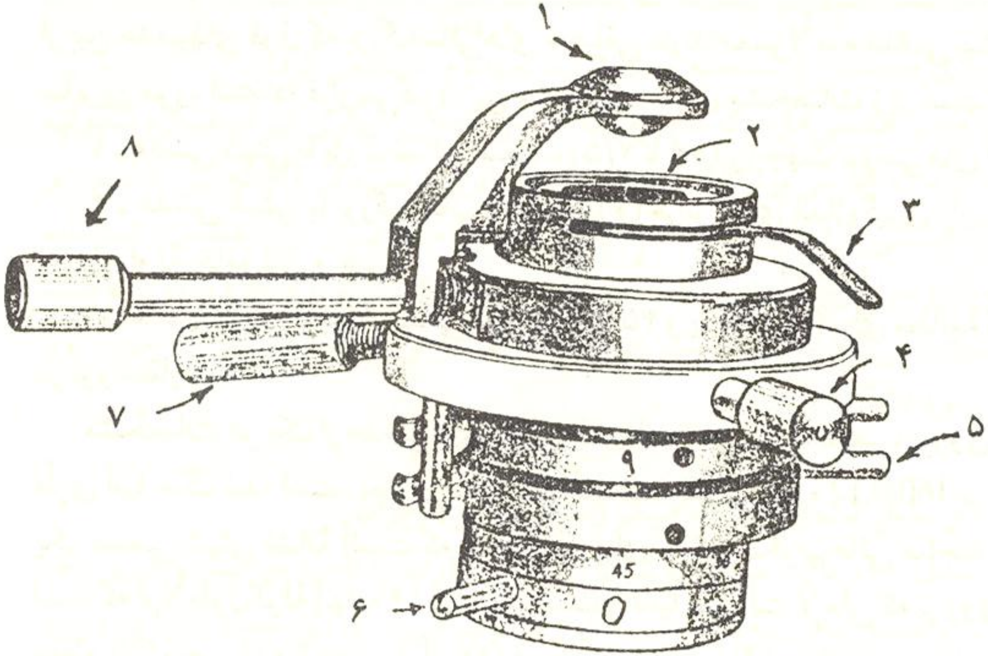
ساختمان کندانسور



شکل ۲ : ساختمان دستگاه کندانسور

۱ ـ عدسی کندانسور بادهانه عددی قوی
۲ ـ عدسی کندانسور بادهانه عددی ضعیف
۳ ـ اهرم دیافراگم ایریس
۴ ـ پیچ تثبیت دستگاه کندانسور
۵ ـ اهرم جهت خارج نمودن پولاریزور از مسیر نور
۶ ـ اهرم جهت چرخاندن صفحه پولاریزور
۷ ـ پیچ تنظیم کندانسور
۸ ـ اهرم جهت بکار انداختن عدسی کندانسور
۹ ـ عدسی کمکی

- میکروسکوپ دارای میزی است که نمونه ها را روی آن قرار می دهند و هم چنین میکروسکوپ دارای دیافراگم است که می توان نور را با آن تنظیم کرد و نوری که از منبع تغذیه وارد میکروسکوپ می شود نور ایزوتروپ است که در بین راه به وسیله منشور نیکل به نور پلاریزه تبدیل می شود. این منشور در بالای دیافراگم قرار دارد.

- عدسی های شیی: میکروسکوپ دارای یک سری عدسی های شیئی می باشند که برای بزرگ یا کوچک دیدن نمونه از آن استفاده می شود که در اصطلاح به آن ها OBJECTIV گفته می شود که ما برای دیدن نمونه ها ابتدا از شماره ٤ آن استفاده می کنیم.

- عدسی برتران : میکروسکوپ عدسی دیگری به نام **برتران** دارد که در بالای میکروسکوپ و در زیر عدسی چشمی قرار دارد.

- پیچ تنظیم بزرگ و کوچکی که در اطراف میکروسکوپ قرار دارد برای واضح کردن تصویر و همچنین بالا و پایین بردن میز میکروسکوپ از آن استفاده می شود.

- آنالیزور: میله ای در میکروسکوپ است که در عدسی چشمی قرار دارد که اگر داخل باشد نور xpl و اگر خارج باشد نور ppl را ایجاد می کند.

- میکروسکوپ دارای دو نیکل است که یکی در بالا و دیگری در پایین قرار دارد به نیکلی که در پایین قرار دارد نیکل پلاریزه و به نیکلی که در بالا قرار دارد نیکل آنالیزور نامیده می شود .

بررسی و تحلیل مقاطع نازک در زیر میکروسکوپ

مقاطع مرتبط با ماسه سنگ ها

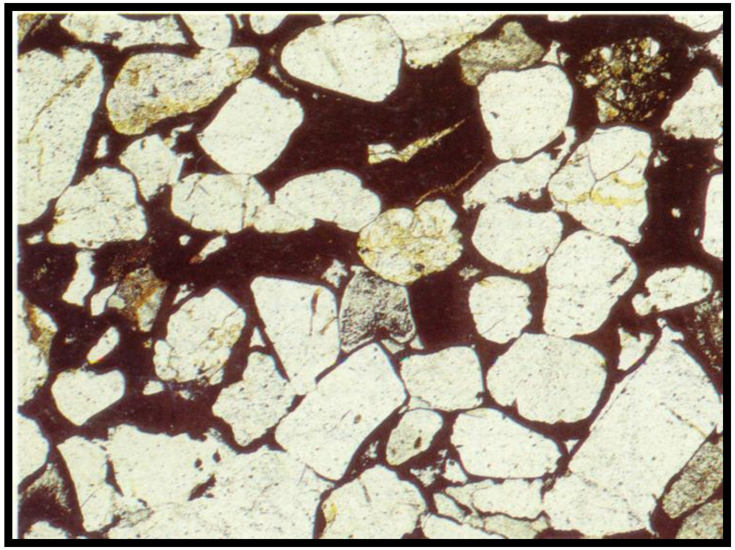
Quartz

- The most abundant grain type in sandstones and conglomerates is quartz.
- The following features should be observed since they may provide clues to the provenance of the sediment:

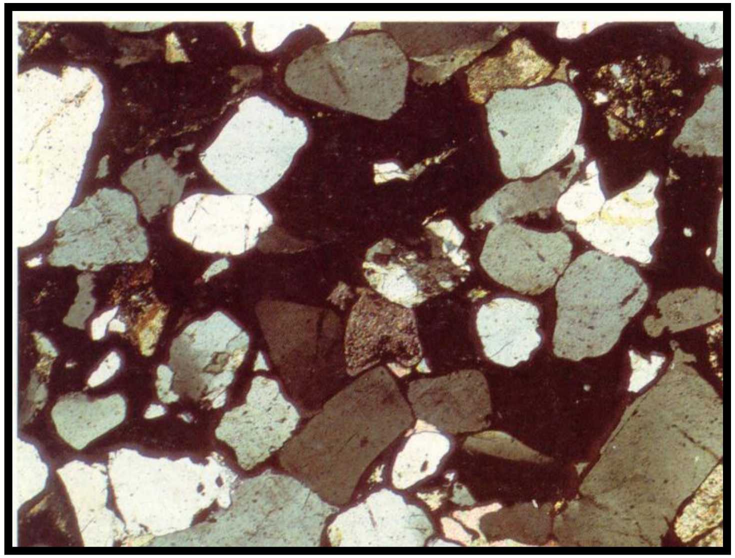
  - ✓ Whether the quartz grains are single crystals (mono-crystalline) or are made up of a number of crystals in different orientations (polycrystalline).
  - ✓ Whether extinction is uniform (the grain extinguishes in one position on rotation of the stage) or undulose (the grain extinguishes over a range of at least 5 on rotation of the stage).
  - ✓ The presence or absence of inclusions.
  - ✓ In the ease of polycrystalline grains, whether the crystal boundaries are straight or sutured.

Quartz

1 and 2 show subrounded quartz grains which are single crystals, taken with plane-polarized light (PPL) and with crossed polars (XPL). The matrix between the sand grains contains opaque iron oxide and some calcite.



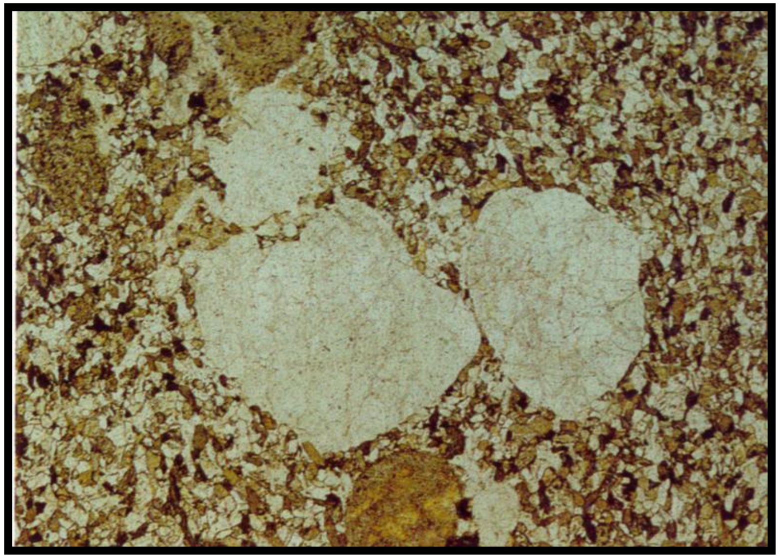
1



2

Quartz

The three rounded grains in the centre of 3 and 4 are made up of number of quartz crystals in different orientations and are thus composite or polycrystalline quartz. The composite nature of the grains is clear only in the view taken with polars crossed. Note that the boundaries between the crystals are sutured. This is characteristic of quartz from a metamorphic source. Composite quartz from igneous sources usually has straighter crystal boundaries. The much finer sediment surrounding the composite quartz grains contains monocrystalline quartz and brownish clasts of fine—grained material which are probably shale or slate fragments.



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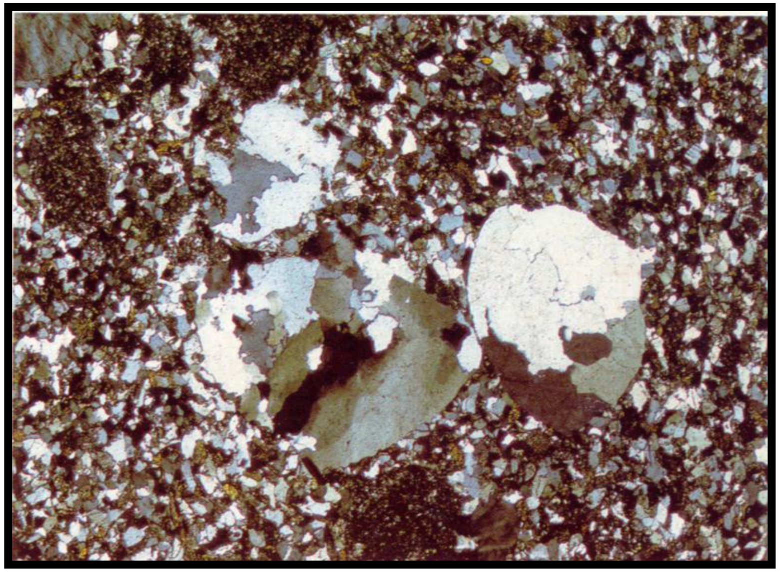
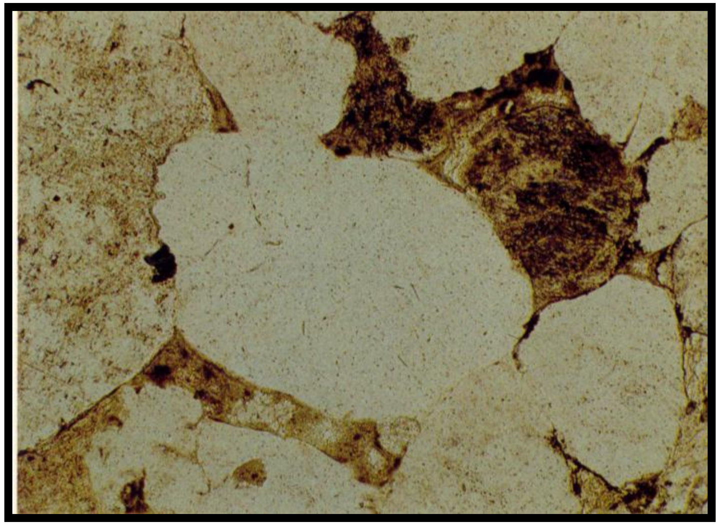


4

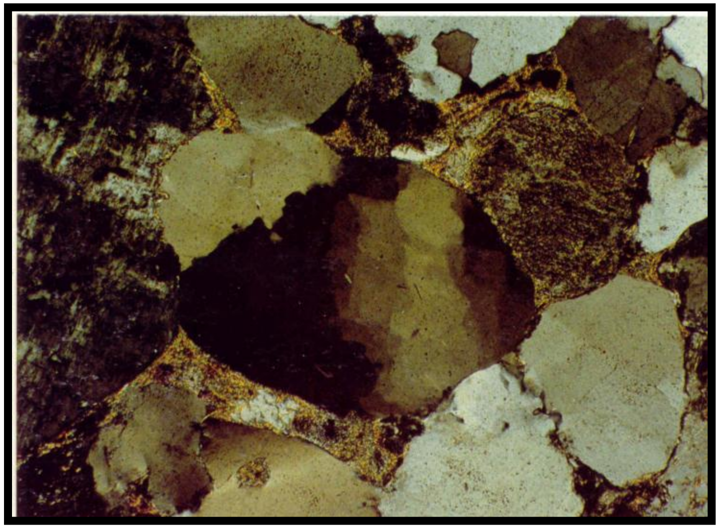
Quartz

The quartz grain in the center of the field of view appears to be a single homogeneous crystal.



5

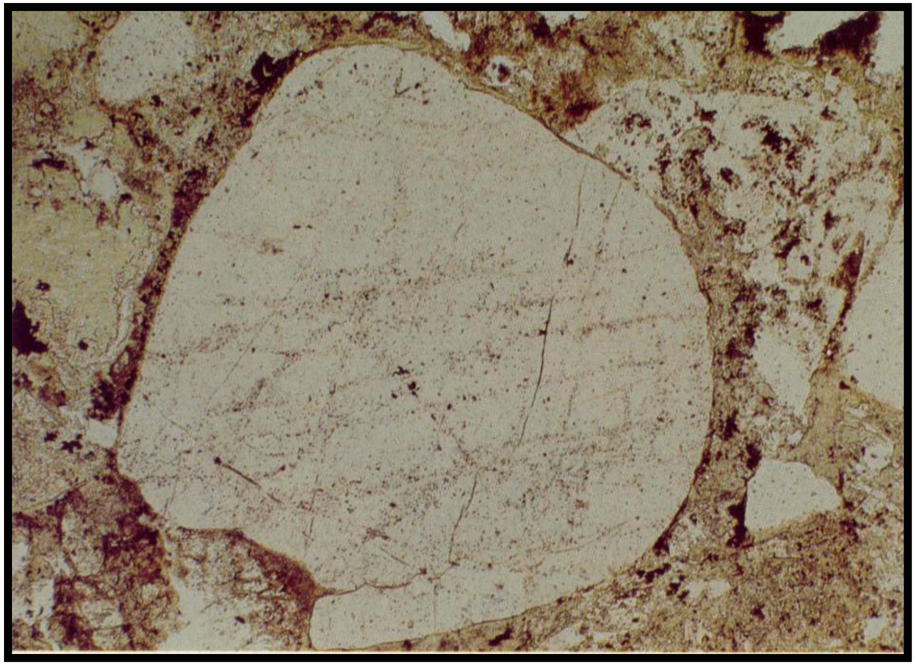
The same field of view is seen under crossed polars, the quartz grain is clearly made up of parts of two crystals. One, comprising the upper left portion of the grain is showing a mid-grey interference colour, whereas the rest of the grain comprises a crystal with areas showing slightly different interference colours. The left- and right-hand sides are in extinction and interference colours become progressively paler towards the centre of the grain. Such a grain would show sweeping extinction when rotated. This phenomenon, known as undulose extinction, is a result of strain and is found in quartz grains from both igneous and metamorphic sources.



