CLASSIFICATION OF DOLOMITE ROCK TEXTURES[1]

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ABSTRACT: Dolomite rock textures can be classified according to crystal size distribution and crystal boundary shape. The classification scheme presented here is largely descriptive but carries genetic implications because size distribution is controlled by both nucleation and growth kinetics, and crystal boundary shape is controlled by growth kinetics.

Size distributions are classified as unimodal or polymodal. Crystal boundary shapes are classified as planar or nonplanar. If the evidence permits, a complete classification includes a description of recognizable allochems, matrix, and void filling. Allochems and preexisting cements may be unreplaced, partially replaced, replaced mimically, or replaced nonmimically. Allochems may be dissolved, leaving molds. Matrix can be unreplaced, partially replaced, or replaced by a unimodal or polymodal size dolomite.

Unimodal size distributions generally indicated a single nucleation event on a unimodal substrate. Polymodal sizes can be formed by multiple nucleation events on a unimodal or polymodal substrate or differential nucleation on an originally polymodal substrate. Planar crystal boundaries develop when crystals undergo faceted growth, and nonplanar boundaries develop when crystals undergo nonfaceted growth. Nonplanar boundaries are characteristic of growth at elevated temperature (> 50°C) and/or high supersaturation. Both planar and nonplanar dolomite can form as a cement, replacement of $CaCO_3$, or neomorphism of a precursor dolomite.

INTRODUCTION

The dolomite-rock-classification scheme presented here is descriptive of textures that develop as a result of the kinetics of dolomite nucleation and growth. The major divisions made in this classification are based on 1) whether the crystal size distributions are unimodal or polymodal, and 2) whether crystal boundaries are planar or nonplanar. The classification includes description of allochems and matrix, which are often selectively or differentially replaced (Cullis 1904; Lucia 1962; Murray 1964; Murray and Lucia 1967; Sibley 1982). The fundamental importance of crystal shape was recognized by Friedman (1965) when he introduced the shape terms: *idiotopic, hypidiotopic,* and *xenotopic.* Friedman's classification is useful in categorizing some dolomites (Zenger 1981; Randazzo and Zachos 1984; Shukla and Friedman 1983). We prefer to classify crystal-boundary shapes as *planar* or *nonplanar* (previously defined as idiotopic or xenotopic; Gregg and Sibley 1984) because this distinguishes shapes that characterize different mechanisms of crystal growth.

The dolomite classification presented here (Fig. 1) emphasizes diagenetic textures. We use the word *texture* in the broad sense, referring to the interrelationship of the fundamental properties of the rock: crystal shape, size, orientation, and packing (see Blatt et al. 1980, p. 9–10). The textures that are described by this classification can be interpreted in terms of the processes that control nucleation and growth of crystals. We will review the theoretical aspects of nucleation and growth before we present the classification because the theory provides the rationale for classification as well as the basis for interpreting any diagenetic texture.

THEORY

Nucleation Effects

Homogeneous nucleation of crystals results from the random collisions of atoms in solution, forming nuclei of a critical size that may continue to grow. This critical size is determined by the activation energy for nucleation, which is a function of supersaturation and the surface free energy of the nuclei (see Walton 1969). In contrast, heterogeneous nucleation occurs when nuclei form on a substrate. The rate of heterogeneous nucleation is greater than the rate of homogeneous nucleation because of the lower surface energy involved in the formation of critical nuclei on a substrate. This reduces the critical size necessary for the formation of stable nuclei, and therefore nucleation may occur more rapidly at lower degrees of supersaturation. During diagenesis there is a high density of suitable substrata, and therefore nucleation is almost always heterogeneous (Berner 1980, p. 95). Dolomitization involves heterogeneous nucleation on a $CaCO_3$ substrate. Nucleation will be favored by 1) high supersaturations with respect to dolomite, and 2) a large number of available active sites, such as surface kinks, for nucleation. Active sites are the preferred location for nucleation because they lower the surface area of the nuclei. Substrates with a high surface area to volume ratio such as micrite are favored for nucleation because the high surface area provides numerous active sites for nucleation.

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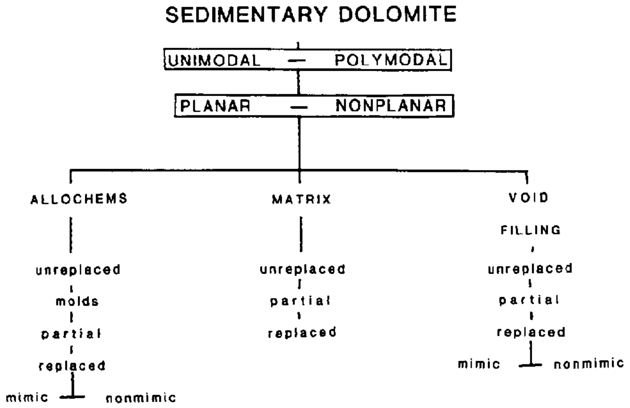


FIG. 1.—Classification of dolomite textures. Use the classification as a flow chart. All samples are classified as unimodal or polymodal and planar or nonplanar. Given samples that have recognizable allochems, matrix and void filling, these should be described according to the indicated adjectives. Examples of the usage are given with photomicrographs.

