of a primary bedding feature that has been cut across by the dolomite boundary is illustrated at B in Figure 1*a*. The bedding planes visible in the limestone in this lobe-shaped structure have been preserved in the dolomite on either side of it. Similar relationships were seen in this quarry as well as in a larger quarry 100 feet directly south and have been discussed in detail by Wagner (1960).

Numerous examples of unaltered country rock partially or completely surrounded by coarsely crystalline dolomite exist in the beds of dolomite, especially near the irregular contact between the dolomite and limestone. Fragments of limestone ranging in size from 2 mm. up to 10 inches in diameter have been completely surrounded by dolomite. Equally as interesting and possibly even more confusing are the mixtures of unaltered limestone in a dolomitic matrix that project as vertical wedges into both the limestone and the dolomite. Enough of these limestone fragments contain the oolitic-pisolitic texture to enable one to refer to the limestone as Gilmore City.

The primary structures that may have been destroyed by the alteration process are the oolites. Various specimens of dolomite surrounding oolitic limestone fragments were studied under the microscope, but none of the oolite structures were found in the dolomite. The dolomite is coarsely crystalline and contains many well-formed rhombs. No fossils were found in the dolomite, but brachio-

pods and corals are present in the limestone. This, however, is not a good criterion to use because fossils are quite rare at this location.

One of the more common characteristics of late diagenetic dolomite is the coarsely crystalline dolomite which grades laterally into nondolomitized limestone. This relationship occurs at a number of locations in the quarry, and the intensity of the gradation is variable. In some instances it is gradual, grading from dolomite to rubbly dolomite and limestone fragments to lithographic limestone. In others, the dolomite-limestone contact is very abrupt and well defined.

The author is convinced that enough evidence has been presented to substantiate the interpretation that is illustrated in figure 1*b*. The outline of the contact between the limestone and the dolomite is no doubt much more irregular, but this has to be postulated because the area is covered. The important point is that the dolomite is present at A and B, but not at C, and that sufficient primary features of the limestone have been preserved in the dolomite. The author further favors the concept that these beds have undergone a process of preferential replacement of slightly arenaceous limestone, as suggested by the presence of thin shale-like seams along the irregular boundary between the dolomite and the limestone. These "shales" were broken down and examined under the microscope, and were found to be composed mainly of authigenic quartz crystals and dolomite rhombs. A majority of the quartz crystals were doubly terminated and the remainder showed evidence of secondary over-growths.

In conclusion, the author proposes to call the dolomites in this area a product of post-diagenetic alteration within the Gilmore City formation rather than referring them to the St. Louis formation.

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