6

Quartz

Inclusions of the fluid present at the time of crystallization are common in quartz crystals and are known as fluid inclusions or vacuoles. 7 shows a quartz grain with abundant vacuoles. These appear as dark specks, and in the sample illustrated, many are concentrated in lines running at a low angle to the length of the picture. Quartz with abundant vacuoles is usually derived from a source of low-temperature origin, such as a hydrothermal vein, and appears milky-white in a hand specimen.



7

Feldspar

- Feldspars are a major constituent of many sandstones and conglomerates. The chemical weathering of feldspars may be rapid, producing micas and clay minerals. Therefore feldspars are most abundant and best preserved in rocks derived from mechanical weathering. The identification of feldspars in thin section is straightforward in the case of multiple-twinned grains of plagioclase or microcline, or where perthitic textures are present. Distinguishing between untwined orthoclase and quartz can be difficult. The following features may help:

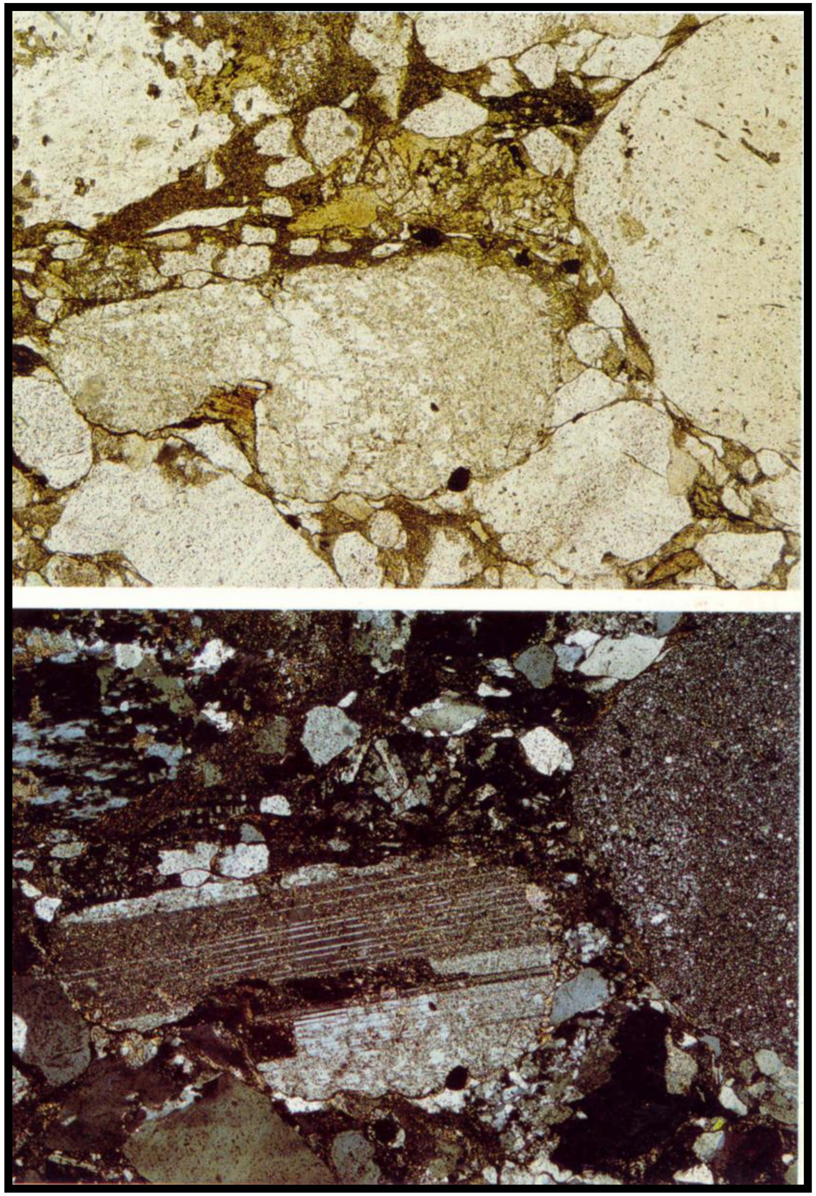
  - ✓ Alteration:
    because orthoclase is more susceptible to chemical weathering than quartz, it is often cloudy or brown-colored in PPL, whereas quartz is usually clear.

  - ✓ Refractive Index:
    the index of quartz is very close to, but higher than that of Canada balsam, whereas the index of orthoclase is always lower than balsam.

  - ✓ Interference figure:
    orthoclase is biaxial but, quartz is uniaxial unless strained.

8 and 9 show a large plagioclase grain which is easily identified by the twinning in the photograph with polars crossed. The grain shows a combination of two types of twins which are probably Carlsbad (simple twin) and albite (multiple twinning).

The cloudiness seen in PPL is caused by patchy alteration of the feldspar.

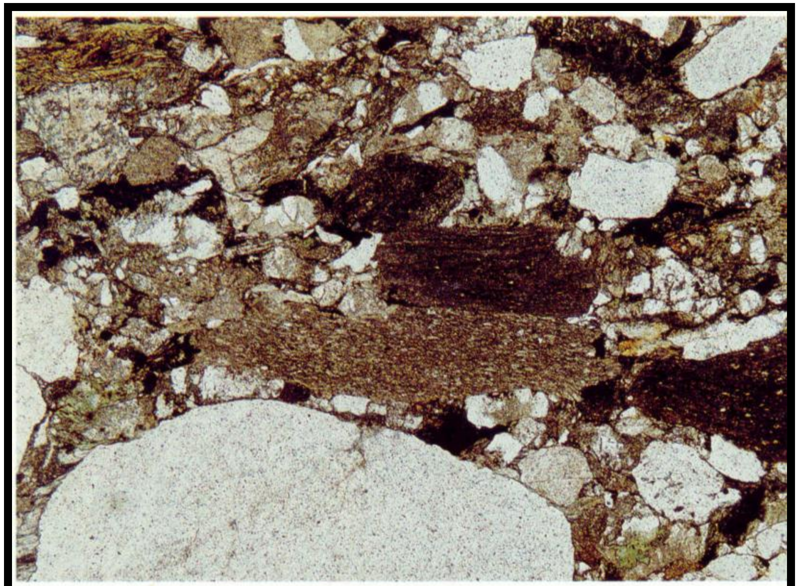


8

9

Rock fragments

10 and 11 show a sediment with many rock fragments. The two fragments in the centre of the photograph above the large quartz grain are made up of fine-grained material which cannot be resolved at this magnification. They are fragments of shale or slate, and the characteristic platy shape is a result of derivation from a cleaved source rock containing abundant platy minerals. The sediment is very poorly-sorted, containing many small rock fragments, quartz grains and at least one twinned feldspar (in the centre, near the top), as well as the large quartz grain, part of which is seen at the base of the photograph.



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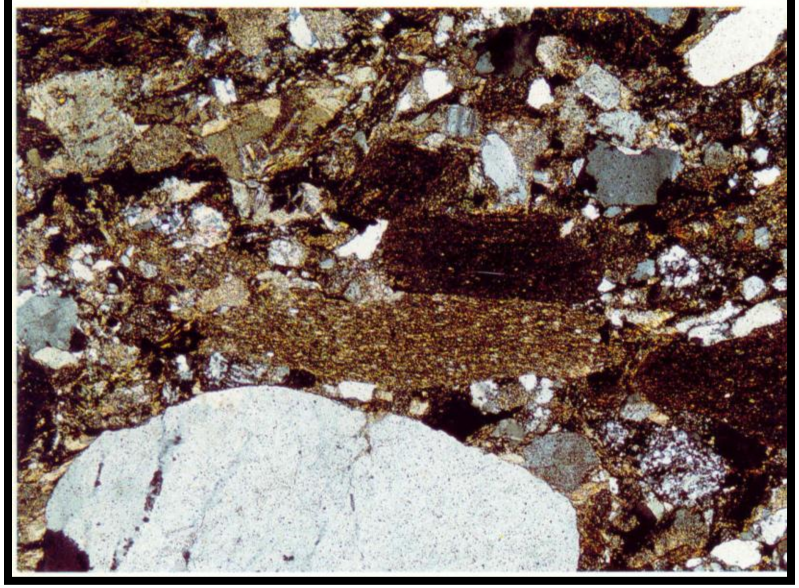
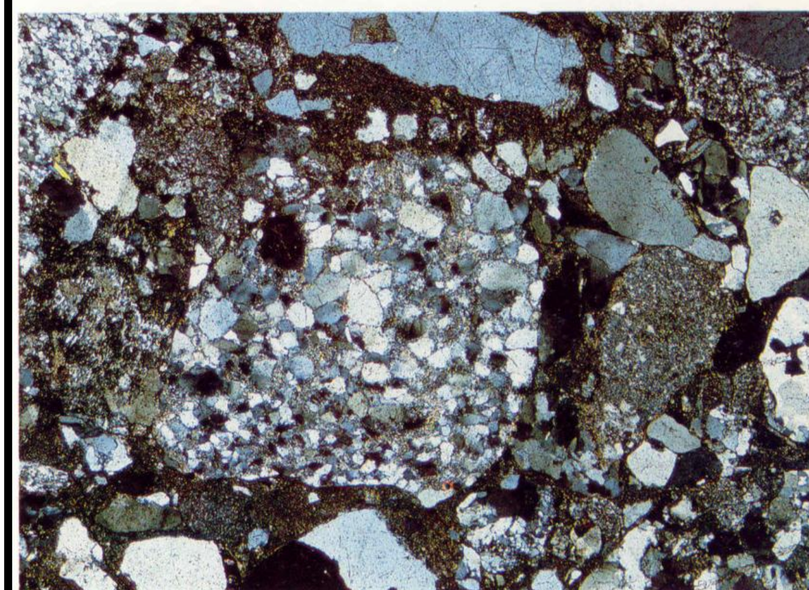


11

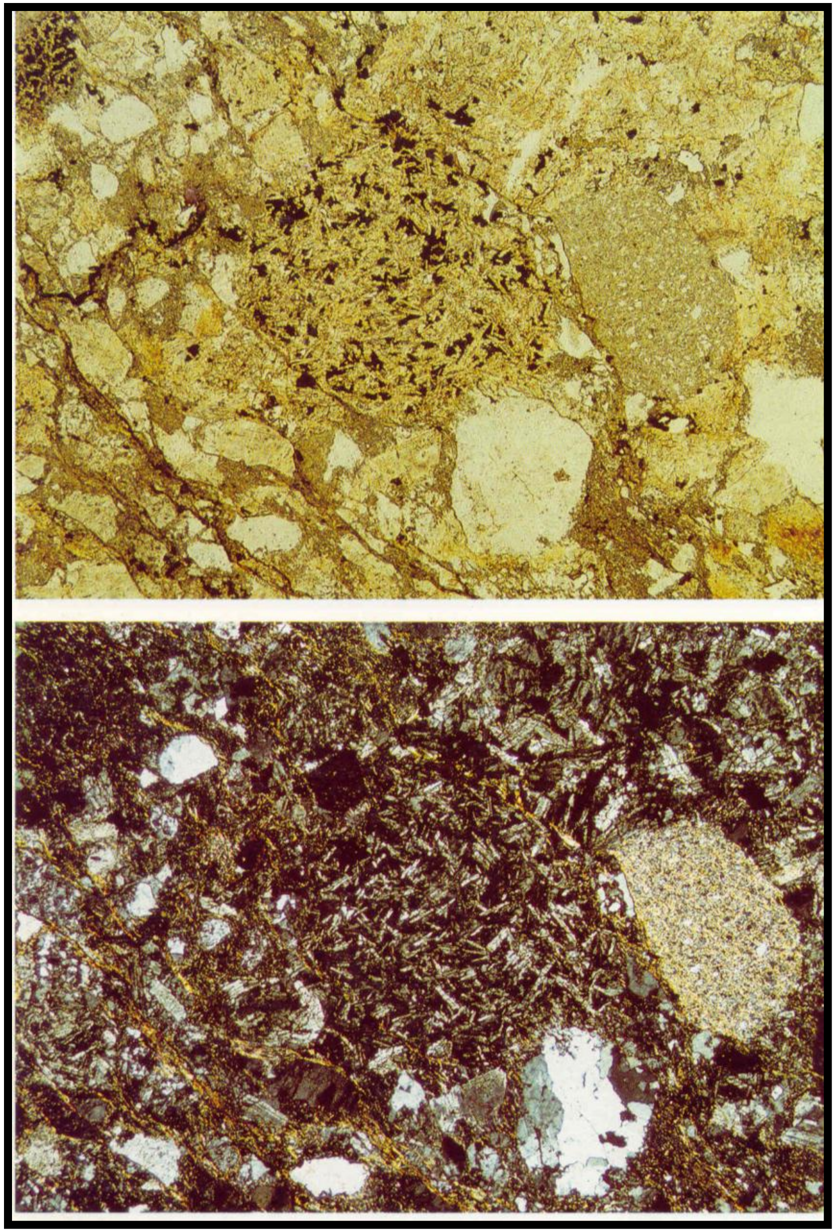
Sedimentary rock fragments, other than chert, are relatively uncommon in terrigenous sedimentary rocks because they usually break down fairly easily into their component grains. 12 and 13 show a large sandstone fragment. Note that although the component particles are all quartz, they are clearly distinguishable even with PPL. This contrasts with the composite quartz grain shown in 3 and 4, where individual crystals are not visible in PPL. The photograph taken with XPl shows that the individual quartz grains are separated by a cement with bright interference colors. This is likely to be clay.

12



13

14 and 15 show a volcanic rock fragment in the centre of the field of view. It consists of plagioclase laths set in an altered groundmass which is too fine-grained for its constituents to be identified at the magnification shown. A second rock fragment to the right of centre is composed of quartz crystals set in a birefringent matrix probably of clay minerals. The sediment also contains separate feldspar grains, some of which are multiple-twinned plagioclase. and both monocrystalline and polycrystalline quartz. The matrix of the whole rock contains birefringent clay or mica minerals.

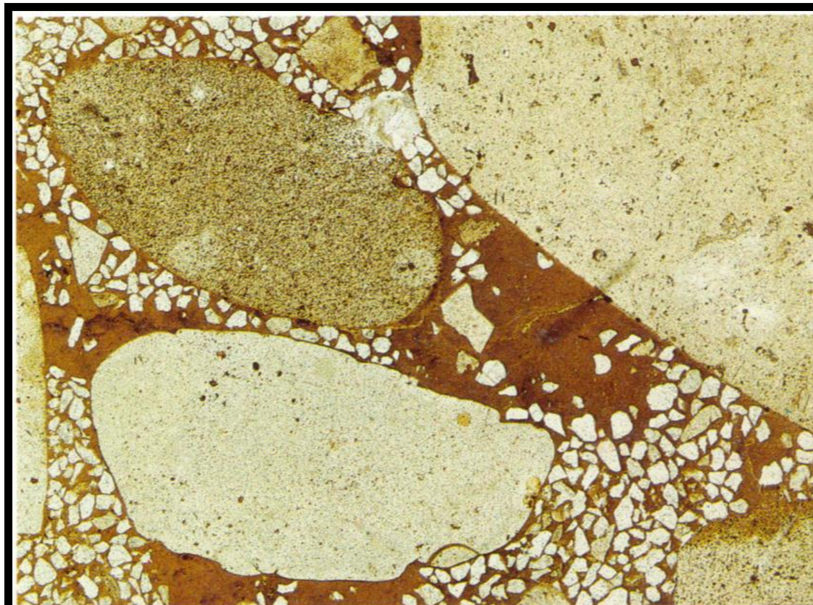


14

15

Chert fragments are quite common in sedimentary rocks since chert is stable and resistant to weathering. Plates 16 and 17 show a thin section of a conglomerate in which the large rounded fragments are chert. The view taken with crossed polars shows that the fragments are made up of very fine-grained quartz.

In the sample illustrated the matrix contains subangular to subrounded quartz grains and small chert fragments set in an iron oxide—rich cement (brown in PPL).



