Fig. 7. Two specimens of *Astropolithon* Dawson(?) collected from the upper part of the Herreria Formation exposed along the road from Barrios de Luna to Mallo (between LSB and LSC). All specimens consist of a doughnut with central stem. The latter is always at the base of the fossil. In this particular sample the stems were interconnected by a horizontal tube with about the same diameter as the stems. True size.

Fig. 8. Silicified oölites (SO) and dolomitized oölites (DO). Dark parts in the spheres are due to weathering. B are rounded bioclasts. Section LSC.

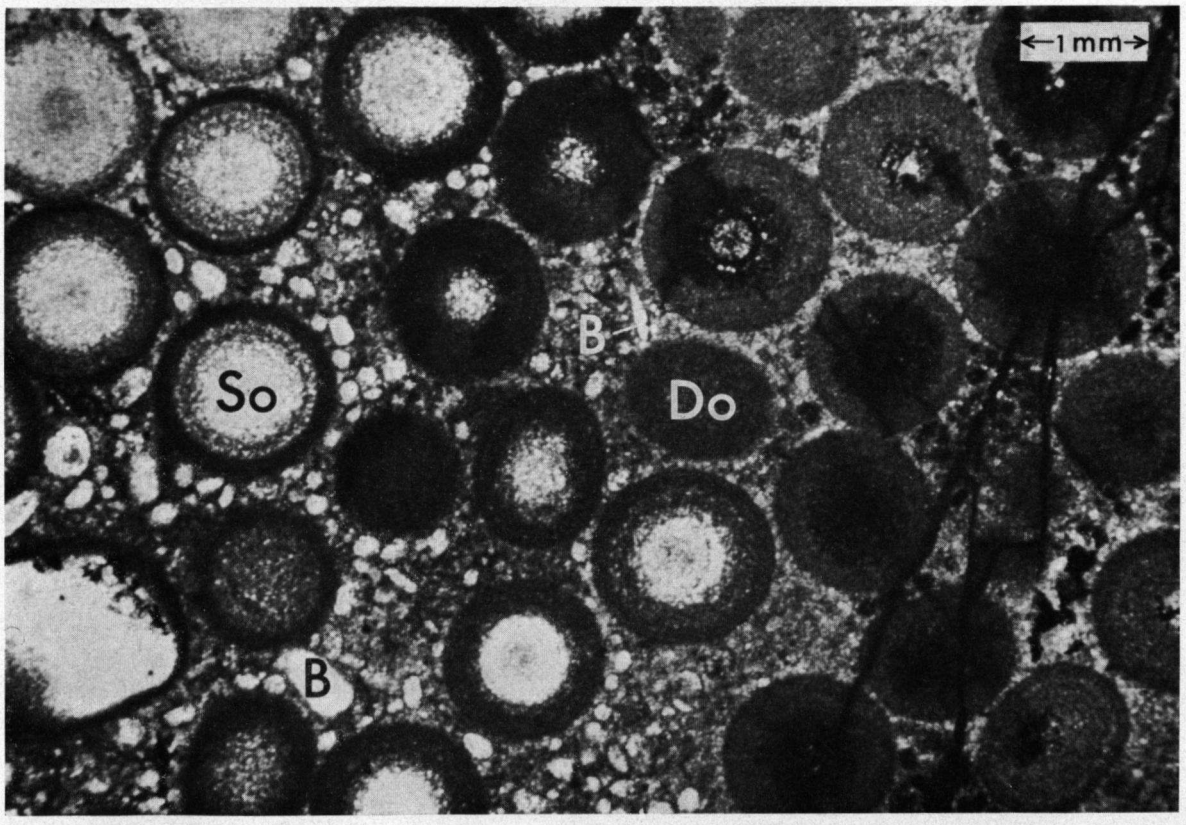
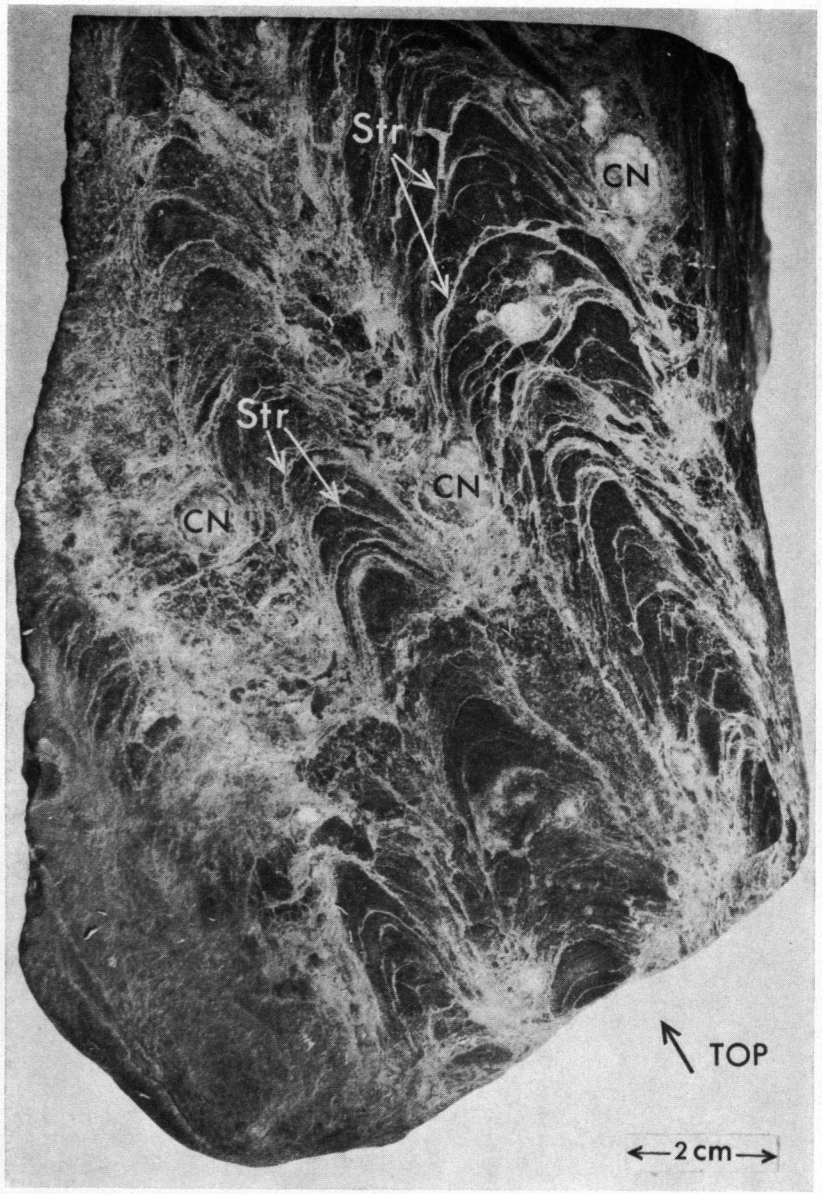