Growth Effects

In systems that are not controlled by transport kinetics, the rate of crystal growth and crystal morphology are determined by the kinetics of surface attachment of atoms or molecules to the crystal (Jackson 1958; Human et al. 1981; Sunagawa 1982). A surface-roughness factor relates the relative surface free energy of a growing crystal to the enthalpy of formation, degree of supersaturation, and temperature (Jackson 1958). At low supersaturation and/or temperatures, crystal growth occurs by nucleation at active sites and lateral migration of layers or growth spirals. This produces faceted crystals and planar interfaces. At high supersaturations, referred to as the critical saturation, or above some temperature, referred to as the critical roughening temperature, growth occurs by random addition of atoms to the crystal surface. Above the critical saturation and/or critical roughening temperature, nonplanar interfaces may form. The roughness factor has been calculated for only a few crystal solution systems (Lewis 1975; Weeks and Gilmer 1979; Human et al. 1981; Bennema 1984) and not for the carbonate minerals. Such calculations require knowledge of either the enthalpy of fusion or the enthalpy dissolution (Jetten et al. 1984). Neither is known for dolomite. Therefore, we cannot evaluate the critical roughening temperature for dolomite. Still, the concept of surface roughening should apply (Jackson, writt. and pers. comm., 1980) and a critical roughening temperature for dolomite has been estimated to lie between 50° and 100°C (Gregg and Sibley 1984, 1986).

Planar as well as nonplanar dolomite crystals may form above the critical roughening temperature. Although it is not entirely clear why planar growth may occur above the critical roughening temperature, it is possible that impurities in the growth media act to stabilize crystal facets (Gregg and Sibley 1984). Theoretically, nonplanar dolomite can form at low temperatures under conditions of high supersaturation. Such occurrences are probably rare.

Submicron-size crystals may have curved faces because at very small sizes, the surface free energy becomes dominant over the free energy contributions due to the anisotropy of the internal structure of the crystal. It is this internal structure that causes and controls facet morphology (Dowty 1976). As crystals become larger, the surface free energy contribution becomes smaller and facets develop.

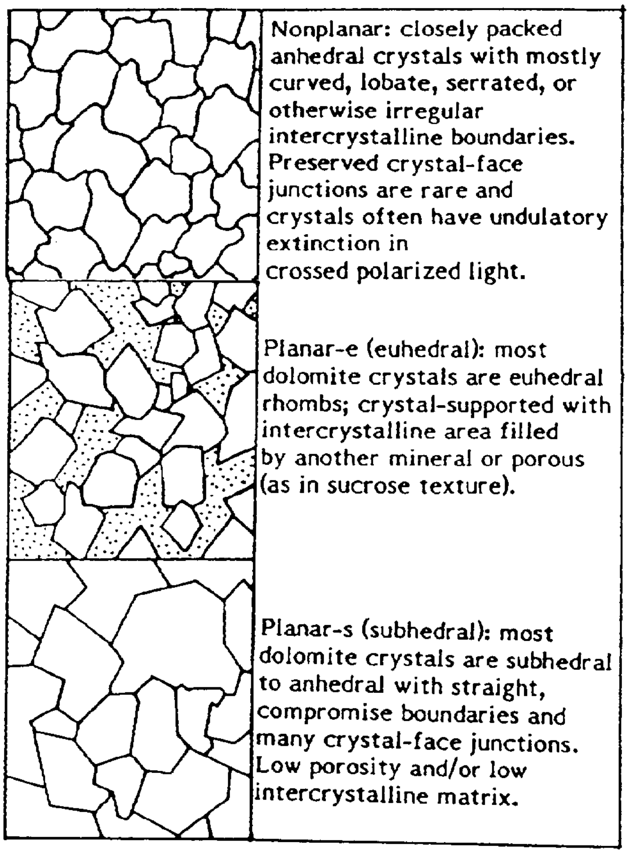
Crystal Size

Crystal size is controlled by an interplay between nucleation and growth kinetics (Spry 1969, p. 125–136). Both nucleation and growth rates increase with temperature, and relative differences between the increases will determine the effect of temperature on crystal size (Genck and Larson 1972). If the nucleation rate increases faster than the growth rate, a relatively finer crystalline aggregate will result at high temperature. On the other hand, if the growth rate increases faster than the nucleation rate, a relatively coarser crystalline aggregate will result at higher temperature. Dolomite crystal growth rate may dramatically increase above the critical roughening temperature (see section above). Therefore, if all other conditions remain constant, dolomitization at high temperature should produce coarser crystals than at low temperature. Because other factors such as composition of substrate and supersaturation also affect nucleation and growth kinetics, it is difficult to quantify the relationship between dolomite crystal size and temperature. For instance, a high density of nucleation sites in a substrate and/or high supersaturation might produce a finely crystalline dolomite, regardless of the temperature. Therefore, although size may be an important indicator of the diagenetic milieu, it should not be used alone to interpret the conditions of dolomitization.

Whether the size distribution of dolomite is unimodal or polymodal is also determined by nucleation and growth kinetics. Unimodal size distributions result from a single nucleation event on homogeneously distributed nucleation sites combined with uniform growth rates. Polymodal size distributions may develop from a heterogeneous distribution of nucleation sites, multiple periods of nucleation, or variations in the local growth rate. Variations in growth rate could also result from variations in the rate of solute delivery to the growing crystals at different sites in the rock.

Reactant Mineralogy

The mineralogy of the reactant (e.g., calcite, high-Mg calcite, or aragonite) should affect the rate of dolomitization because of the difference in the free energy of the reactants. Therefore, we predict that aragonite would always be dolomitized faster than low-Mg calcite of a similar surface area. High-Mg calcite has a higher standard free energy than low-Mg calcite and, therefore, should be dolomitized faster than low-Mg calcite. The exact change in standard free energy of high-Mg calcites with different amounts of $MgCO_3$ is still debated (Mackenzie et al. 1983).



Nonplanar: closely packed anhedral crystals with mostly curved, lobate, serrated, or otherwise irregular intercrystalline boundaries. Preserved crystal-face junctions are rare and crystals often have undulatory extinction in crossed polarized light.

Planar-e (euhedral): most dolomite crystals are euhedral rhombs; crystal-supported with intercrystalline area filled by another mineral or porous (as in sucrose texture).

Planar-s (subhedral): most dolomite crystals are subhedral to anhedral with straight, compromise boundaries and many crystal-face junctions. Low porosity and/or low intercrystalline matrix.