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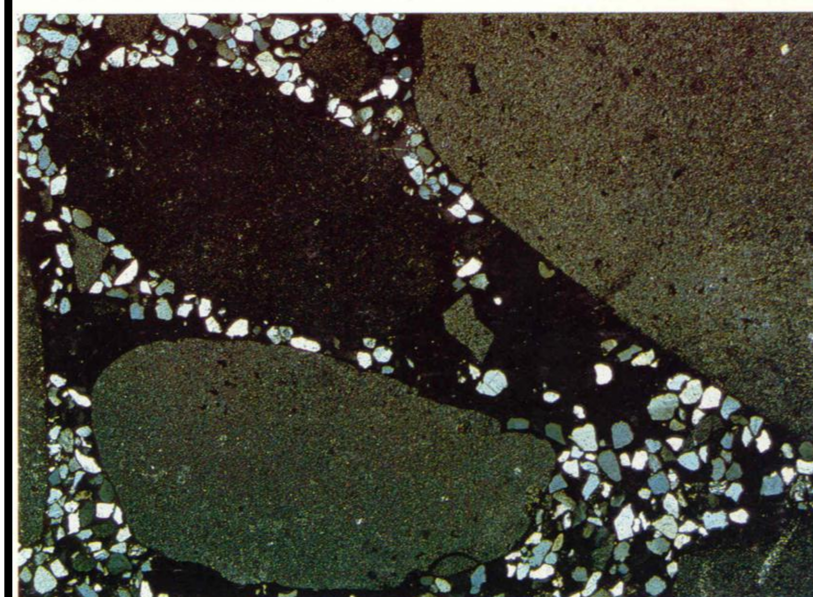
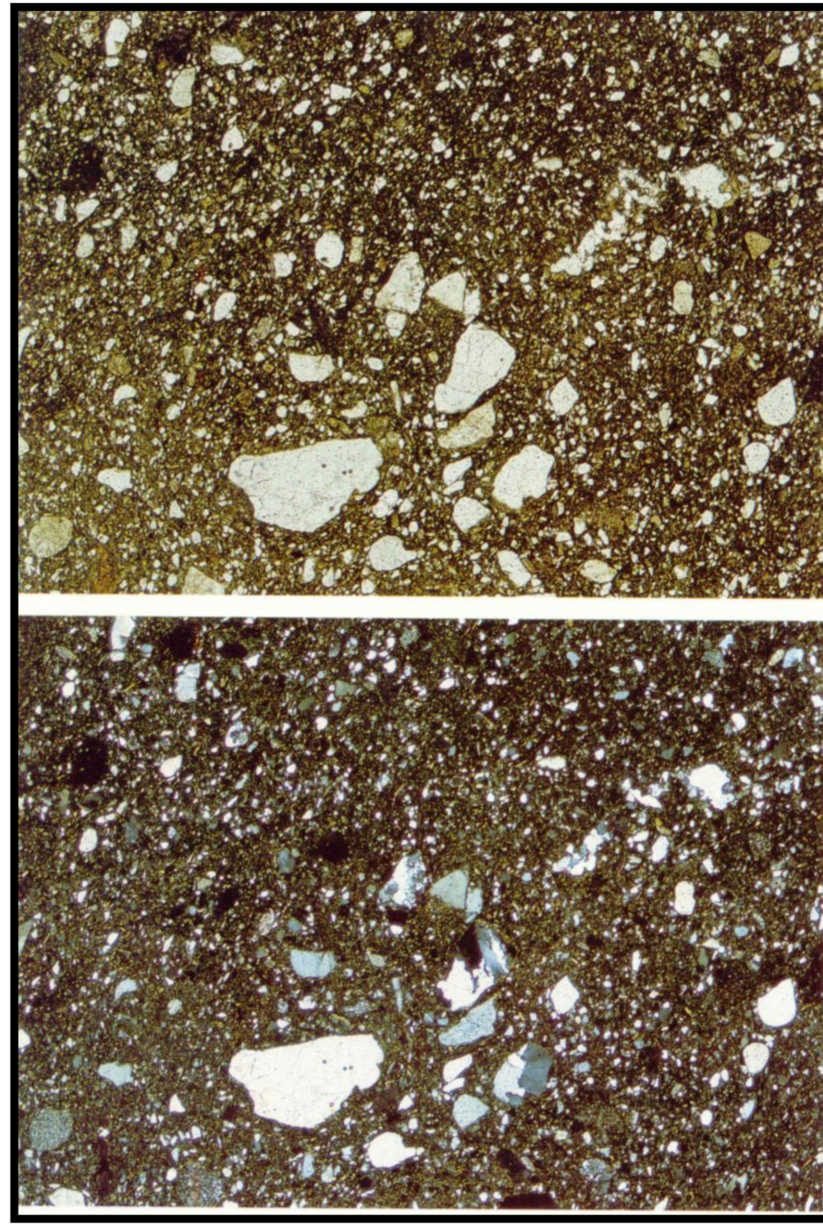


17

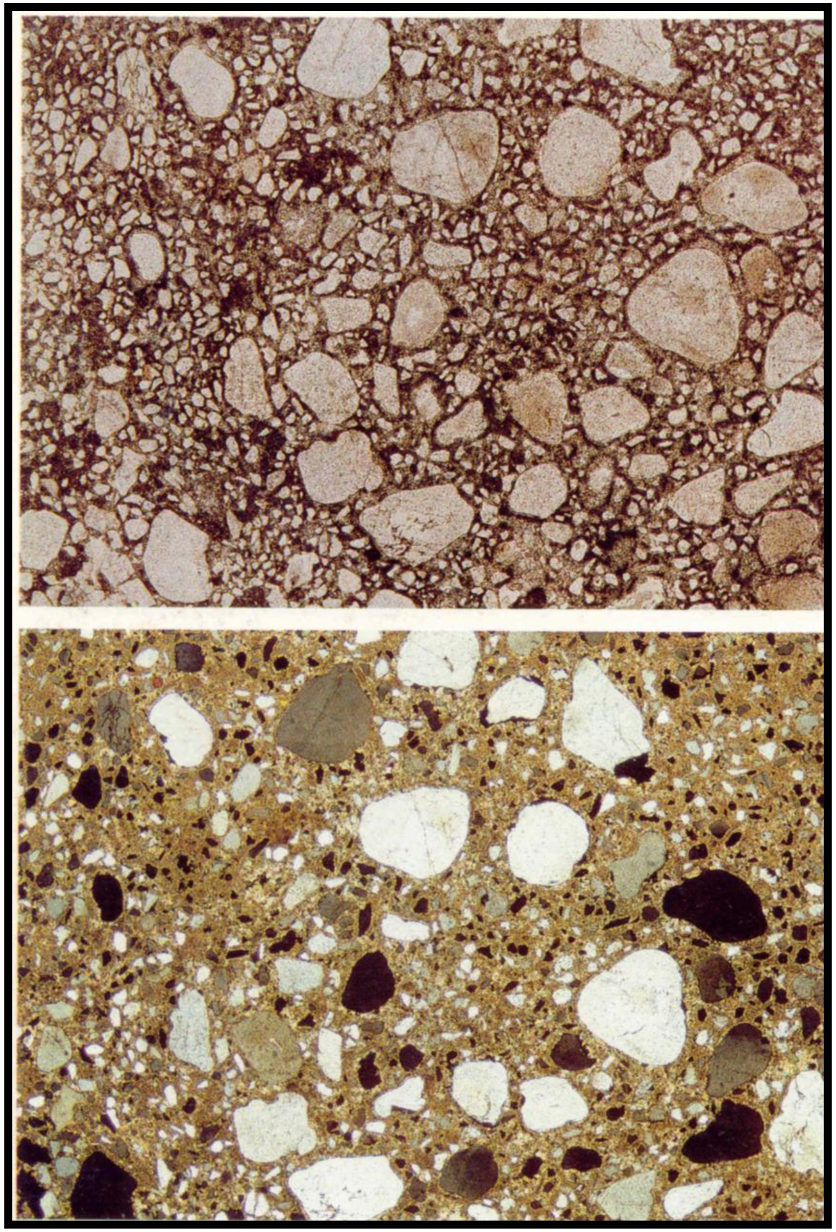
Sandstones :

Matrix

On deposition, many sandstones contain little sediment matrix between the component grains. Some terrigenous mud may be deposited with the grains and those sediments with more than 15% clay matrix are classified as greywackes.



A few sandstones have a matrix of carbonate mud. 18 and 19 show a sediment containing large. rounded quartz grains together with smaller, subangular to subrounded grains in a fine-grained matrix having high relief. In the XPL. photograph, high-order interference colors, characteristic of calcite, can be seen. This sample is a sandstone with a carbonate mud matrix, which was probably deposited at the same lime as the grains, rather than being introduced later as a cement,



18

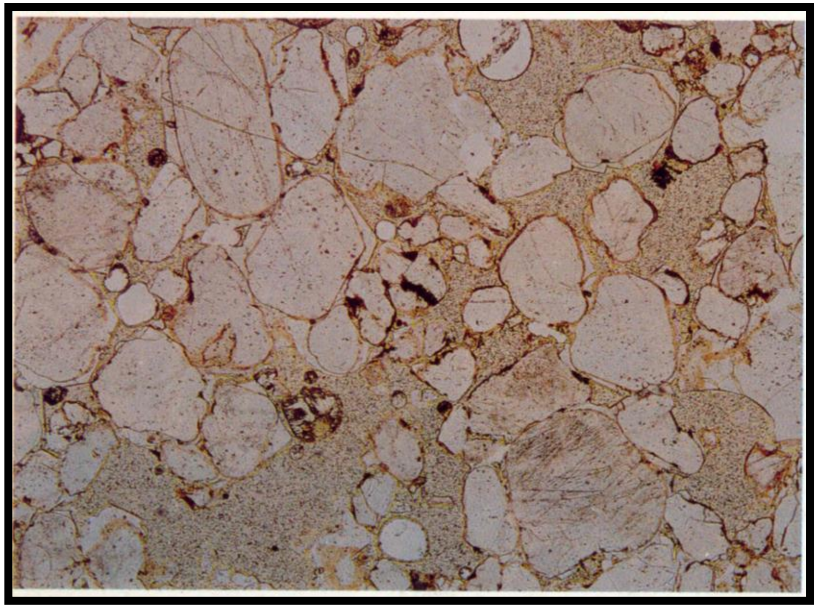
19

Sandstones :

Cement

Cementation is the principal process leading to porosity reduction in sandstones, the most common cements being quartz, calcite and clay minerals. Clay mineral coatings on component grain surfaces are important in the diagenesis of sediments, in that they may inhibit the growth of pore-filling quartz or calcite cements. Such textures require the use of the electron microscope for detailed study.

20 and 21 show a highly porous sandstone with rounded quartz grains. The speckled areas which appear black in the XPL photograph are pores filled with the mounttng medium. Although comprising a loose fabric of grains, the sandstone is well-cemented by secondaey (authigenic) quartz in the form of overgrowths on the detrital grains. The surfaces of the original grains are picked out by a thin red-brown rim of iron oxide. Since both the overgrowth and the detrital cores of each grain show uniform interference colors, it is clear that the overgrowths grew in optical continuity with the grains on which they nucleated.



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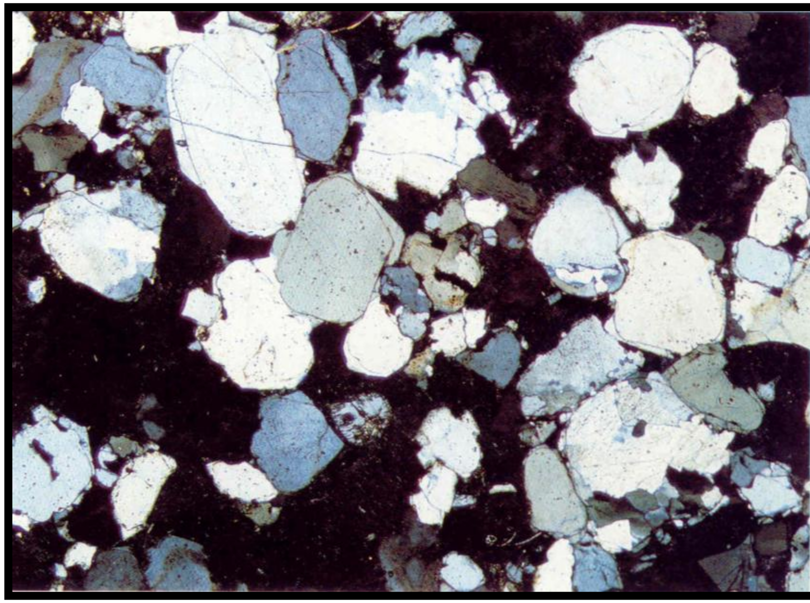
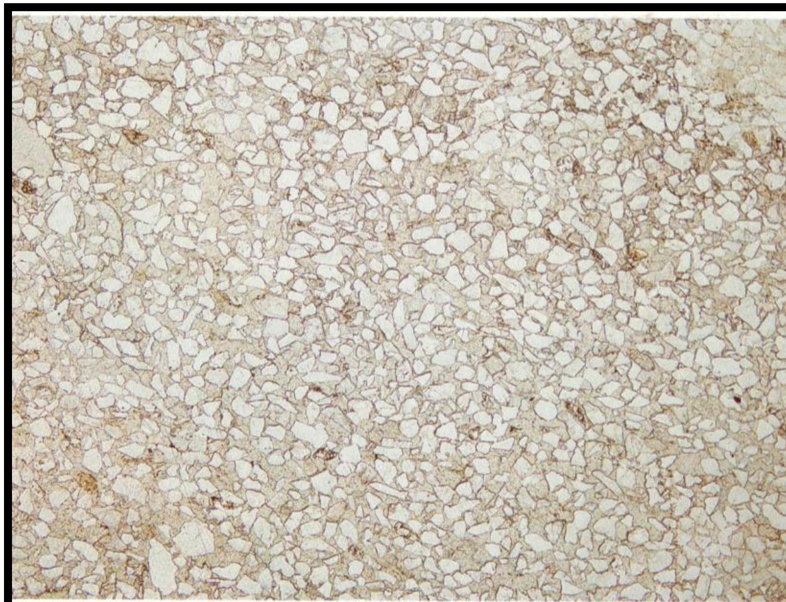


21

Calcite cements in sandstones are usually fairly coarse-grained. Occasionally they are so coarse that one cement crystal envelopes many detrital grains, resulting in a poikilitic texture. 22 and 23 show a sandstone in which the detrital grains are subangular to subrounded quartz. The cement is calcite of such a grain size that there are only a few crystals in the field of view shown. Individual cement crystals can be distinguished in the XPL photograph by their slightly different interference colors (high-order grey and pink).