←1 mm→
So
B
Do
B

Fig. 9. Dolomitized, distorted oölites. Section LSD.

Fig. 10. Stromatolites from the marker bed in the Dolomite Member. Str. are dolomitized strings, CN are pinkish-white calcite nodules. Section LSF. True size.


Str
CN
Str
CN
CN
TOP
2 cm

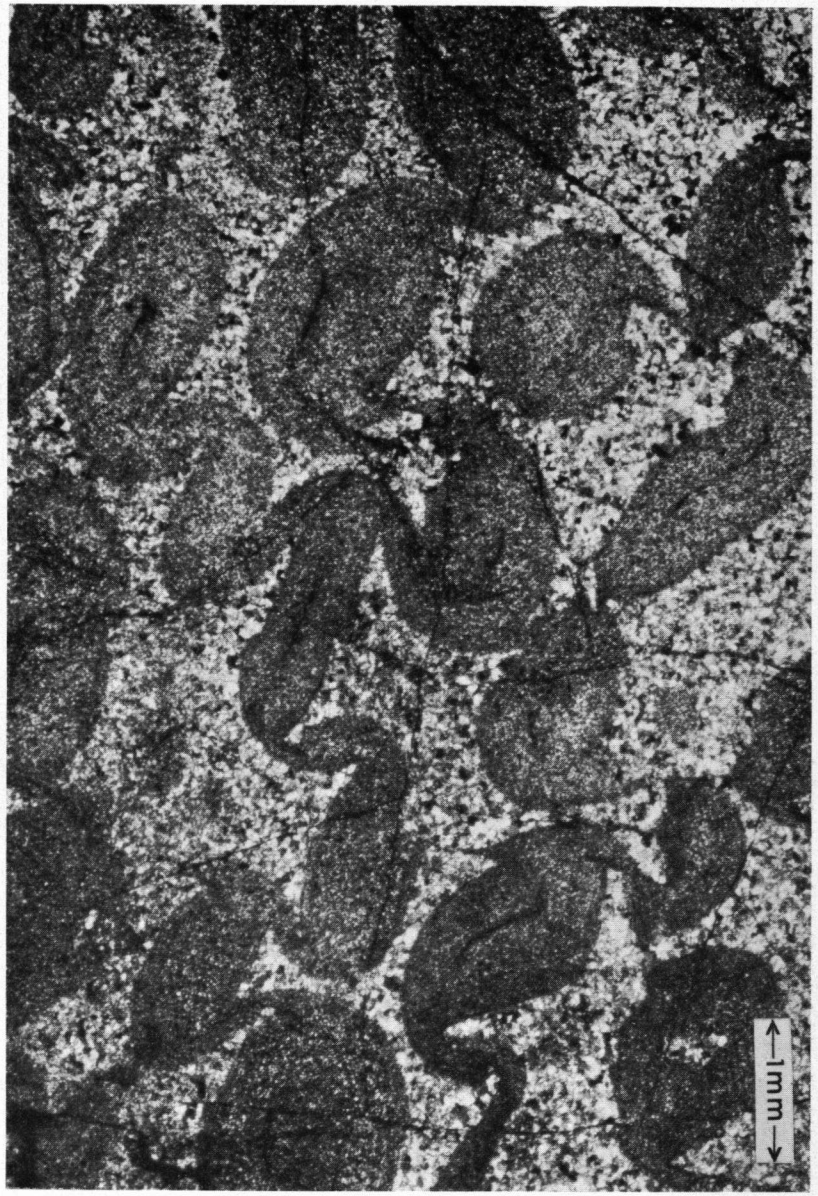
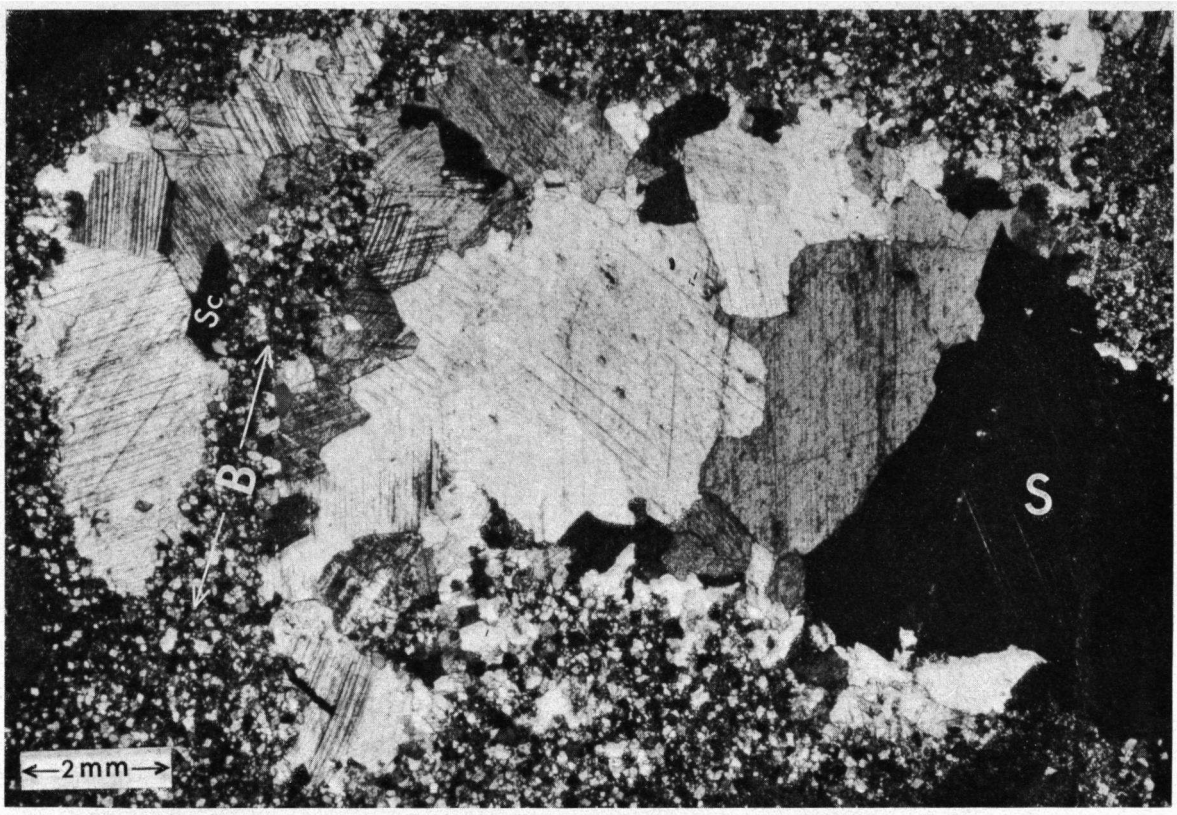