FIG. 2.—Planar and nonplanar dolomite textures.

However, at some concentration of $MgCO_3$ in the calcite, the free energy of the high-Mg calcite will be greater than the free energy of aragonite, and, at this point, high-Mg calcite should be dolomitized faster than aragonite.

Experiments by Katz and Matthews (1977) and Gaines (1980) demonstrated that aragonite is dolomitized faster than low-Mg calcite, but in these experiments, the ion activity product of Ca^+ and CO_3^{2-} was controlled by the reactant. Therefore, the solution chemistry was not the same in the experiments with the different reactants. We have dolomitized mixtures of aragonite and calcite at 175°C and found that the aragonite in the mixture was 100 percent dolomitized before any of the calcite was replaced. The aragonite and calcite were the same size, but we do not know if they had the same number of active sites.

Neomorphism

Neomorphism is an important process in dolomite paragenesis. We use the term *neomorphism* to include the transformation of poorly ordered and/or nonstoichiometric dolomite to ordered and stoichiometric dolomite (Gregg and Sibley 1984). We do not use the term *recrystallization* because this transformation from nonstoichiometric and/or poorly ordered (protodolomite) to stoichiometric and/or ordered dolomite can be considered a change in mineralogy. Neomorphism also includes the surface-energy-driven increase in size from a fine crystalline to coarse crystalline rock. However, it is unlikely that crystal size alone provides an adequate driving force for neomorphism except under epigenetic and metamorphic conditions. Therefore, it is possible for planar dolomite crystals that formed at low temperature to persist above the critical roughening temperature. The process of neomorphism does not include dolomitization of $CaCO_3$.

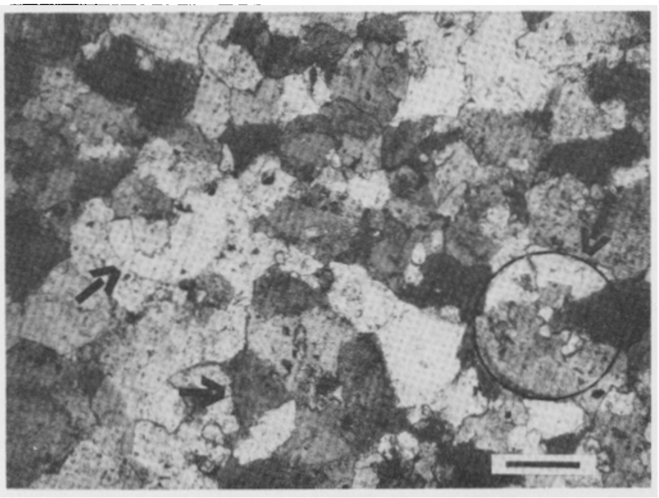


FIG. 3.—Unimodal, nonplanar dolomite with nonmimically replaced allochem (ghosts of ooids). There are crystal-face junctions on 16.5% of the crystals based on 263 crystals counted. Arrows point to circular ghosts. The ghosts' structure on the right has been enhanced by tracing with a pen. Crossed polars. Bonneterre Fm., Cambrian, Missouri. Scale bar = 0.5 mm.

CLASSIFICATION

The classification scheme we propose is hierarchical (Fig. 1), with two major categories: 1) crystal size distribution—unimodal or polymodal, and 2) crystal boundary shape—planar or nonplanar (Fig. 2). Planar textures are further subdivided as euhedral (e) or subhedral (s). Where the evidence permits, the classification may include a description of the original allochems, matrix, and void filling. In many cases it will be sufficient to classify a sample simply with the two major categories. For example, Figure 3 shows a unimodal, nonplanar dolomite. However, detailed analyses may require a more detailed description. Figure 4 shows a polymodal, planar-s dolomite with allochem molds, a unimodal matrix, and void-filling dolomite. The more detailed description often involves observations and petrographic interpretations with a lower degree of certainty than those necessary to determine the size distribution and crystal shape. Because these interpretations may be very uncertain, the value of detailed classification must be weighed against the problems inherent in such interpretations.

The first step in classifying a sample is to determine if the dolomite crystal size distribution is unimodal or poly-

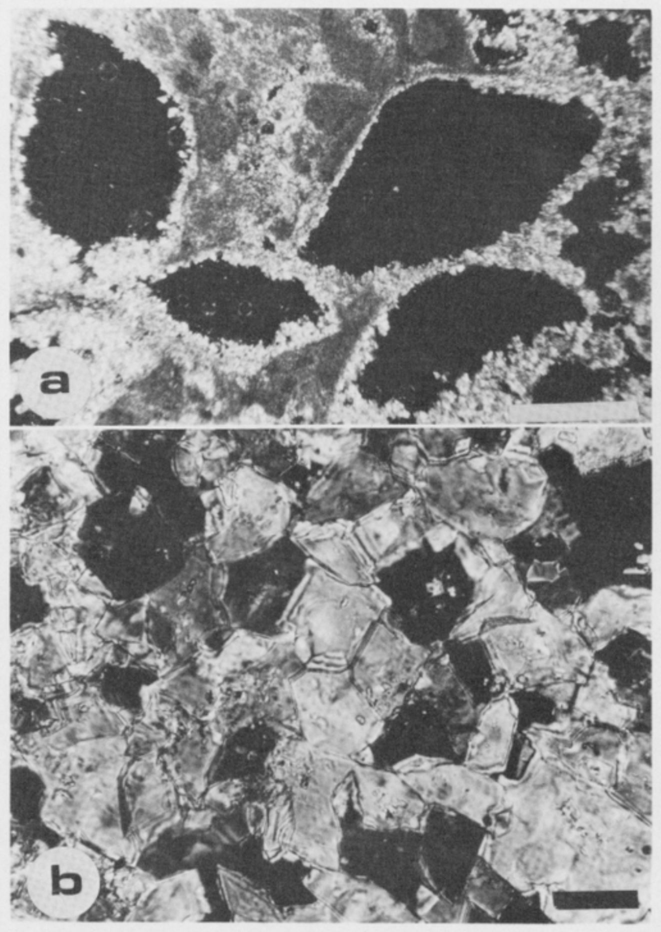


FIG. 4.—a) Polymodal, planar-s dolomite with nonmimically replaced coralline algae, foram molds (dark), and void-filling dolomite. Crossed polars. Scale bar = 0.25 mm. b) Planar-s matrix from a. Point counts of 213 crystals indicate that 46% have crystal-face junctions. Crossed polars. Seroe Domi Fm., Pliocene, Aruba, N.A. Scale bar = 0.2 mm.