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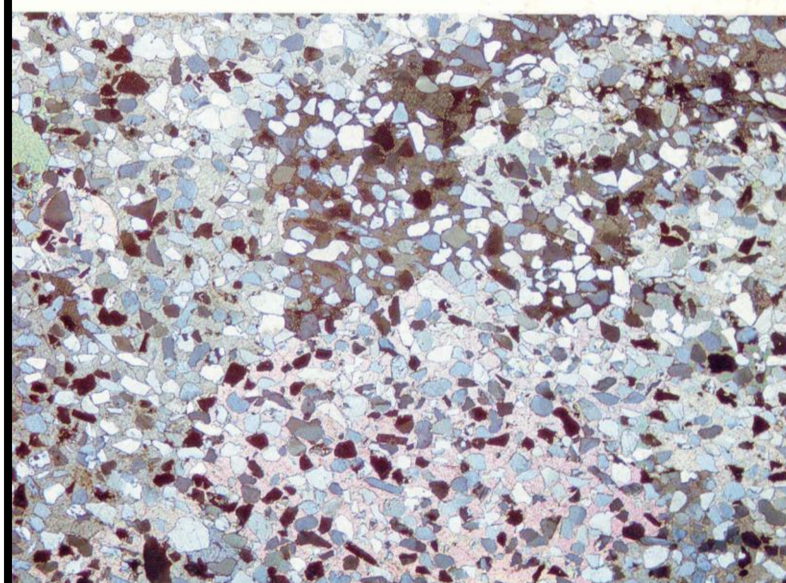
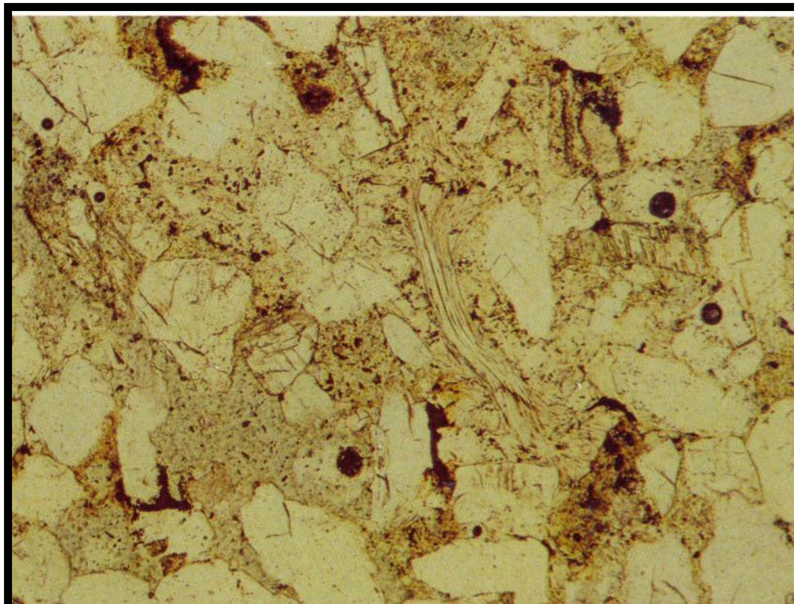
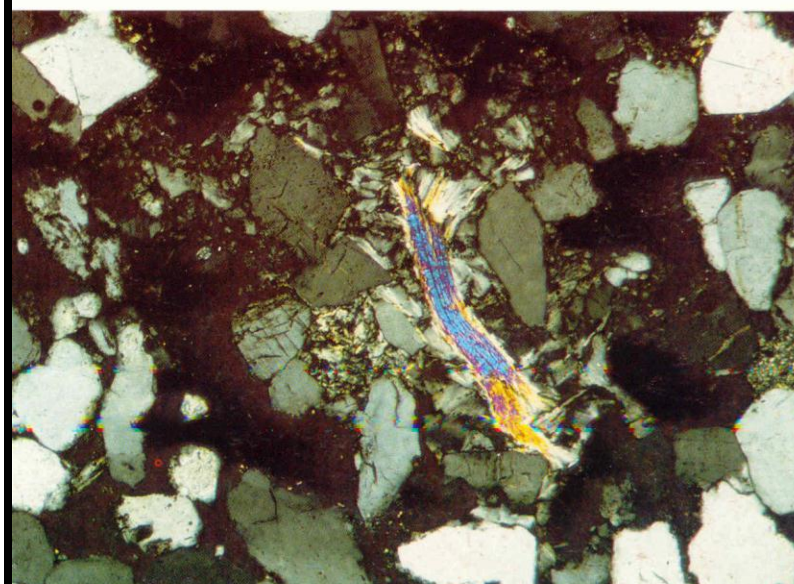


23

24 and 25 show a quartz sandstone at high magnification. Note the mica flake in the centre of the photograph. In the field of view shown many of the intergranular pores are unfilled (e.g. lower left) and are thus black in the XPL view. However, the quartz grains and mica flake in the centre of the view are surrounded by numerous small crystals with low relief and showing first order grey interference colors. These are clay minerals in the form of a cement. Usually an electron microscope is needed to demonstrate the shapes of clay mineral crystals and techniques such as X-ray diffraction to determine the exact identity of the minerals.



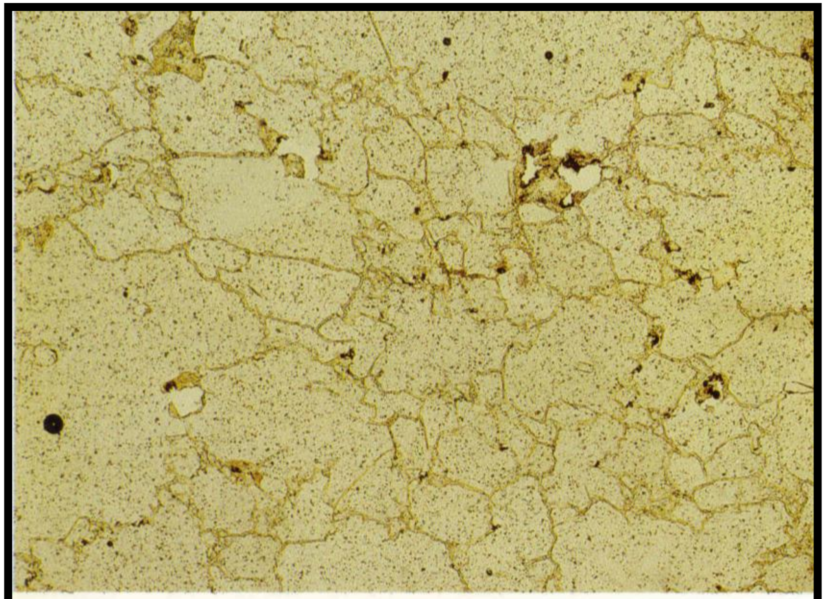
24



25

Compaction-Pressure- Solution

Where pressure-solution is more intense, the contacts between grains become sutured. 26 and 27 show a sandstone in which grain contacts are irregular and wavy because of pressure-solution. Silica dissolved during the process may be precipitated as cement away from grain contacts, leading to the destruction (occlusion) of porosity. As can be seen, the result is a texture in which the original grain boundaries can no longer be identified. The sample illustrated is particularly unusual in that a thin zone of clay or mica separates the sutured quartz grains, it has a higher relief than the quartz and is clearly visible in the photograph taken with PPL. This thin zone of material together with the sutured contacts enables the quartz grains to move slightly relative to their neighbors. This property imparts flexibility to the sandstone, demonstrable in hand specimens. Sandstones of this type are known as flexible sandstones and are extremely rare.

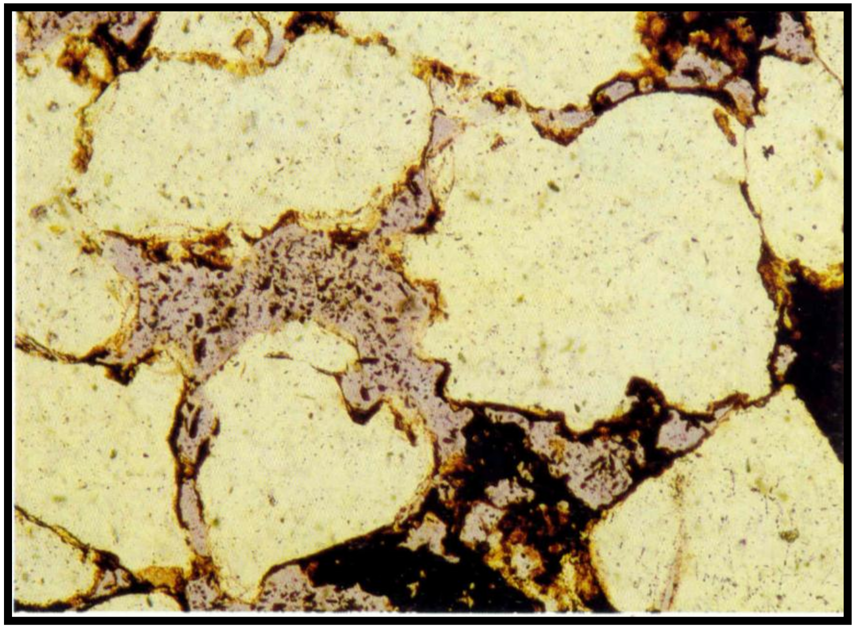


26

27

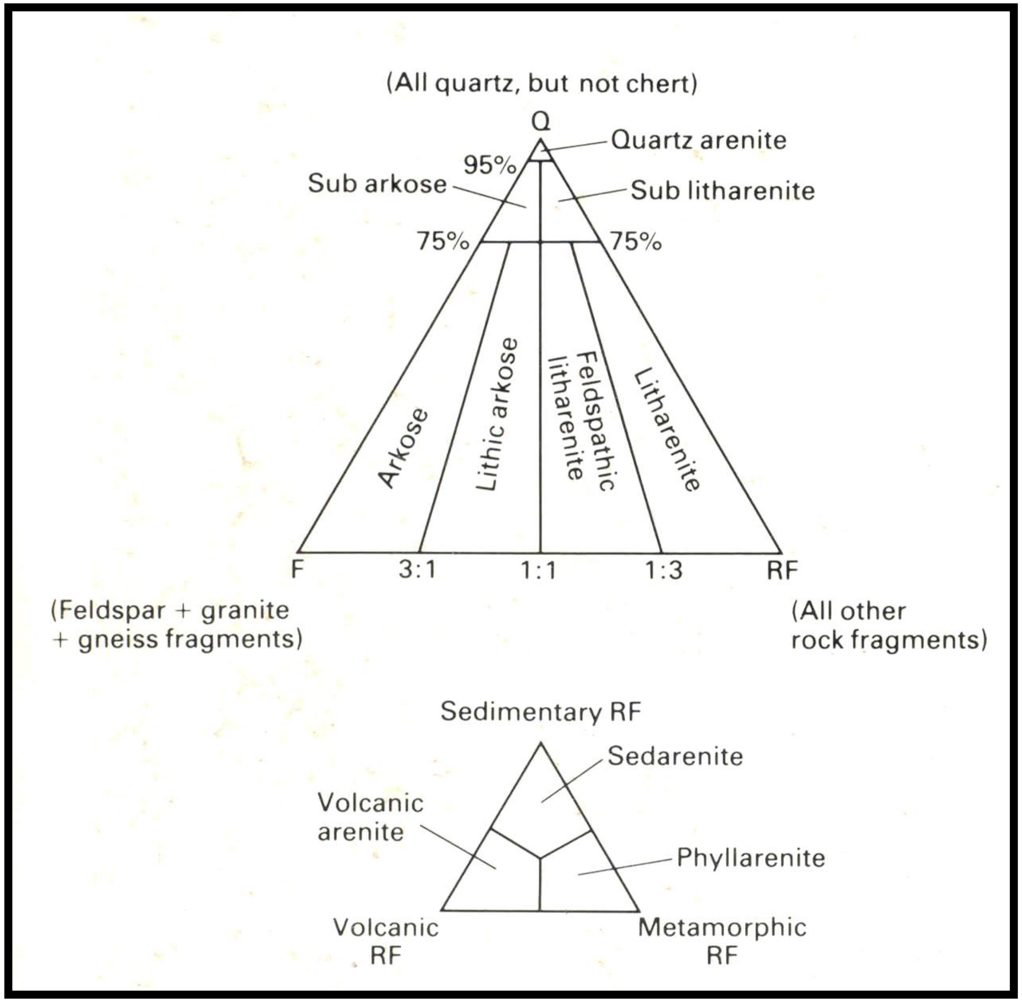
Grain solution and replacement

28 shows a porous sandstone. In this example the mounting medium has been impregnated with a dye so that the pores appear mauve-colored. Note that the margins of some of the quartz grains are embayed. This has occurred as a result of corrosion of the quartz during diagenesis and has led to enhancement of the porosity.



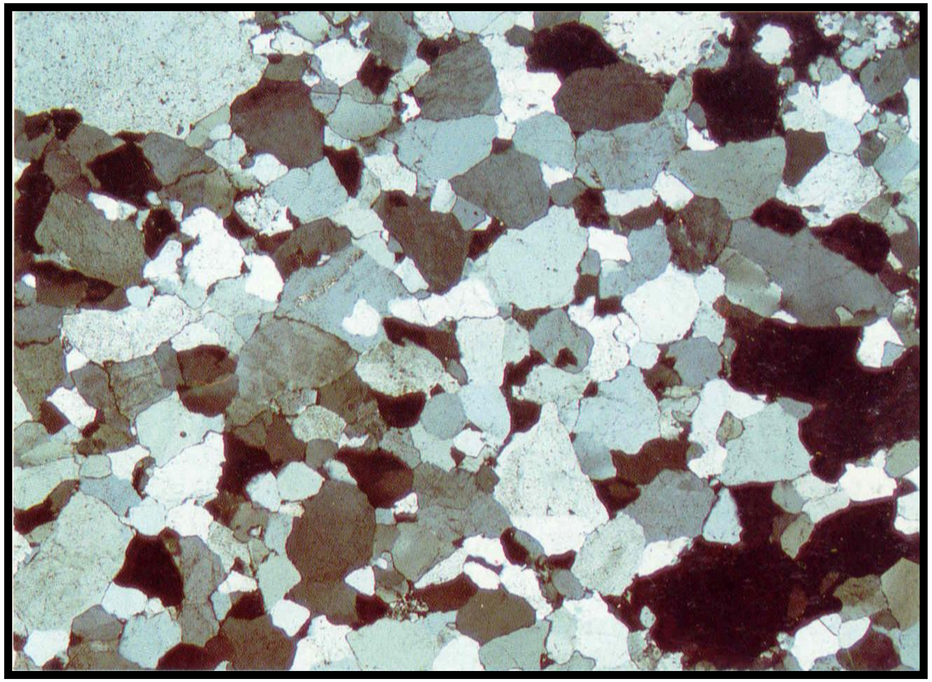
28

Classification of those rocks containing less than 15% fine-grained matrix in terms of the three principal components; quartz, feldspar (plus granite and gneiss fragments) and other rock fragments.



Quartz arenite

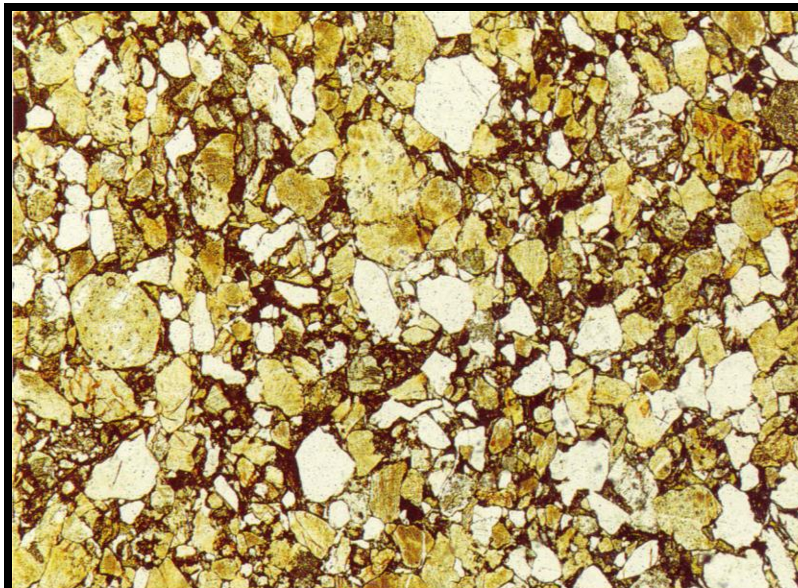
29 shows a sandstone which consists almost entirely of quartz and is thus classified as a quartz arenite. Such sandstones were called quartzites in older classifications, althoagh it is perhaps better to restrict the term quartzite to metamorphic rocks. Since they contain more than 95% quartz, quartz arenties are always mineralogically mature. The example shown is texturally submature to mature, lacking clay and being reasonably well' sorted.



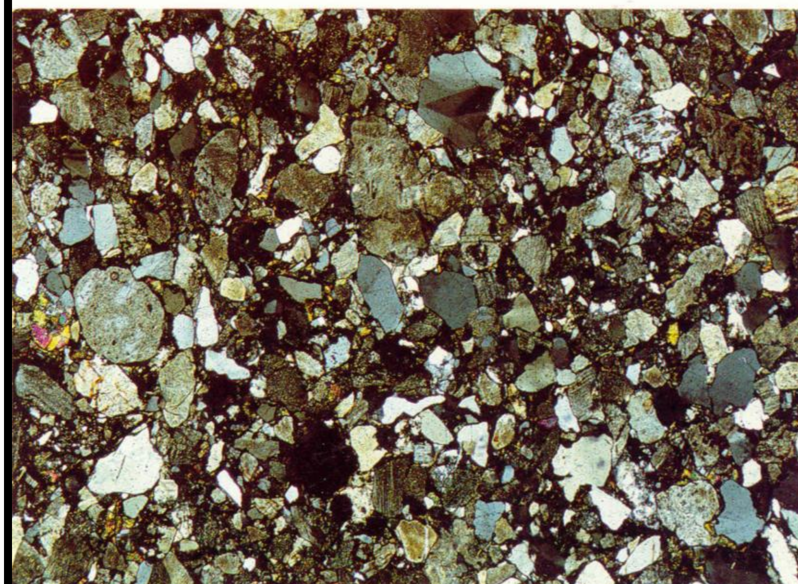
29

Arkose

30 and 31 show a sediment in which more than 50% of the grains are feldspar, easily identifiable in PPL by the brown color resulting from their alteration and in crossed polars by the remnants of multiple twinning in many grains. Most of the other grains in the sediment are clear quartz, so the sample is an arkose. A sediment with such a high proportion of relatively unstable feldspar grains is mineralogically immature. The matrix contains abundant opaque iron oxide.