1mm

Fig. 11. This Photomicrograph showing a band (B) of dolomite rhombs which might have formed in the crack of an old gypsum? crystal. After the original mineral was leached out, calcite crystals formed in the cavity. Sc is a rather well developed calcite crystal. Calcite crystal S extends from wall to wall. Section LSF.

Fig. 12. Detail of the calcite crystals developed in the band of fig. 11. Notice the poikilitically enclosed dolomite rhombs (arrow) and the straight intercrystalline boundaries of the calcite crystals.


Sc
B
S
←2 mm→

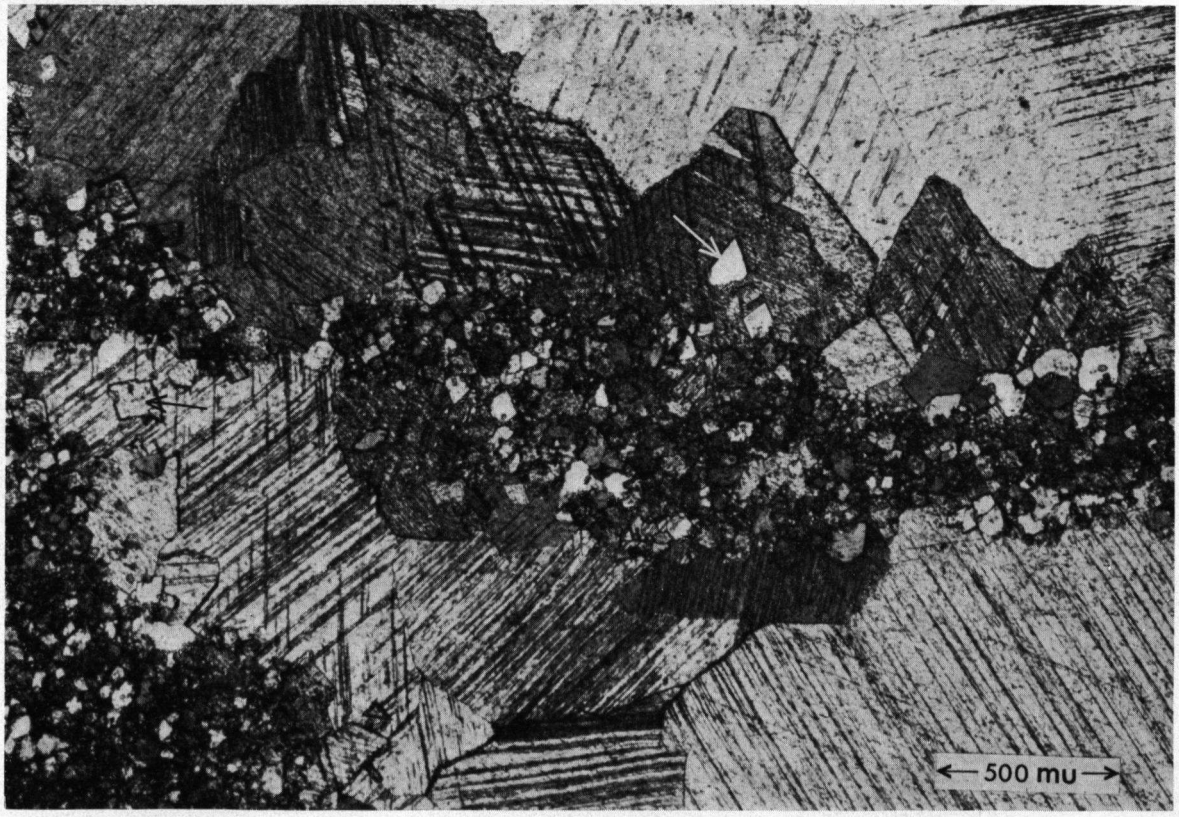
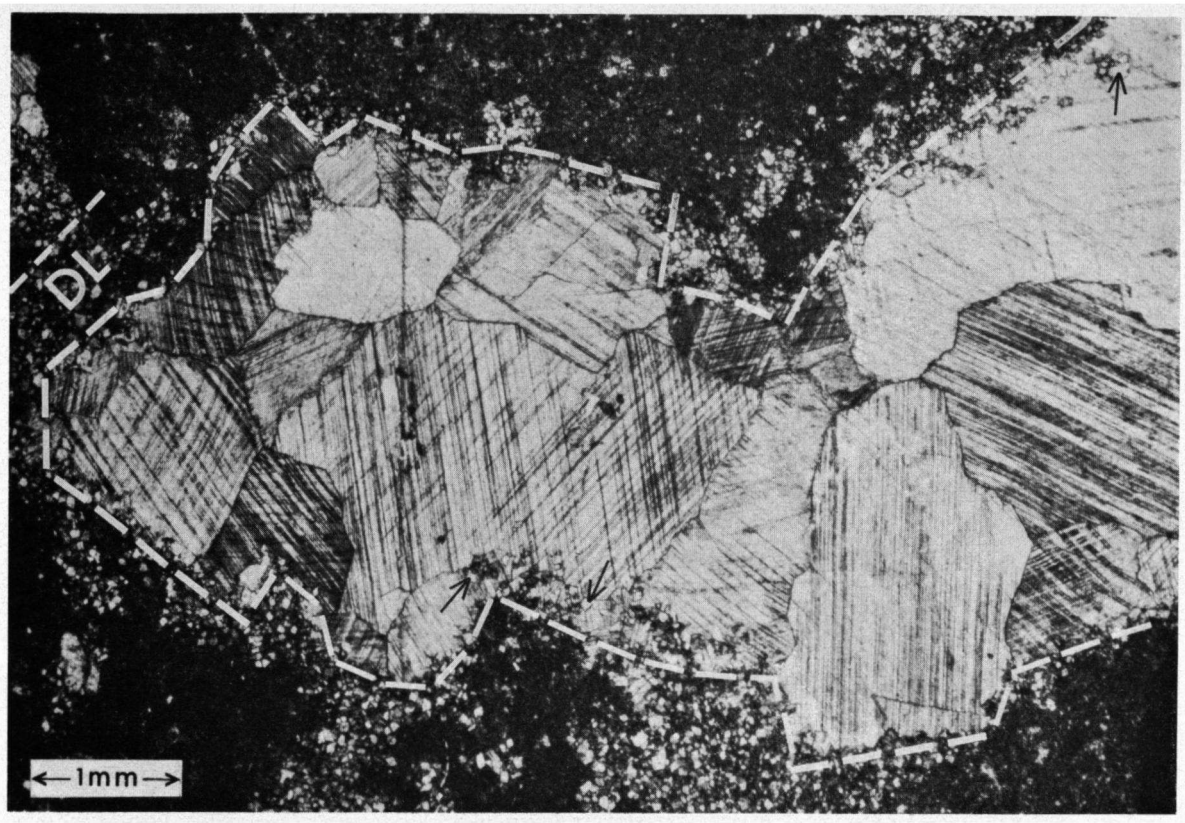

← 500 mu →

Fig. 13. Photomicrograph of a calcite nodule showing subhedral crystals along the rim and larger crystals towards the centre. Note the dolomite lining. DL, the poikilitically enclosed rhombs (arrows) and the faint suggestion of rectangular re-entrants (broken line). Section LSF. Compare with figure 14.

Fig. 14. Replacement and void-filling anhydrite. The large blocky crystals have grown by replacement of limestone. The fracture in the lower left has been filled with clear anhydrite crystals. These crystals have developed overgrowths by replacement of the limestone wall rock. The same observation may commonly be made in a carbonate sand where anhydrite fills the interparticle space and continues growth by replacement of the particles.
After: Murray, R. C., 1964, Jour. Sed. Petrol., 34/3, p. 519, fig. 8. (by permission).

Fig. 15 Has been omitted just before printing.