modal. This distinction can be made qualitatively or quantitatively by measuring crystal diameters in thin section (Harrell and Eriksson 1979). The second major level of the classification is to categorize the dolomite crystal shape as planar or nonplanar. The terms *planar* and *nonplanar* are equivalent to the terms *idiotopic* and *xenotopic* in Gregg and Sibley (1984). We chose to change the terminology because planar and nonplanar are simpler. We also used xenotopic in a significantly different sense from that used by Friedman (1965), and this has caused some confusion. Planar dolomite crystals have straight boundaries. Nonplanar dolomite crystals have curved, lobate, serrated, indistinct, or otherwise irregular boundaries, and they commonly have undulatory extinction. Saddle dolomite is nonplanar dolomite cement. It is possible for nonplanar dolomites to have irregular dolomite-dolomite crystal boundaries and planar dolomite solution or dolomite–other-phase boundaries. The reason for this is that dolomite-dolomite crystal boundaries will generally have a lower surface energy than dolomite–other-phase boundaries.

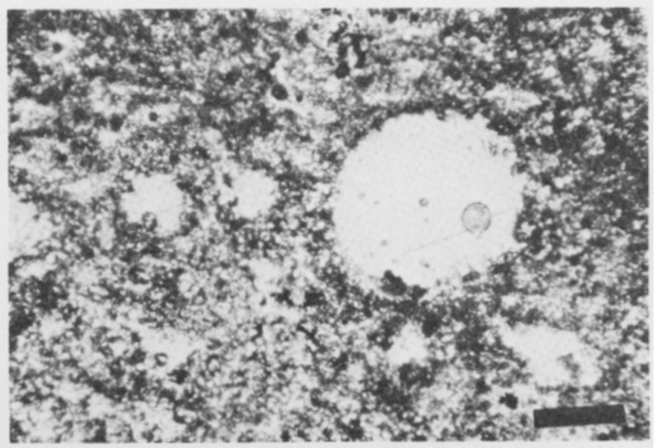


FIG. 5.—Unimodal, planar-e dolomite with crinoid molds. Burlington Fm., Mississippian, Missouri. Plane light. Scale bar = 0.5 mm.

If a rock has a high porosity and planar crystals, the crystals will tend to be euhedral. This texture is referred to as planar-e (see Fig. 5). If a rock has a low porosity and planar dolomite, the crystals will be subhedral to anhedral and referred to as planar-s. Qualitative inspection is generally adequate to distinguish planar-s and nonplanar dolomite, but occasionally the distinction may be difficult to make. Therefore, we developed quantitative criteria for differentiating the two textural types based on the number of crystals with crystal-face junctions (see Fig. 6 and Table 1). A full discussion of this technique is found in Gregg and Sibley (1984, p. 913). Quantitative criteria assure reproducible classification of samples. Point counts of a number of dolomite samples show that approximately 50 percent of the crystals in subhedral to anhedral planar dolomites have crystal-face junctions, whereas only 20 percent of the crystals in nonplanar dolomites have crystal-face junctions (Table 2). We have arbitrarily chosen 30 percent as the minimum number of crystal-face junctions in a planar dolomite. Occasionally, a rock may be composed of both planar and nonplanar dolomite. In such a case we classify the rock according to the more abundant shape, then note the minor shape. For example, one may find a polymodal, planar-s dolomite with the matrix replaced by planar-s dolomite and allochems replaced by nonplanar dolomite (Fig. 7).

Further description of a dolomite may include characteristics of allochems, matrix, and void filling. Allochems may be unreplaced, dissolved leaving molds, replaced, or partially replaced. If they are replaced, they may be mimically (Fig. 8) or nonmimically replaced (Fig. 9). Mimic replacement (Kaldi and Gidman 1982) refers to preservation of the form and internal structure of an allochem. Mimic replacement requires abundant dolomite nuclei unless the allochem being replaced is a single crystal such as an echinoid fragment. Mimic replacement does not require pseudomorphic replacement of the crystals making up the fossil. Nonmimic replacement may preserve the form but not the structure of an allochem. This will occur if there are relatively few crystals replacing