30



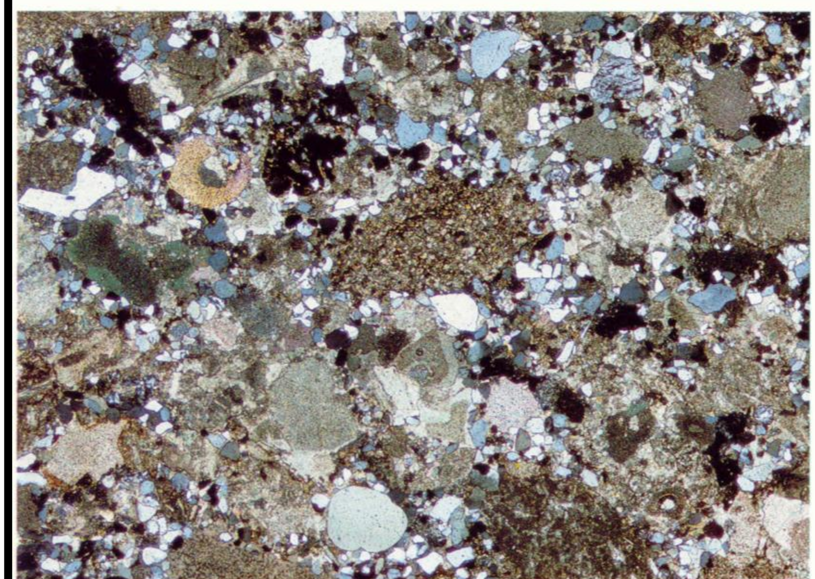
31

Litharenites

Litharenites are sandstones with less than 95% quartz and more rock fragments than feldspar. They may he classified according to whether the rock fragments are predominantly sedimentary, volcanic or metamorphic .

32 and 33 show a sedarenite, in which the fragments are from carbonate rocks. The fine-grained fragment just above the centre is from dolomite rock.

32

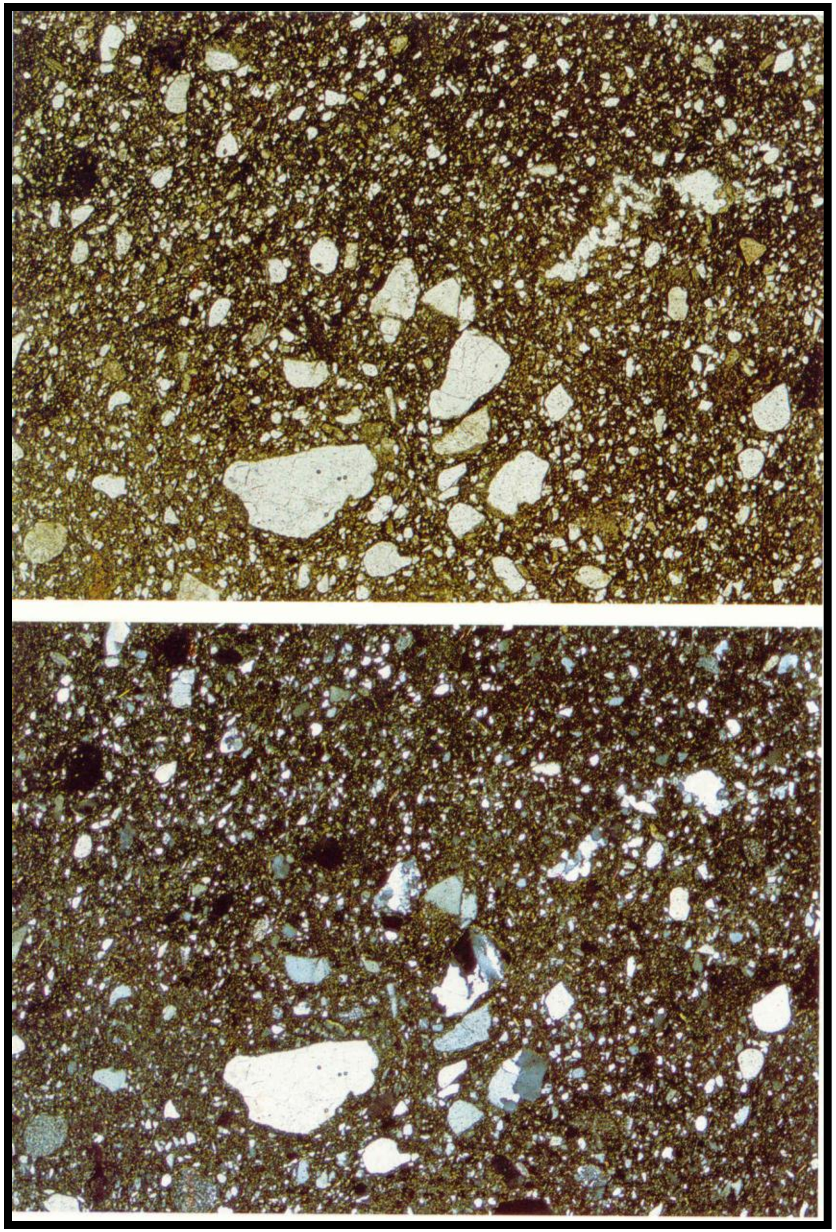


33

Greywacke

Greywackes are those sandstones containing more than 15% fine-grained matrix.

34 and 35 show a typical greywacke, being poorly- sorted and containing abundant fine-grained matrix (almost opaque in the view taken with plane-polarized light). The fragments are predominantly monocrystalline and polycrystalline quartz grains, but a small percentage of rock fragments (cloudy particles of fine-grained material) make this a lithic greywacke.



34

35

مقاطع مرتبط با سنگ های آهکی

Etching and staining characteristics of carbonate minerals

Mineral	Effect of etching	Stain colour with Alizarin Red S	Stain colour with potassium ferricyanide	Combined result
Calcite (non-ferroan)	Considerable (relief reduced)	Pink to red-brown	None	Pink to red-brown
Calcite (ferroan)	Considerable (relief reduced)	Pink to red-brown	Pale to deep blue depending on iron content	Mauve to blue
Dolomite (non-ferroan)	Negligible (relief maintained)	None	None	Colourless
Dolomite (ferroan)	Negligible (relief maintained)	None	Very pale blue	Very pale blue (appears turquoise or greenish in thin section)

- The three most important components of carbonate rocks are allochemical components, microcrystalline calcite, and sparry calcite.

  - ✓ Allochemical components or allochems, are organized aggregates of carbonate sediment which have formed within the basin of deposition. They include ooids, bioclasts, peloids, intraclasts and oncoids.

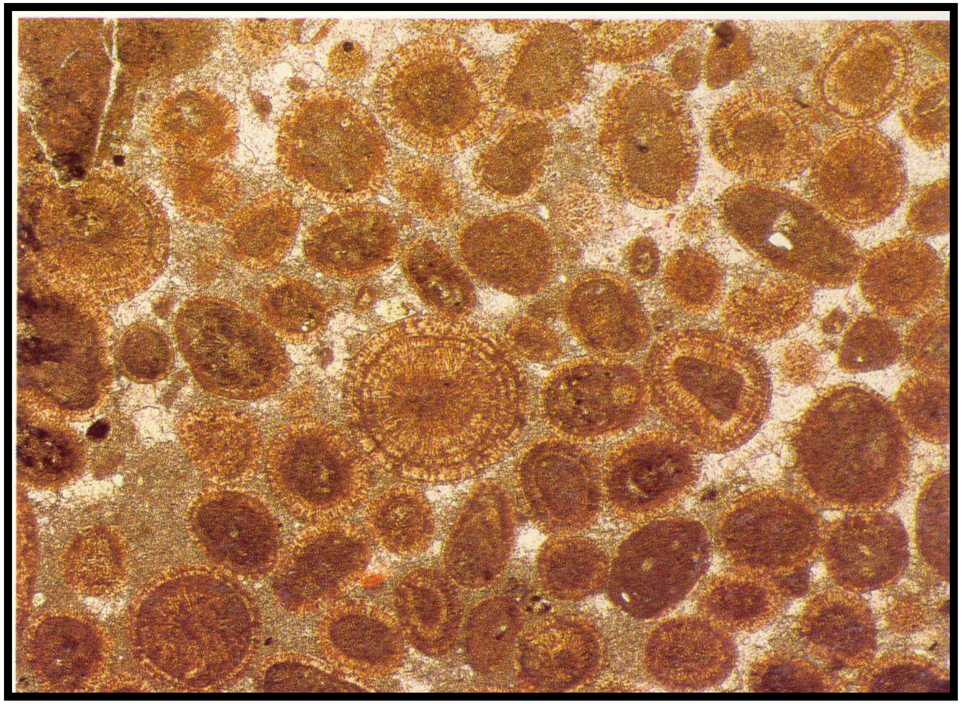
  - ✓ Microcrystalline calcite or micrite is carbonate sediment in the form of grains less than 5µm in diameter. Much of its forms in the basin of deposition, either as a precipitate from seawater or from the disintegration of the hard parts of organisms, such as green algae. The term ‘carbonate mud’ is also used for this fine sediment, although strictly mud includes material of clay- and silt-size (up to 62µm).

  - ✓ Sparry calcite, sparite or spar refers to crystals of 5µm or more in diameter. Much of it is coarse, with crystals commonly up to 1mm in size. It is usually a pore-filling cement and thus may form in a rock a long time after deposition of the original allochems and micrite.

Ooids

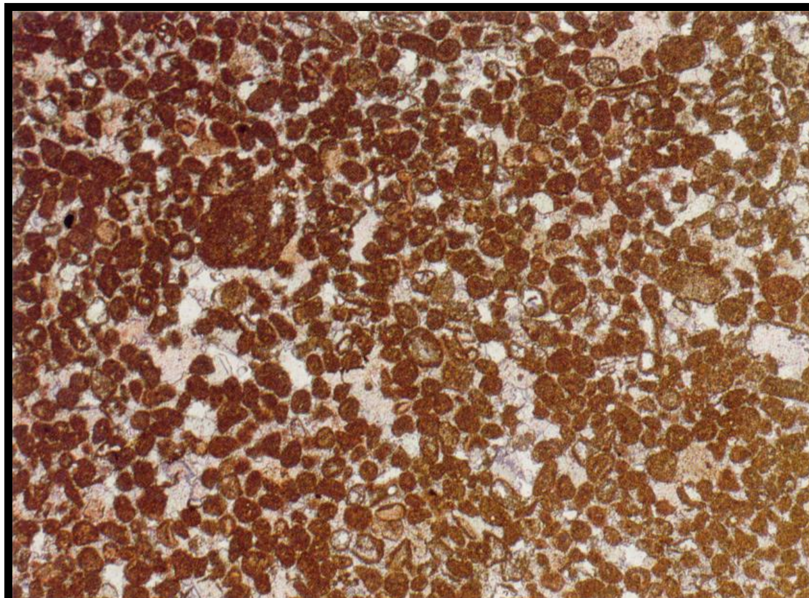
Ooids or ooliths are spherical or ellipsoidal grains, less than 2mm in diameter, having regular concentric laminae developed around a nucleus.

36 shows ooids with well-developed radial and concentric structures. The nuclei are micritic carbonate grains. The sample shows a range of ooids, from those with a small nucleus and thick cortex (the oolitic coating), to those with a large nucleus and a single oolitic lamina. The later are called superficial ooids. The matrix between the ooids is a mixture of carbonate mud and sparry calcite cement.

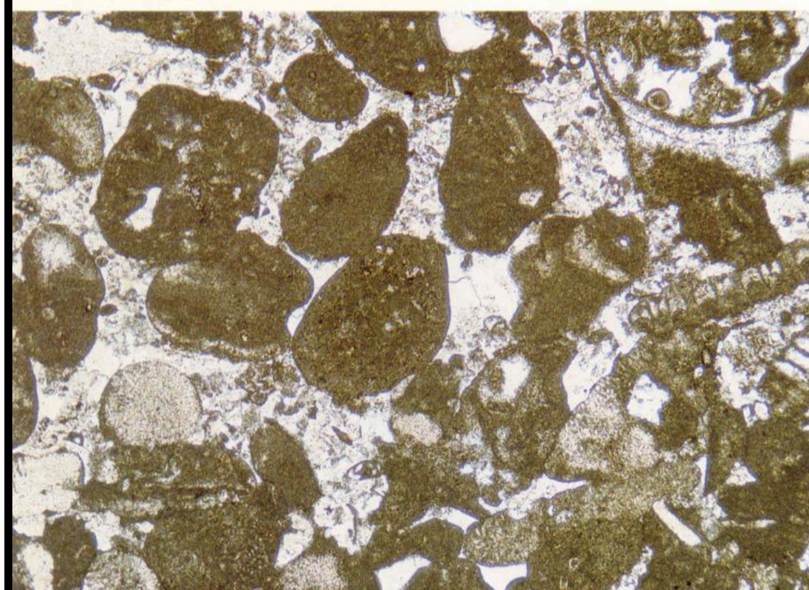


36

Peloids



37



38

Those grains composed of micrite and lacking any recognizable internal structure are called peloids. 37 shows a limestone in which the allochems are mainly peloids, circular to elliptical in cross-section and averaging about 0.1 mm in diameter. Such peloids are generally interpreted as faecal in origin and are called pellets. The photograph shows pellets at the lower end of the size range for typical pellets, which extends up to 0.5 mm.

38 shows large and less regular peloids.

Intraclasts

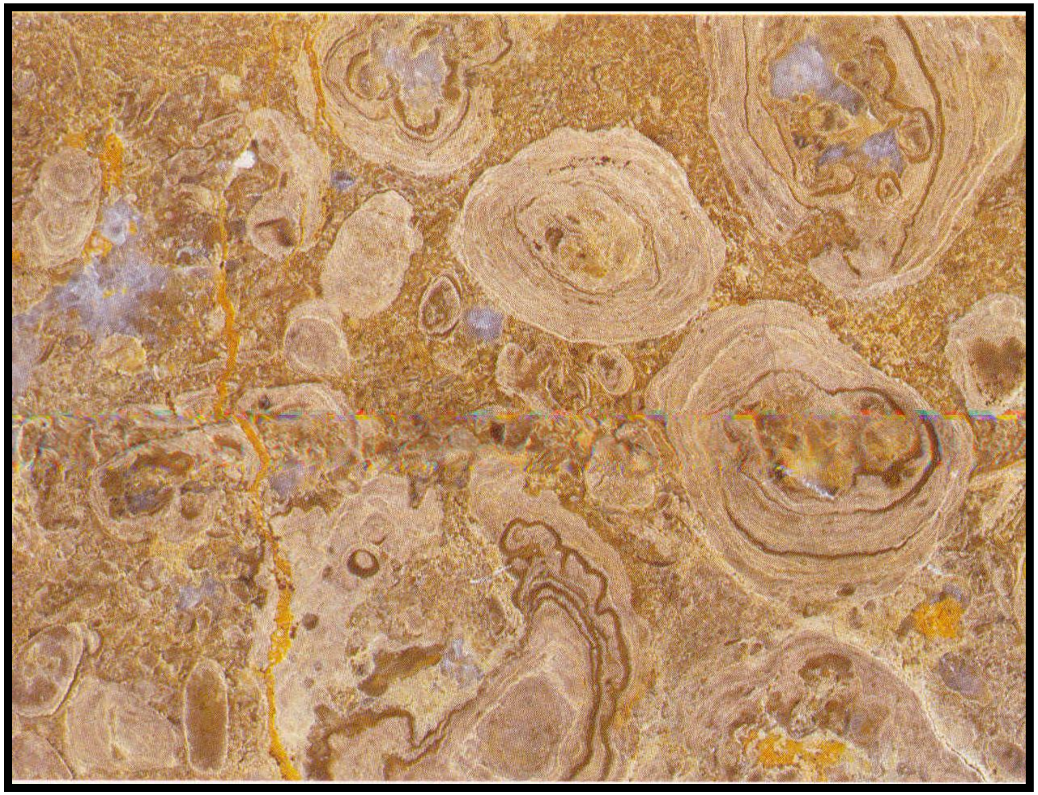
Intraclasts are sediment which was once incorporated on the sea-floor of the basin of deposition and was later reworked to form new sediment grains. 77 shows a large grain which might be described as a 'coated bioclast'.