DL
1mm

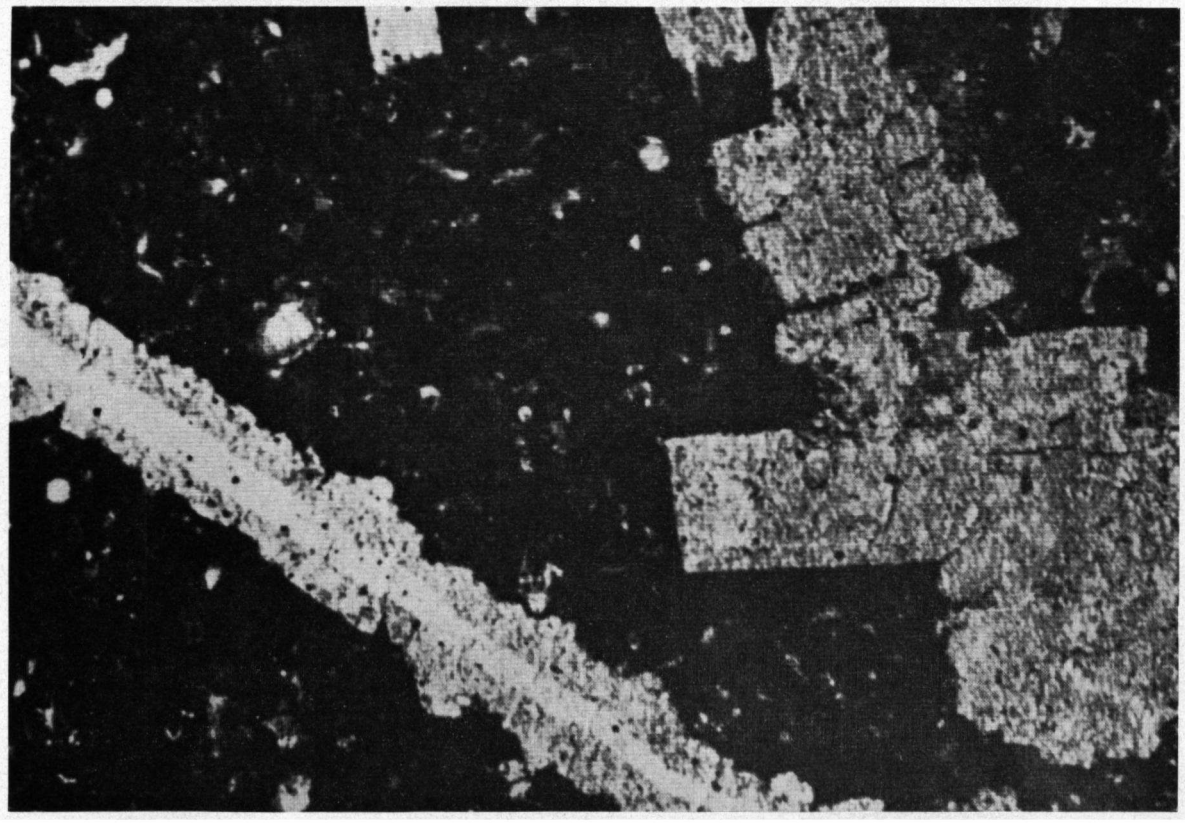
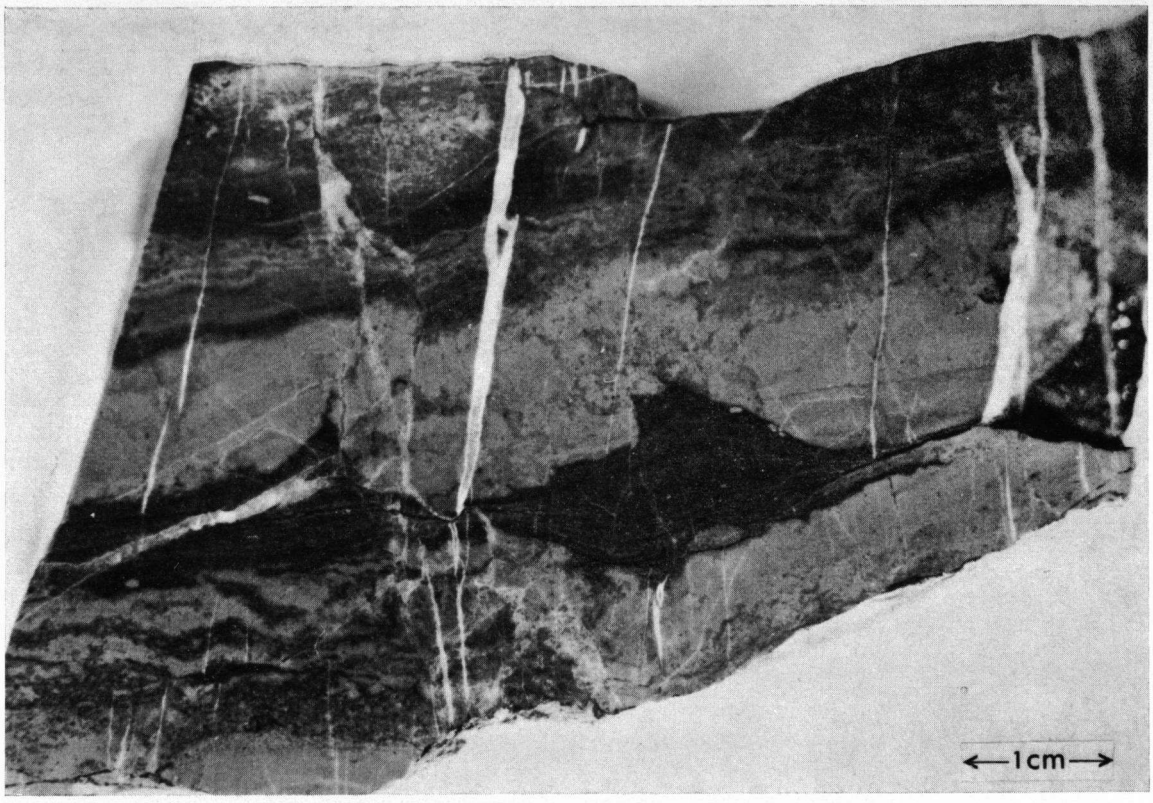