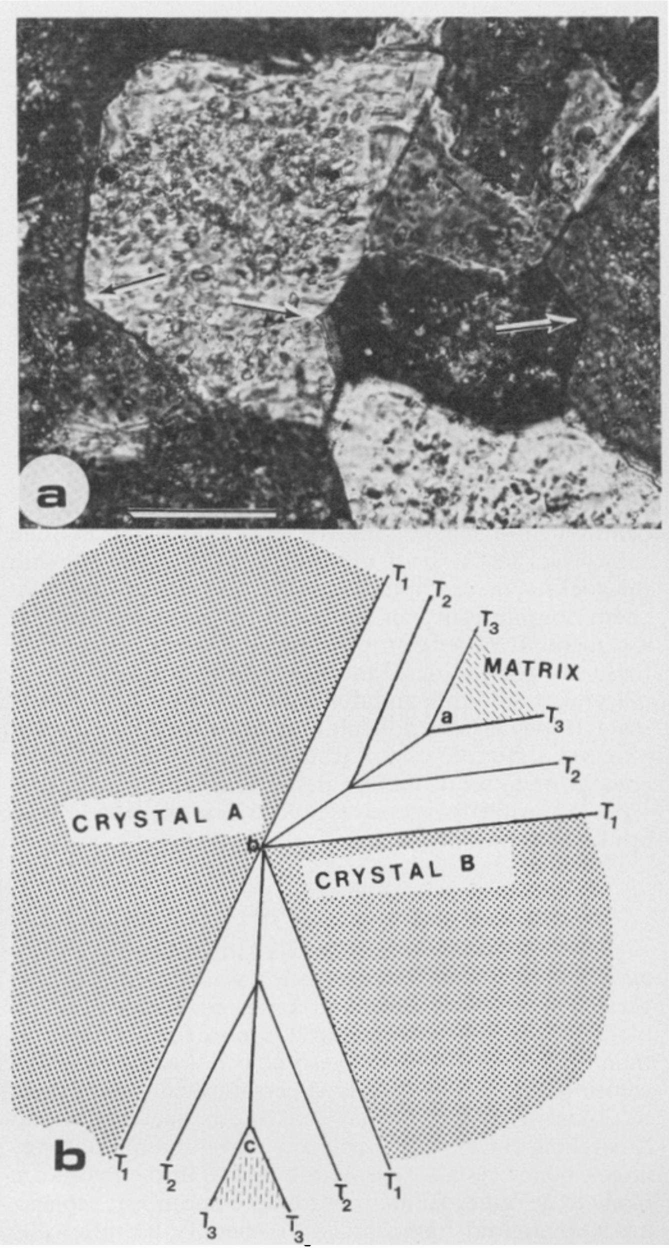


FIG. 6.—a) "Crystal-face junction" (arrows) preserved by straight-compromise boundaries in a planar e dolomite. Seroe Domi Fm., Pliocene of Bonaire, N.A. Crossed polars. Scale bar = 0.05 mm. b) How a crystal-face junction forms. Crystals A and B meet at point b at time 1 (T_1) as shown, and continue to grow at constant rates, represented by T_2 and T_3. At T_3, straight-compromise boundaries exist, forming angle abc and preserving a crystal-face junction of crystal B at point b. From Gregg and Sibley (1984).

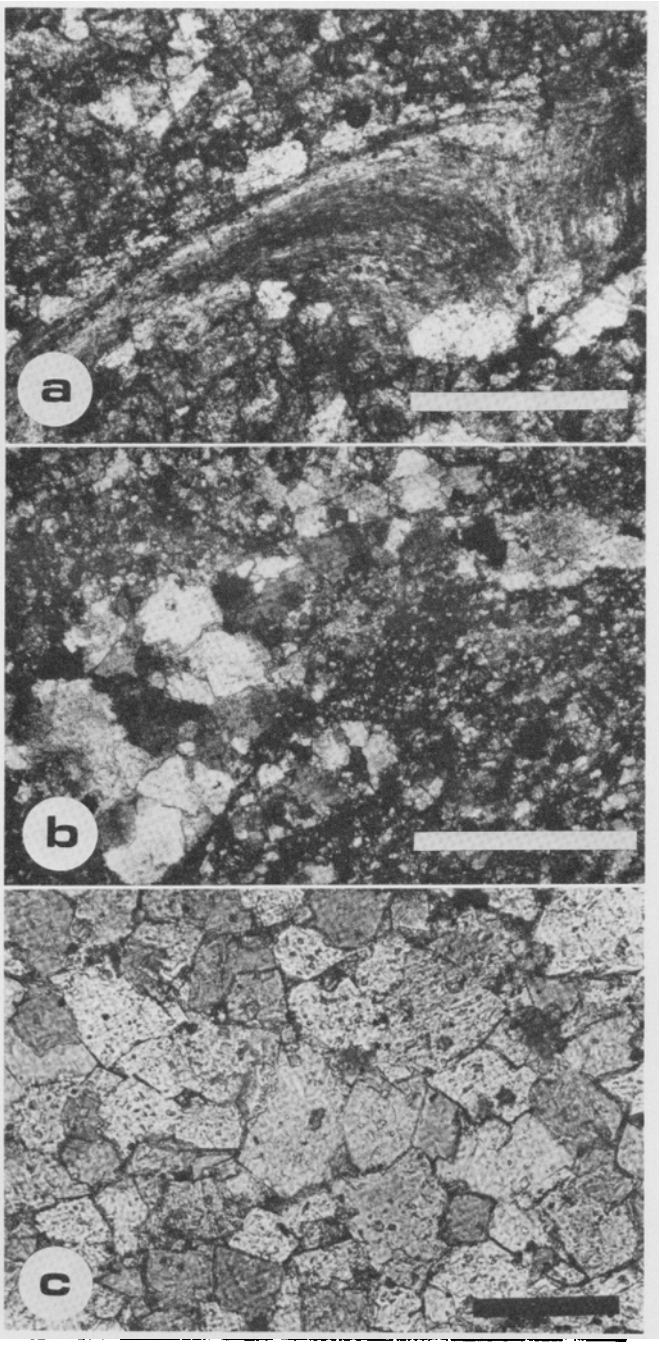


FIG. 7.—a) Unimodal, planar dolomite with unreplaced brachiopods and replaced matrix. Crossed polars. Scale bar = 1.0 mm. b) Polymodal planar dolomite with nonmimically replaced brachiopods (nonplanar) and matrix replaced by planar dolomite. Crossed polars. Scale bar = 1.0 mm.This sample was collected 1 foot above 7a. c) Close-up of planar-s dolomite in b. Scale bar = 0.1 mm. Trenton Fm., Ordovician, Michigan Basin.