39

Oncoids

Oncoids, or oncoliths. are presumed to be biogenic, blue-green algae on the grain surfaces, trapping and binding fine sediment particles.

40 is a photograph of a polished rock surface showing oncoids. Note the size of the grains, the asymmetrical growth and the wavy nature of many of the laminae, all features characteristic of oncoids. The bluish-grey areas are sparry calcite and the orange-brown areas are stained with iron oxides.



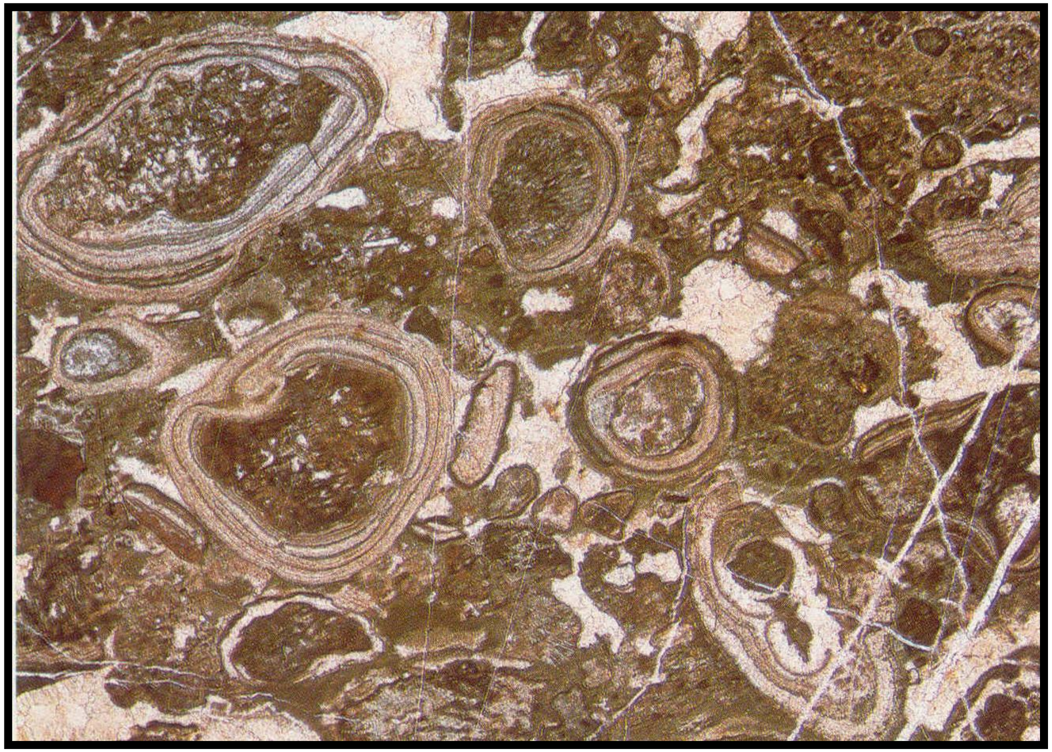
40

Pisoids

The term pisoid or pisolith usually refers to grains presumed to have formed inorganically, usually in a subaerial environment.

41 shows grains with a regular, well-defined concentric layering, in grains up to 5mm in diameter. This is typical of inorganic growth and these grains may be pisoids.

Pisoids are commonly fractured or broken. Broken pieces can be seen towards the top right of the photograph.



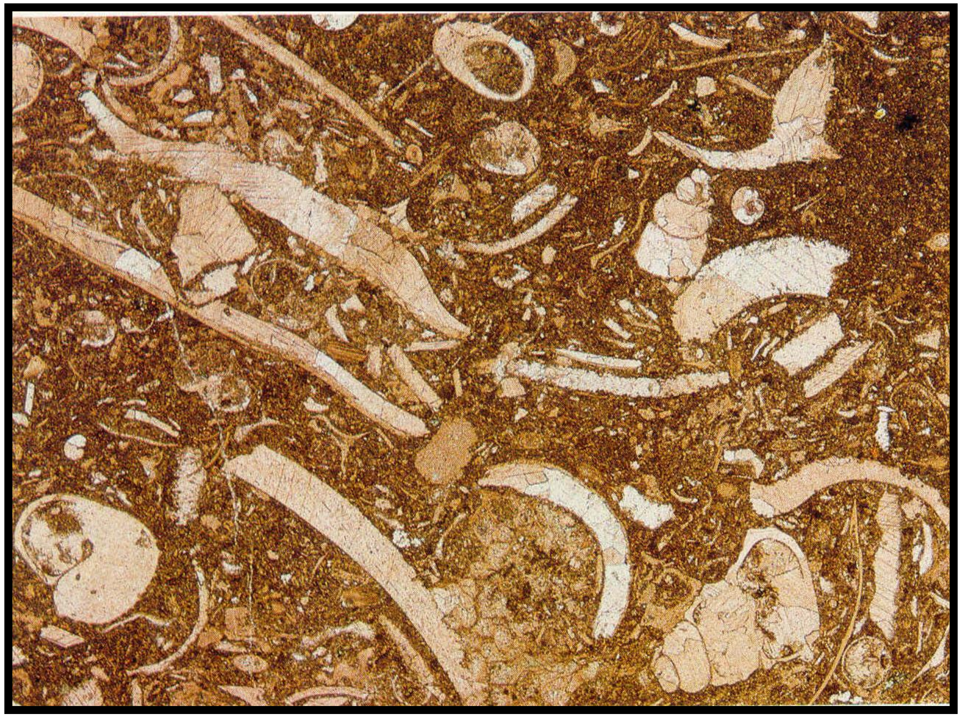
41

Bioclasts

Molluscs

42 shows a limestone with abundant molluscan casts. In this case shell moulds have been infilled with a few large calcite crystals. Gastropods can be seen, both in long section (lower right) and transverse section (lower left).

The rock matrix is micritic sediment.



42

Bioclasts

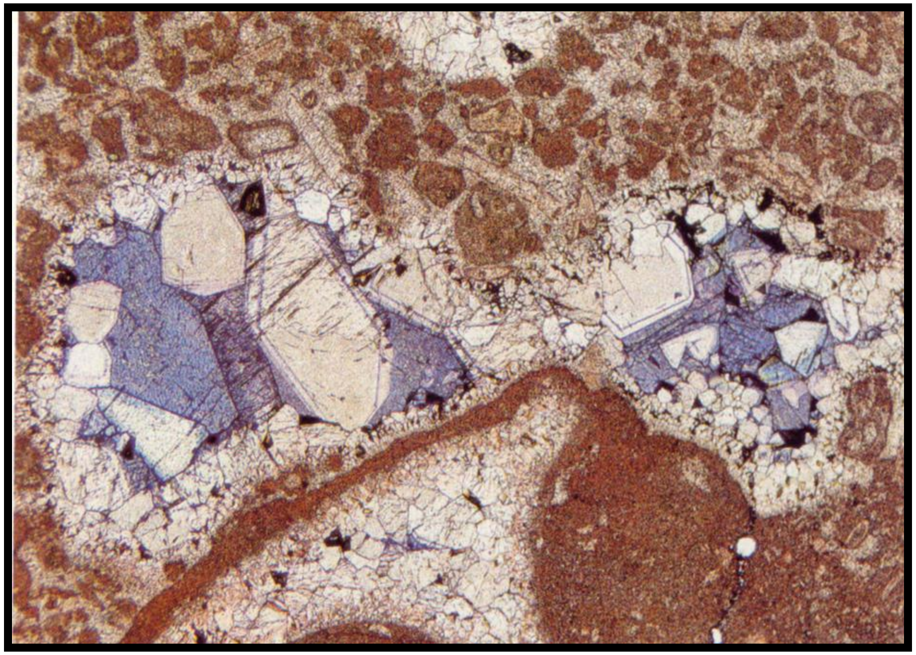
Corals

Corals are best identified by their overall morphology.

43 shows a transverse section and parts of two longitudinal sections of the colonial rugose coral Lithostrotion.

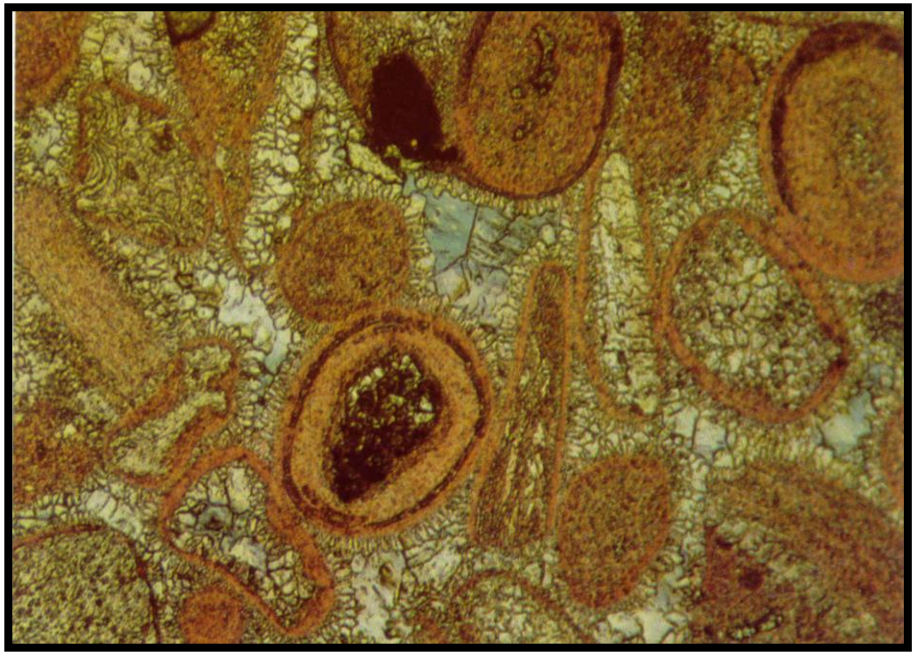
43

Carbonate cement



44

45



Compaction

Apart from cementation, the major process leading to porosity reduction in sediments is compaction. Early stages of compaction in uncemented sediments involve the readjustment of loose grain fabrics to fit more tightly together, the fracture of delicate shells, the squashing of soft grains, and the dewatering of carbonate mud.

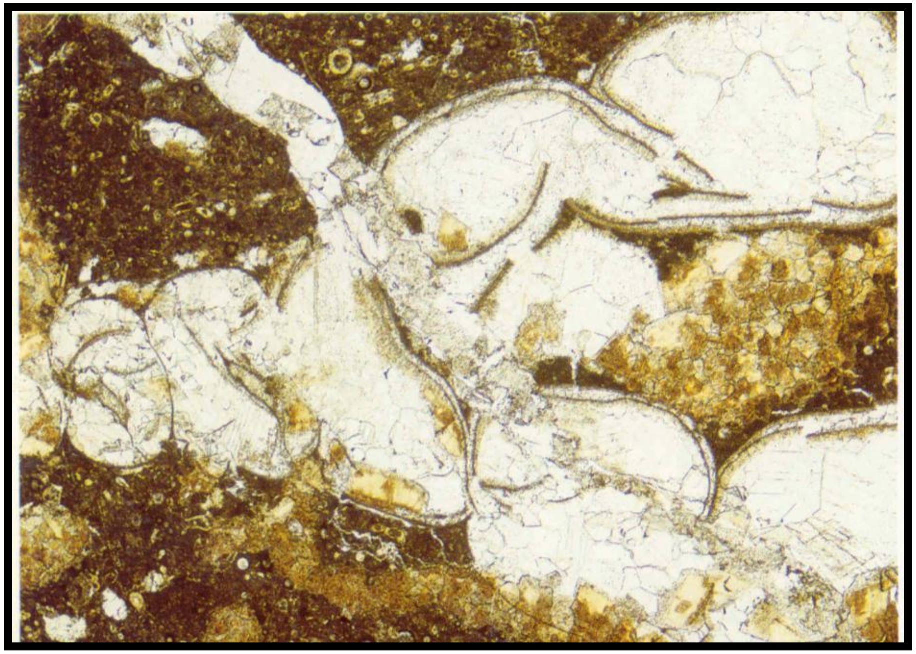
46 shows a peloidal limestone in which either the outer layers of the peloids, or a very thin early generation of cement, has flaked off during compaction. The micritic grains must have been rigid or compaction would have resulted in their deformation.

46

Compaction

47 shows a cross-section of a gastropod preserved as a cast. The inner wall of the organism is marked by a micrite envelope and a thin generation of early cement (see for example the chambers in the upper part of the photograph). The wall of the shell has been fractured and some fragments disoriented during compaction. Both micrite envelope and early cement are fractured and the fractures then healed by a coarse sparite cement. <u>Thus after deposition, the mollusc was micritized and then cemented by a thin early generation of fine carbonate.</u>

47



Pressure-solution and deformation

48 illustrates a case of grain-to-grain pressure- solution. Before the pores of a rock are filled by cement, stress is concentrated at the points where the grains meet and part of one or both the grains dissolves. In the example, ooids have undergone solution. The later cement is a mauve-stained, slightly ferroan sparite. Note the small rhombic areas of fine calcite spar (e.g. midway up, half-way between centre and left-hand edge). These are calcite pseudomorphs after dolomite.

48

Limestone Classification

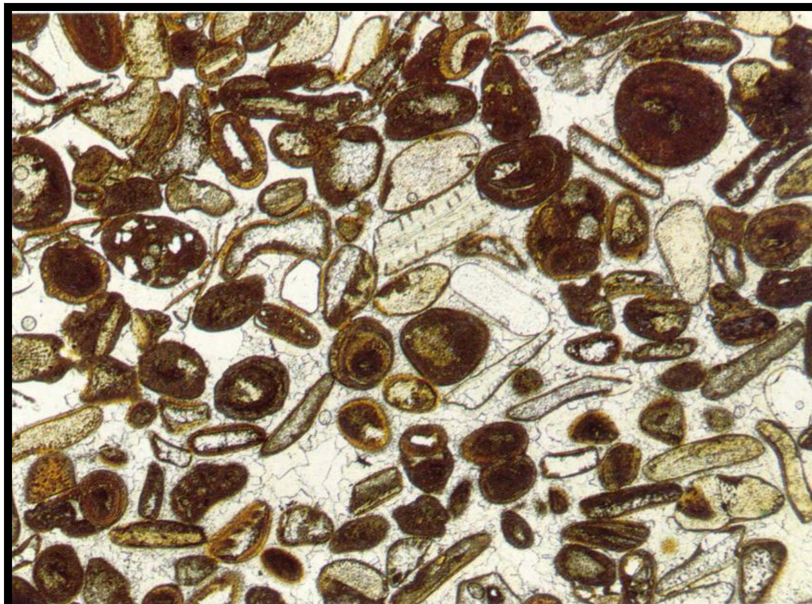
Classification of limestones according to Dunham (1962).

Rock names are in capital letters.