the allochem. Ghosts (Fig. 3) are inclusions in dolomite that form the outlines and, sometimes, internal structure of original allochems. Fluorescence microscopy is often useful for detecting allochems that have otherwise been obliterated by dolomitization (Dravis and Yurewicz 1985). These are extreme cases of nonmimic replacement. If original depositional matrix can be distinguished from void filling, then the matrix may be described as replaced, partially replaced, or unreplaced. Void filling should be described. We use the term *void filling* rather than the term *cement*. *Cement* is defined as passively precipitated crystals that grow attached to a free surface (Bathurst

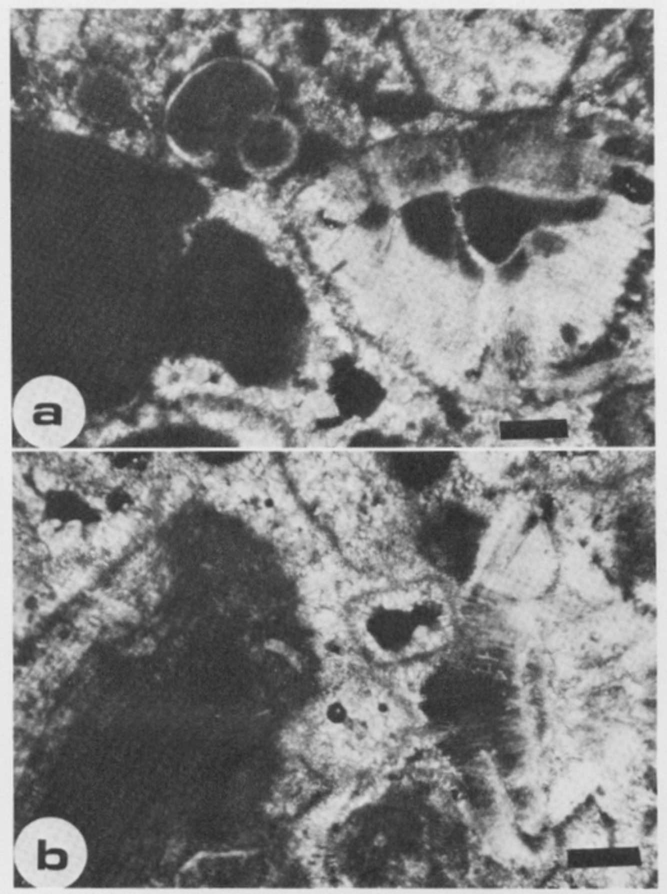


FIG. 8.—a) Mimically replaced forams and coralline algae in a polymodal, planar-s dolomite. b) Same fossil as in a, but in limestone. Both samples are from the Seroe Domi Fm., Pliocene, Curacao, N.A. Crossed polars. Scale bars = 0.25 mm.

TABLE 1.—*Criteria for recognizing a preserved crystal-face junction at a compromise boundary (from Gregg and Sibley 1984)*

1) The crystal-face junction must be in contact with a neighboring dolomite crystal and appears to make a "bite" into that crystal. This includes crystals where the crystal-face junction overlaps the neighboring crystal.
2) No observable porosity or nondolomite minerals are neighboring the crystal.
3) Angles larger than 160° should not be counted, and care should be taken not to count arcuate boundaries.
4) The two straight edges forming the interface must cover a perimeter of at least one-half of the longest diameter of the crystal. The edges may be in contact with more than one crystal provided that they contact a single crystal where they join (i.e., triple junctions are not included).

1975, p. 416). *Void filling* includes cement and dolomite that replaced a precursor cement. It is often difficult to distinguish dolomite cement from dolomite that replaced a precursor cement. The term *void filling* is used, therefore, to cover both types of dolomite. Subcategories of void filling allow a more detailed description. For example, it is often possible to demonstrate that void-filling dolomite did replace a precursor cement (Fig. 10), and this can be noted in the classification. If there is not direct evidence that a void-filling dolomite replaced a precursor, then the classification should stop at "void-filling dolomite." The classification scheme can be amended with limestone classification schemes (e.g., a polymodal, nonplanar, crinoidal grainstone).

We have not included absolute crystal size or porosity in our classification and, of course, these are important parameters of any rock description. For size description, we suggest measured or estimated crystal diameters. We recommend using Choquette and Pray's (1970) classification of porosity.

There are some problems inherent in the part of the classification scheme that describes allochems, matrix, and void filling. These problems arise because these aspects of the classification cannot be quantified, and recognition of allochems, matrix, and void filling is often subjective. The severity of these problems will vary with the rocks. For example, dolomite may replace an allochem nonmimically, or it may fill an allochem mold as a cement. It may be impossible to distinguish between these two possibilities. Indeed, the difference between replacement dolomite and dolomite cement is only one of scale. It may also be difficult to distinguish dolomite that replaced a micritic matrix from dolomite that replaced a cement, or dolomite that formed as a cement. Where these types of problems are severe, classification should stop at planar versus nonplanar.

INTERPRETATION

To show how textures can be classified and interpreted, we will illustrate with a hypothetical wackestone (Fig. 11). First, assume that matrix and fossils are both composed of low-Mg calcite and the matrix is more finely crystalline than the fossils. If this wackestone is dolomitized with a solution that is very highly supersaturated with respect to dolomite, dolomite may nucleate in the matrix and fossils (Fig. 11A). The fossils are composed of relatively large calcite crystals, so dolomite nuclei in the fossils are likely to be rather far apart, leading to nonmimic replacement. (Echinoid fragments will generally be mimically replaced because the fossil fragments are composed of single crystals of $CaCO_3$.) The final dolomite is a polymodal, planar-s dolomite with mimically and nonmimically replaced fossils and a unimodal matrix (Fig. 11A'). If the dolomitizing solution is somewhat less supersaturated with respect to dolomite, the matrix may be dolomitized, but the fossils may remain undolomitized (Fig. 11B). The fossils remain undolomitized because at the lower saturation state very few dolomite nuclei form on the coarser calcite. If these fossils remain as calcite, the resultant rock will be a unimodal, planar-s dolomite with unreplaced allochems (Fig. 7a). If the allochems that resisted dolomitization are later dolomitized above the critical roughening temperature or above the critical saturation, the resultant texture may be polymodal with a planar-s matrix (Fig. 7c) and nonmimically replaced al-

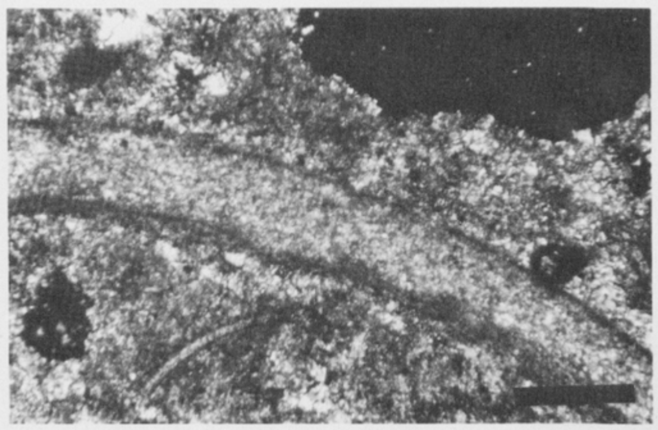


FIG. 9.—Nonmimically replaced mollusc fragment in a polymodal, planar-s dolomite. Seroe Domi Fm., Pliocene, Aruba, N.A. Scale bar = 0.25 mm.

lochems with nonplanar dolomite (Fig. 7b). A third possibility is that the unreplaced fossils will dissolve either during or after dolomitization, leaving molds (Fig. 11B′). If the undolomitized matrix and allochems dissolve, the resultant dolomite would be a unimodal, planar-e dolomite (Fig. 11C′). This is the category of dolomites that is commonly referred to as sucrosic. A situation similar to that depicted in Figure 11C may occur but the dolomite may continue to grow until it completely fills the space (Figs. 3 and 11D′), resulting in a unimodal, planar-s dolomite.

There are other scenarios for the evolution of textures depicted in Figure 11. For example, if the original lime matrix was aragonite and the fossils calcite, dolomite might nucleate selectively in the matrix (Fig. 11B). Also, the greater number of nuclei in 11B compared to 11C could be due to a difference in surface area of the reactant. If the matrix in 11C were coarser than the matrix in 11B, one would expect fewer dolomite crystals in 11C. Other scenarios may be related to variations in the saturation state of the solution. For example, if a solution starts out highly supersaturated with respect to dolomite (11B) and then the saturation state drops below that necessary for

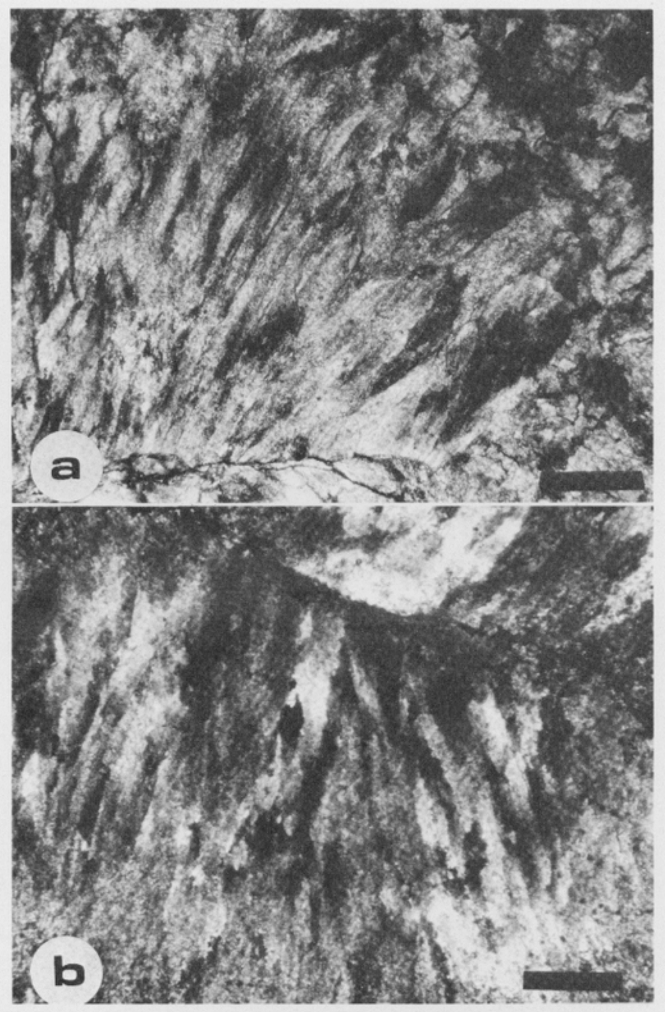


FIG. 10.—a) Fibrous calcite probably after submarine aragonite cement (Sears and Lucia 1980). b) Dolomite mimically replaced the same type of cement as shown in a. Both samples from Niagara Group, Silurian, Michigan Basin. Crossed polars. Scale bars = 0.25 mm.