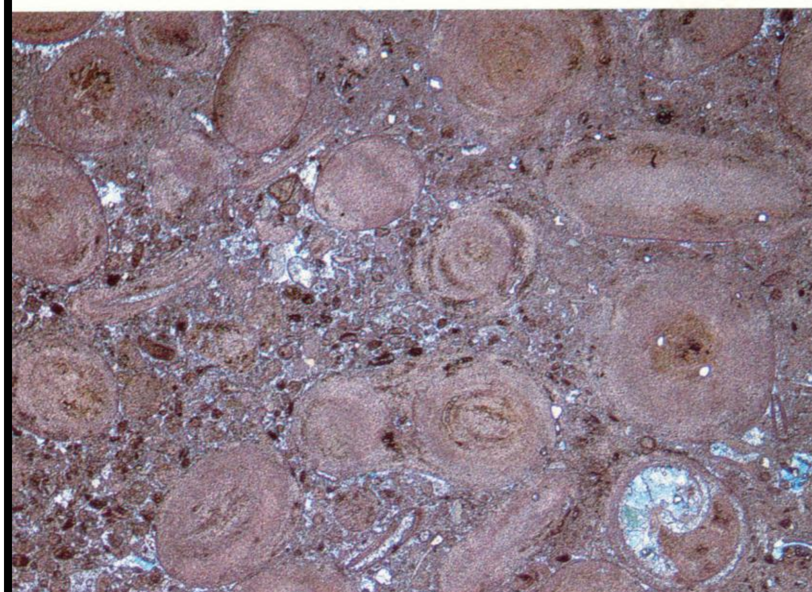
<table>
<tr><td colspan="4">Original components not organically bound together during deposition</td><td>Components organically bound during deposition</td></tr>
<tr><td colspan="3">contains carbonate mud</td><td>no carbonate mud</td><td rowspan="3"></td></tr>
<tr><td colspan="2">mud-supported</td><td colspan="2" rowspan="2">grain-supported</td></tr>
<tr><td>< 10% allochems</td><td>> 10% allochems</td></tr>
<tr><td>MUDSTONE</td><td>WACKESTONE</td><td>PACKSTONE</td><td>GRAINSTONE</td><td>BOUNDSTONE</td></tr>
</table>

49 illustrates a grainstone. The rock is grain-supported with a spar cement. The sediment is loosely-packed, suggesting that cementation occurred before significant compaction.

50 shows a packstone. The rock shows two sizes of grains, having large and small peloids.



49



50

51 shows a wackestone. The grains are bioclasts, mainly echinoderm plates with some bryozoans (e.g. lower left part). These grains are supported by a matrix of carbonate mud in which many small particles are visible at this magnification.

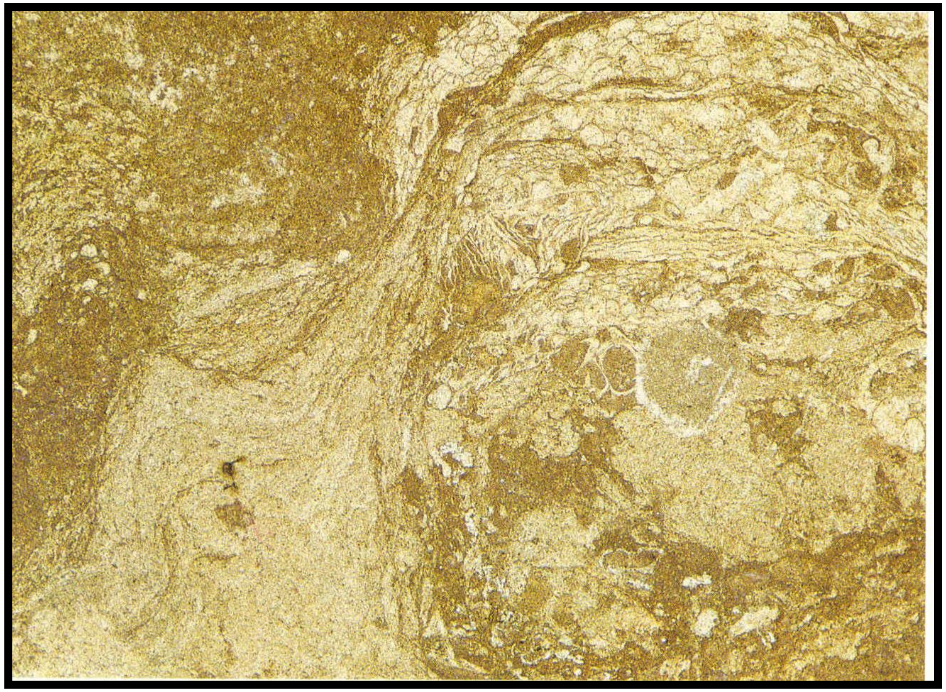
52 shows a mudstone, being a matrix-supported limestone with less than 10% allochems. In this case the allochems are microfossils — foraminifera and calcite casts of radiolaria.

51

52

A boundstone is a limestone in which sediment is bound together by organisms, such as occurs in many reefs. Textures are often more clearly visible at hand specimen scale.

52 shows a thin section of a reef limestone comprising growths of a number of problematic organisms (probably algae or foraminifera) which have encrusted one another while incorporating fine-grained sediment into the rock framework.



52

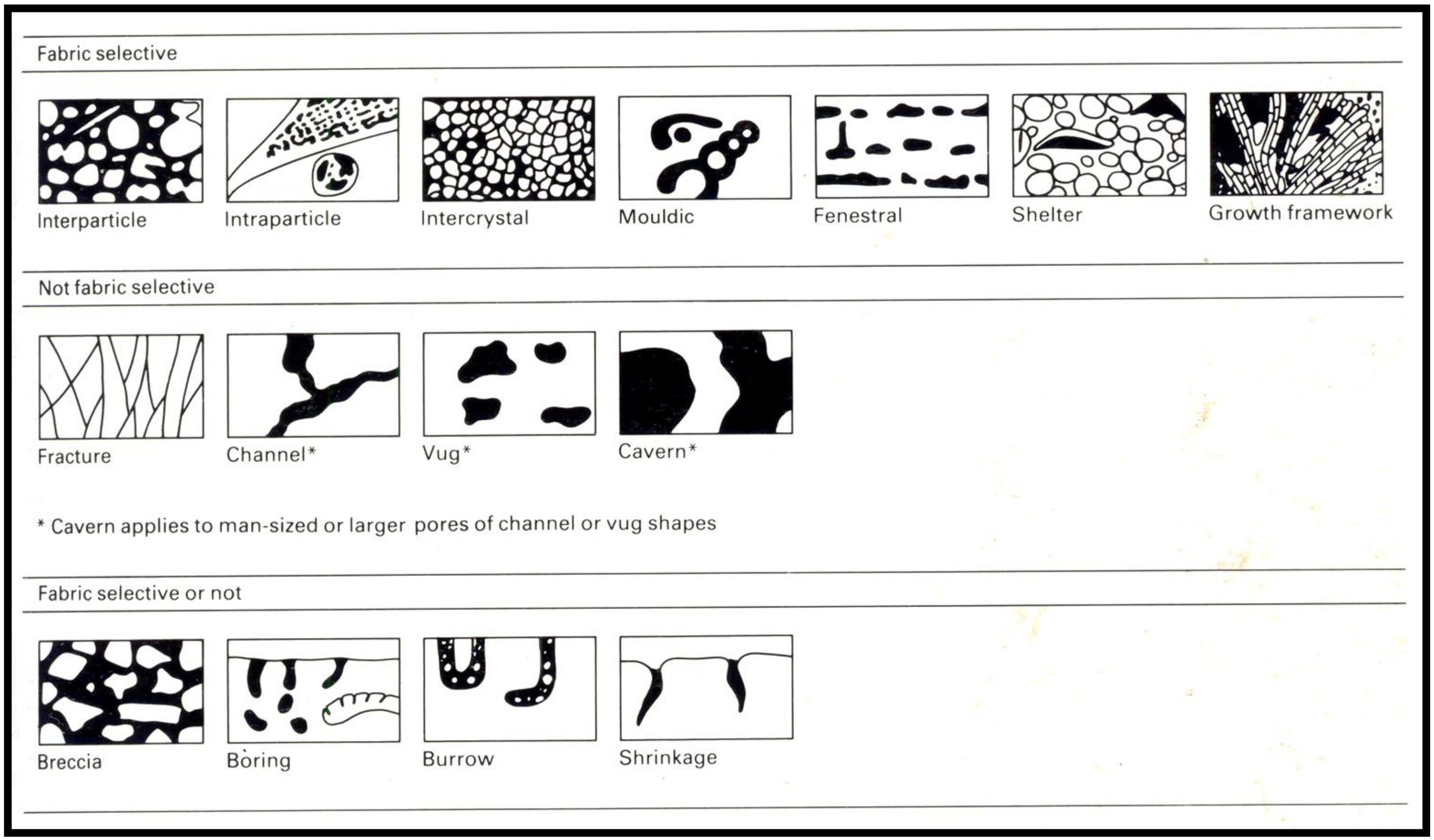
Limestone Classification

- Classification of limestones according to Folk (1959).

<table>
<tr><td colspan="3" rowspan="2">Volumetric allochem composition</td><td colspan="2">>10% allochems</td><td colspan="3"><10% allochems</td><td rowspan="5">Undisturbed reef and bioherm rocks</td></tr>
<tr><td>Sparry calcite > Micrite</td><td>Micrite > Sparry calcite</td><td colspan="2">1–10% allochems</td><td><1% allo-chems</td></tr>
<tr><td colspan="3">>25% Intraclasts</td><td>INTRASPARITE</td><td>INTRAMICRITE</td><td rowspan="5">Most abundant allochems</td><td>Intraclasts INTRACLAST-BEARING MICRITE</td><td rowspan="5">MICRITE, or if sparry patches present DISMICRITE</td></tr>
<tr><td rowspan="4"><25% Intraclasts</td><td colspan="2">>25% Ooids</td><td>OOSPARITE</td><td>OOMICRITE</td><td>Ooids OOID-BEARING MICRITE</td></tr>
<tr><td rowspan="3"><25% Ooids Volume ratio, bioclasts: peloids</td><td>> 3:1</td><td>BIOSPARITE</td><td>BIOMICRITE</td><td rowspan="2">Bioclasts FOSSILIFEROUS MICRITE</td></tr>
<tr><td>3:1 to 1:3</td><td>BIOPELSPARITE</td><td>BIOPELMICRITE</td><td rowspan="2">BIOLITHITE</td></tr>
<tr><td>< 1:3</td><td>PELSPARITE</td><td>PELMICRITE</td><td>Peloids PELOID-BEARING MICRITE</td></tr>
</table>

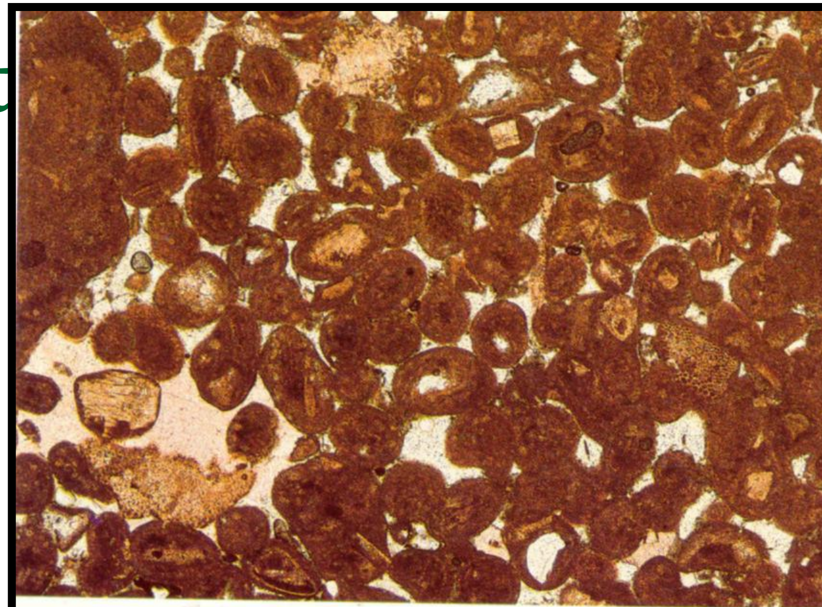
Limestone Porosity

Basic porosity types in sediments. Pores shaded black.

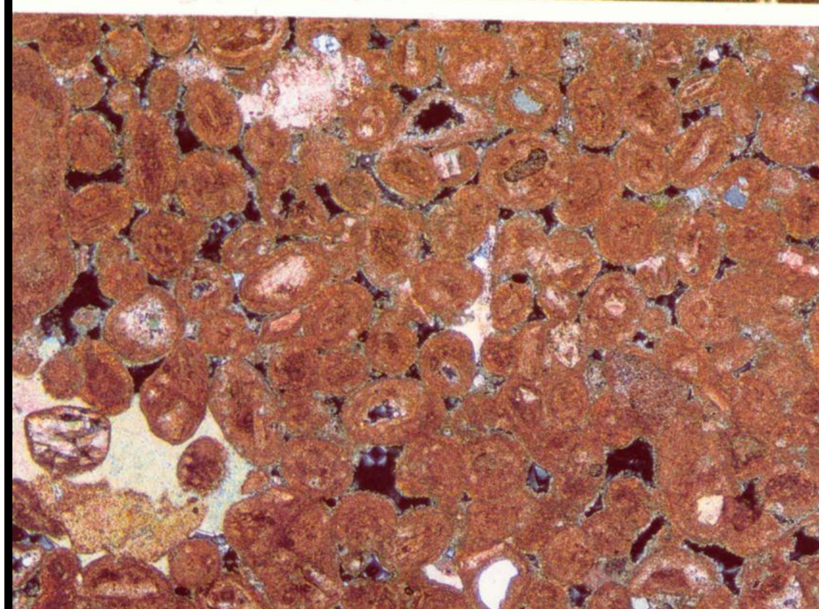


Limestone Porosit

53 and 54 show an oolitic,peloidal sediment in which much of the depositional space between grains is unfilled by sediment or cement. The rock is said to show primary intergranular porosity. When deposited, such a sediment may have had as much as 50% pore-space. <u>This has been reduced by compaction and by the introduction of some cement</u>.



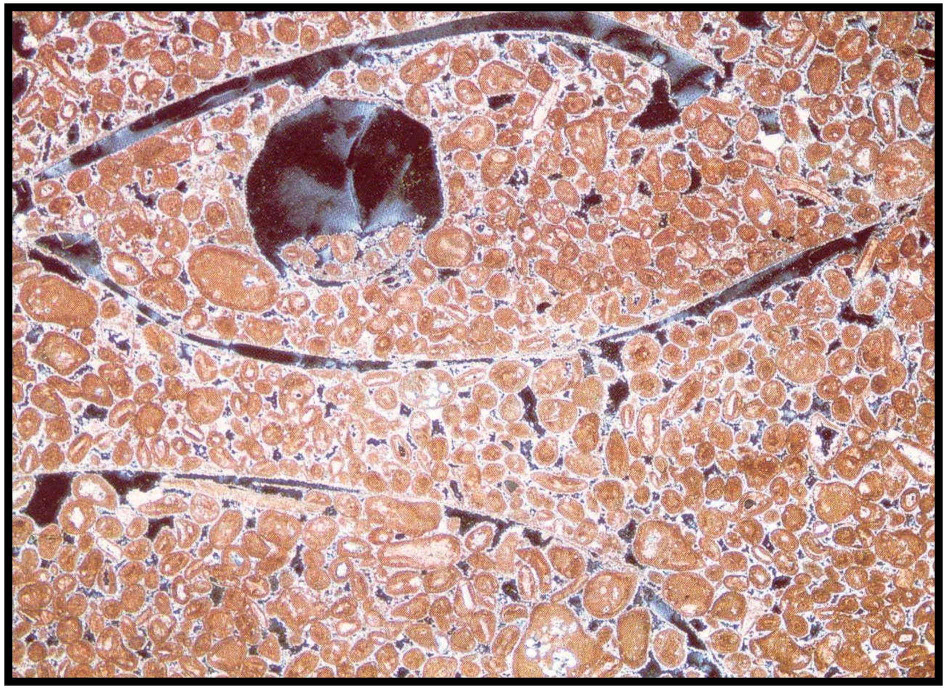
53



54

Limestone Porosity

A common type of secondary porosity is mouldic porosity, usually formed by the dissolution of aragonite bioclasts. 55 shows a sediment having primary inter-granular and secondary mouldic porosity. Thin micrite envelopes have supported the shell moulds.

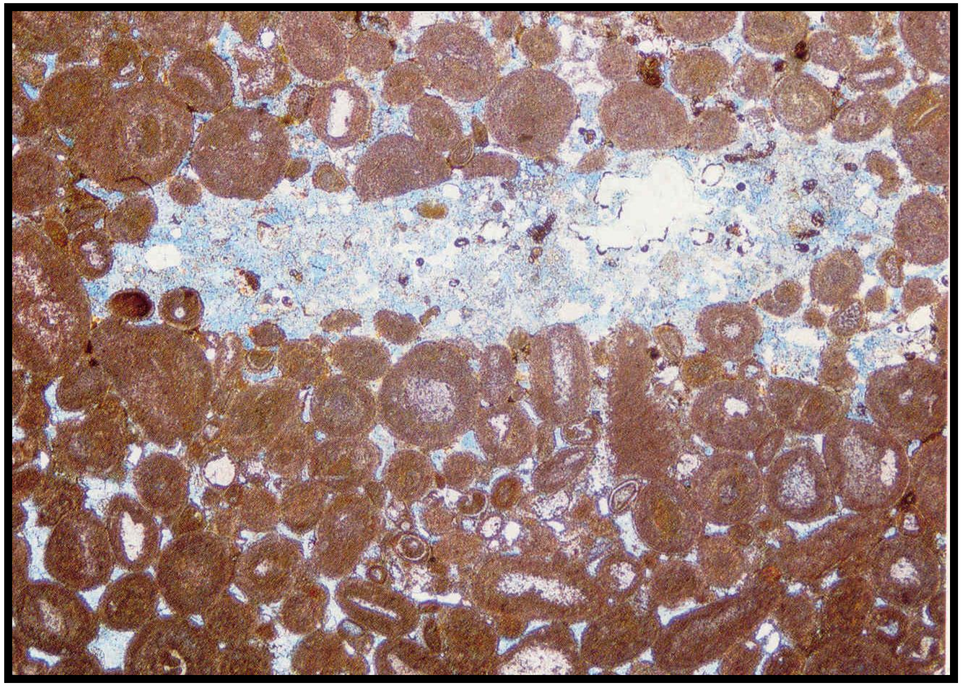


55

Limestone Porosity

Porosity may develop as a result of the burrowing and boring activities of organisms.

56 Shows a section through a boring made by an organism in an oolitic sediment. Note that grains are truncated around the margins of the boring, indicating that the sediment was lithified when the organism was at work and hence the structure is a boring rather than a burrow. The boring is infilled with a ferroan calcite cement, some of which has been lost during the making of the section.

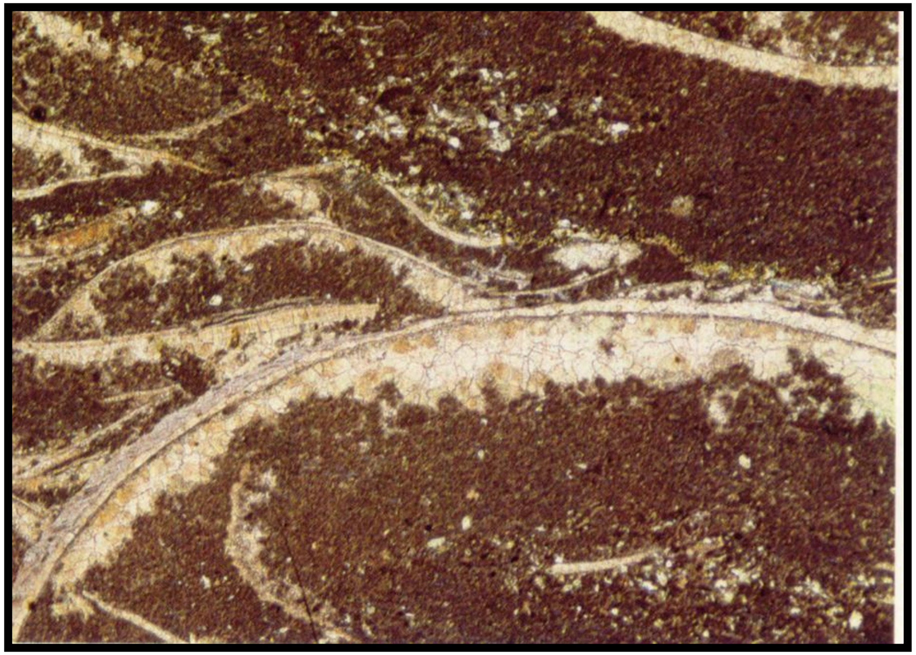


56

Limestone Porosity

Shelter porosity occurs below curved shell fragments which are preserved in a convex-up position.

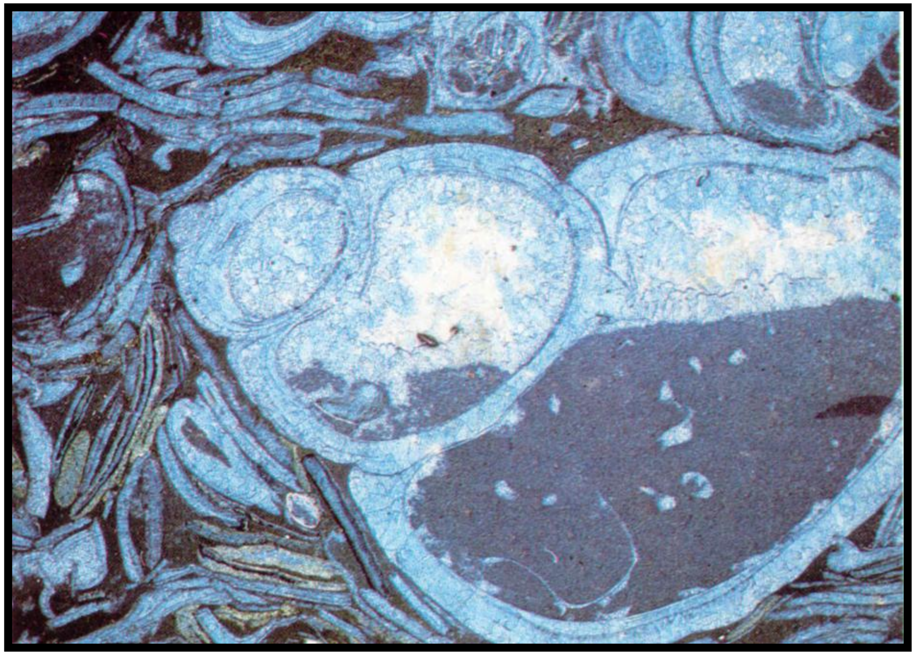
57 shows bivalve fragments in a carbonate mud sediment. Those preserved in a convex-up position, including the large fragment extending right across the field of view, have areas of sparite cement below them which was precipitated during the infilling of shelter cavities. Sediment was unable to fill the cavities because of the 'umbrella' effect of the shell.



57

Limestone Porosity

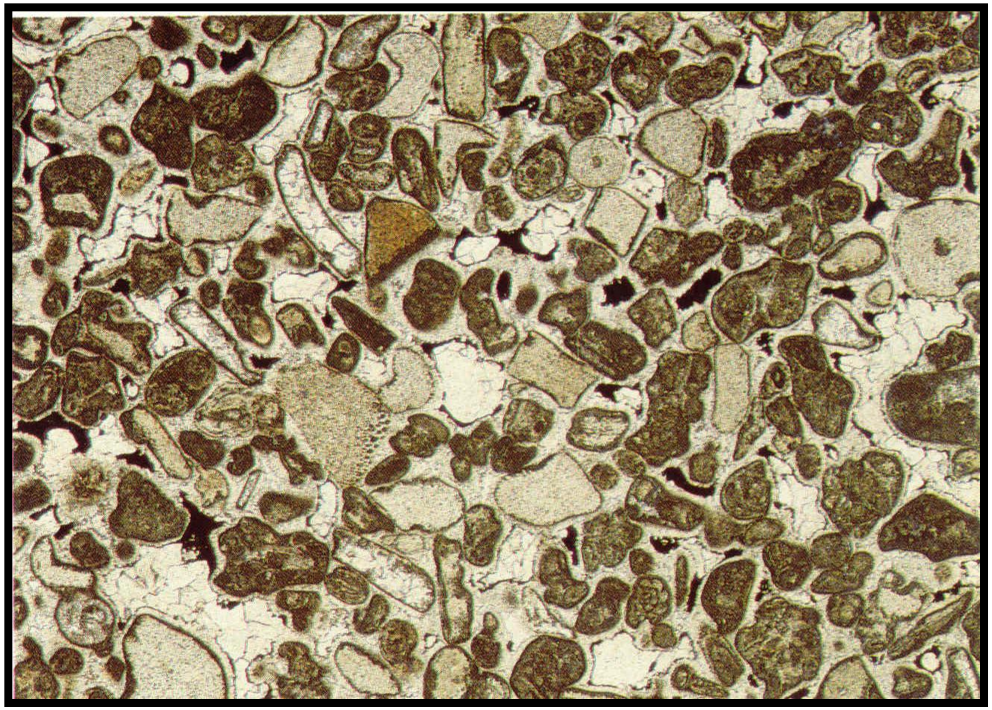
Pore-space in limestones may be filled with sediment as well as cement. Sediment partially infilling cavities, particularly in fossils or fenestrae, will indicate the horizontal plane at the time of its deposition. Such sediment infills are known as geopetal infills. 58 shows geopetal sediment within a gastropod. On deposition the gastropod would have had a primary porosity within its chambers (intragranular porosity).



58

Limestone Porosity

Some pore-spaces have hydrocarbons within them or have evidence that hydrocarbons have passed through.
59 shows a limestone in which a few pores are filled with black hydrocarbon and others are lined by a thin coating of it. Examination of its relationship to the cement shows that the hydrocarbon entered the rock after an early generation of isopachous cement (marine?) and before the final filling of coarse blocky cement.



59

Dolomitization

- Dolomite, $CaMg(C03)$, is a major component of limestones. It is usually secondary, replacing pre-existing carbonate minerals. Unlike calcite. it often occurs as euhedral rhomb-shaped crystals. However. since its optical properties arc similar to those of calcite, it can he difficult to distinguish between the two. For this reason etching and staining of sections with Alizarin Red S is carried out.

- Dolomitic rocks are classified according to their dolomite content as follows:
  - ✓ 0 to 10% dolomite → limestone
  - ✓ 10 to 50% dolomite → dolomitic limestone
  - ✓ 50 to 90% dolomite → calcitic dolomite
  - ✓ 90 to 100% dolomite → dolomite

- Since the term dolomite is used for both the mineral and the rock, some workers prefer the term dolostone for the rock, although the term has not been universally accepted and is not employed here.

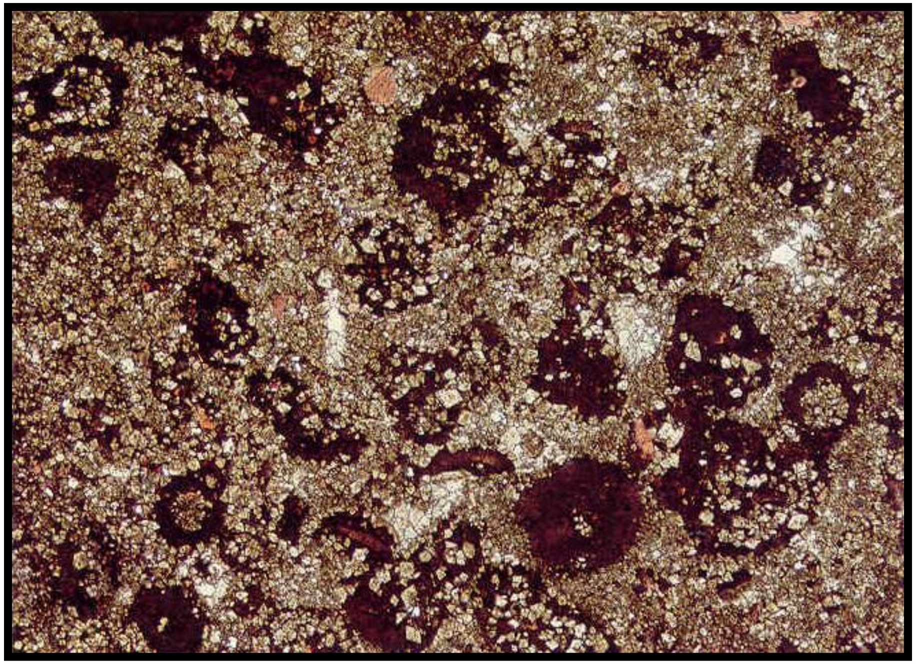
Dolomitization

60 shows a dolomitic limestone containing 20 to 30% dolomite. The dolomite is unstained and occurs as euhedral rhomb-shaped crystals which contain inclusions, probably of calcite, and are thus cloudy. The unaltered limestone surrounding the dolomite is pinkstained, non-ferroan calcite and shows a patchy texture of micrite and sparite with few recognizable grains.

60

Dolomitization

61 shows a calcitie dolomite in which the original calcite matrix has been wholly replaced by dolomite (unstained) but the micritic allochems (peloids) have resisted dolomitization and are only partly replaced (dolomite unstained, calcite red). Where replacement is incomplete. euhedral rhomb-shaped crystals are visible. Where replacement is complete, crystals have grown together and the euhedral shape is lost.

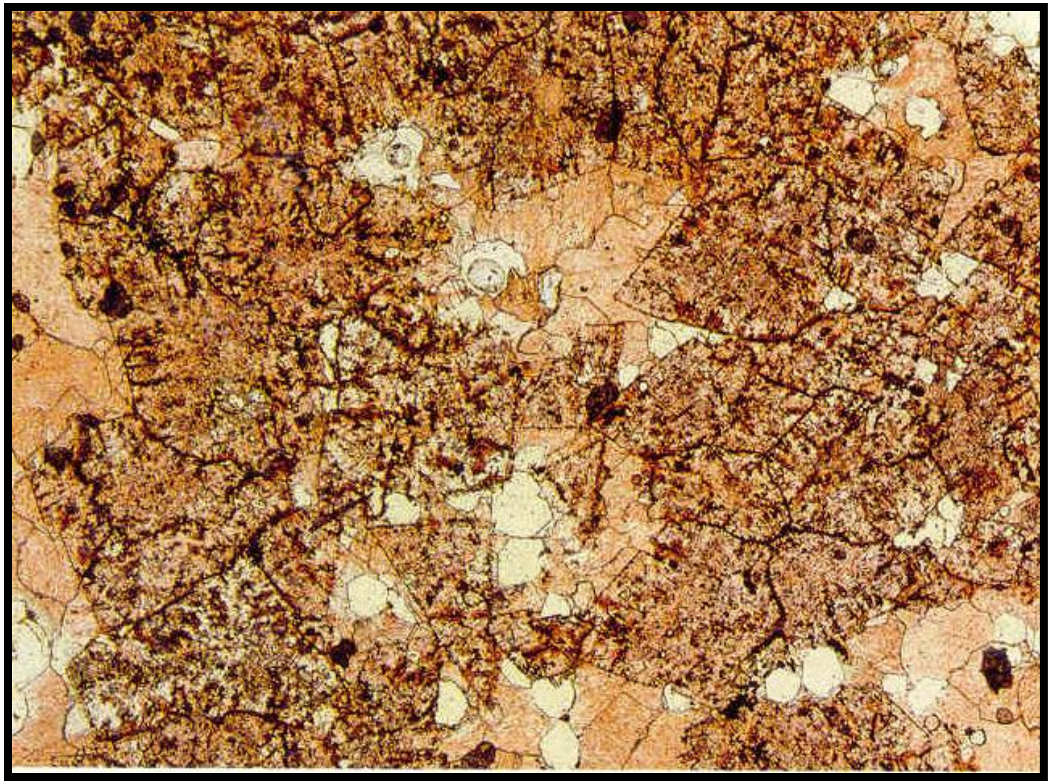


61

Dedolomitization

Dolomite may he replaced by calcite, usually by the action of oxidizing meteoric waters. This process of dedolamitization yields rhomb-shaped crystals of calcite or rhomb-shaped areas which comprise a mosaic of replacement calcite (dedolomite).

62 shows large rhomb-shaped areas which are now pink-stained calcite crystals. The morphology of these areas suggests that they were originally single dolomite crystals. Note that the 'dedolomite' is full of brown inclusions of iron oxides.



62

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