TABLE 2.—*Summary of point counts of crystal-face junctions to distinguish planar versus nonplanar dolomite. Two to three hundred crystals per section were counted.* $\bar{x}$ *= mean; s = standard deviation; n = number of thin sections*

Planar Dolomite				Nonplanar Dolomite			
	Percent Crystal-Face Junction				Percent Crystal-Face Junction		
Unit	$\bar{x}$	s	n	Unit	$\bar{x}$	s	n
Bonneterre Dol. (Cambrian)	48.4	45	11	Bonneterre Dol. (Cambrian)	20.4	4.1	6
Derby-Doe Run Dol. (Cambrian)	51		1	Derby-Doe Run (Cambrian)	19		1
Potosi Dol. (Cambrian)	45.3	5.0	3	Davis Fm. (Cambrian)	15.9	6.1	8
Heuco Lm. (Permian)	55		1	Heuco Lm. (Permian)	11		1
Galena Gp (Ordovician)	55		1	Galena Gp (Ordovician)	24		1
Seroe Domi Fm. (Pliocene)	42.7	3.4	4	Eminance Dol. (Cambrian)	22	4.2	2
Unnamed from Eniwetak Atoll (Eocene)	55	3.8	2	Gasconade Dol. (Ordovician)	20		1
				Trenton Fm. (Ordovician)	22.5	6.4	2
Total	48.2	5.3	23	Total	18.7	5.4	22

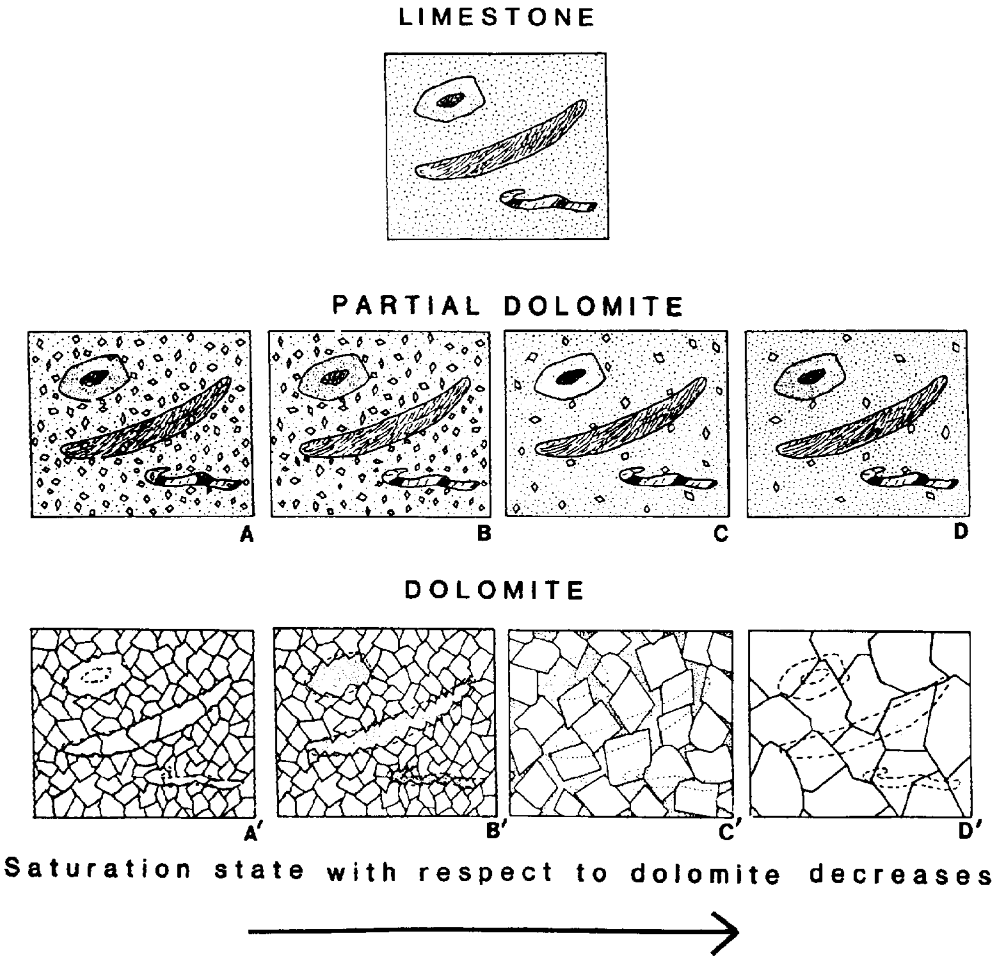


FIG. 11.—Sketch showing four scenarios for textural evolution of a wackestone being dolomitized. A-A′, B-B′, C-C′ show three different textural evolutions that may occur as a result of increasing supersaturation with respect to dolomite. D-D′ depicts a situation where the saturation state with respect to dolomite is relatively low but the residence time of the rock in the dolomitizing solution is quite long, leading to a low-porosity dolomite. All textures depicted here are planar. A′ has a mimically replaced crinoid and nonmimically replaced brachiopod and trilobite fragments. B′ has allochem molds. C′ is unimodal, planar-e, with allochem ghosts. D′ is unimodal, planar-s, with allochem ghosts.

nucleation but above that necessary for growth, a texture such as that in 11C or 11C′ might develop.

Allochem molds may develop prior to, during, or after dolomitization. Many molds are formed by dissolution of calcitic fossils (Fig. 5). Because calcitic molds are much more common in dolomites than limestones, these molds probably form either during or after dolomitization. If calcitic fossils are present in a rock, formation of molds versus dolomitization of the fossils can be determined by the degree of supersaturation with respect to dolomite (see Fig. 11A and B). If the solution is highly saturated with respect to dolomite, the fossils are likely to be replaced. If the solutions are not highly saturated with respect to dolomite, dolomite will not be as likely to nucleate on the fossils, and the fossils may subsequently dissolve to form molds. It is also possible to form molds if the dolomitizing solution is highly supersaturated with respect to dolomite and undersaturated with respect to the mineral that makes up the fossil.

CONCLUSIONS

Dolomitization of a limestone involves nucleation and growth of dolomite. These are kinetic processes that are reflected in the texture of the resultant rock. The classification we have proposed is intended to categorize dolomites according to readily recognized textural features that can be interpreted in terms of the parameters that control rates of nucleation and growth. Rocks with the same texture were subjected to dolomitization at similar relative rates of nucleation and growth. There are many factors that may affect these rates in nature. This classification should help us evaluate those factors in ancient dolomites.

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