Fig. 16. Finely crystalline dolomites with dark argillaceous streaks. The texture resembles textures which are common in evaporites (see Riley & Byrne, 1961). Section LSG.

Fig. 17. Detail of fig. 16. Darker spots might have been gypsum? crystals (arrow) which are now dolomite with indeterminable, very fine, dark material.


1cm

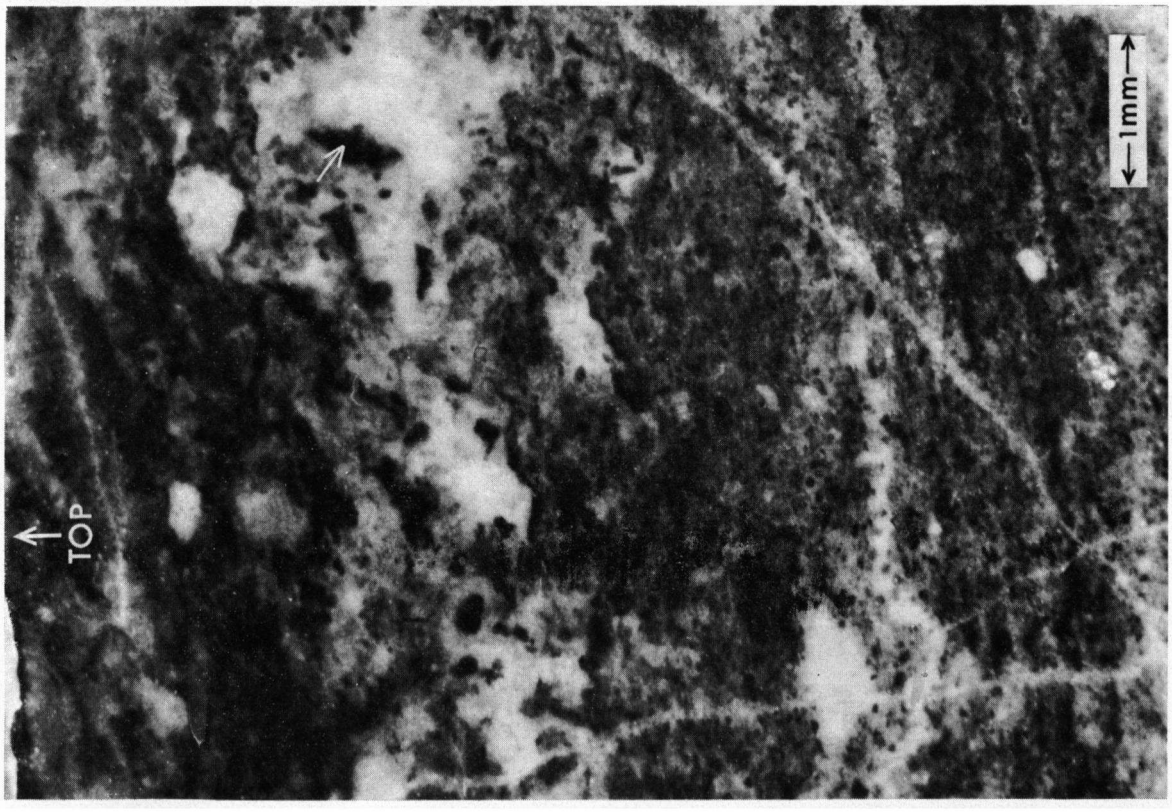
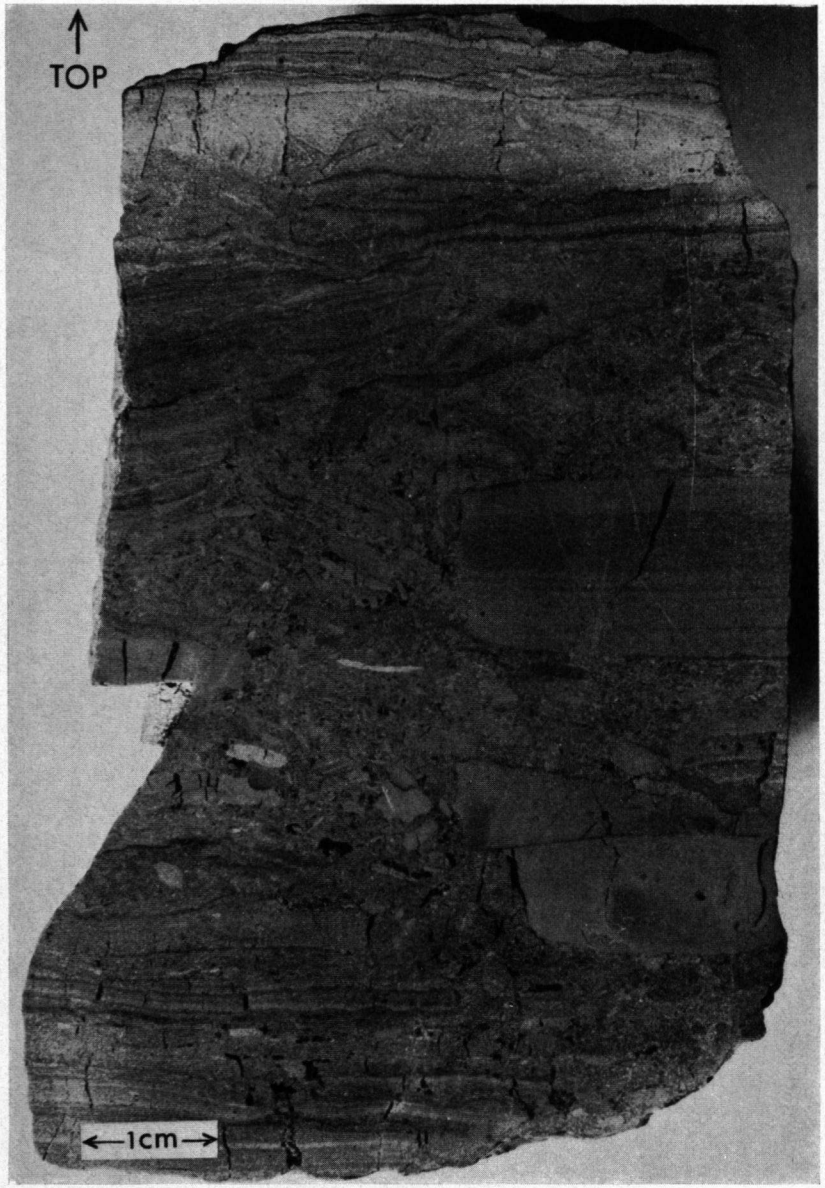

TOP
1mm

Fig. 18. Varve-like laminations and small scale cross-bedding in the finely crystalline dolomite. Section LSM.

Fig. 19. Intraformational breccia. Section LSM.


TOP
1cm

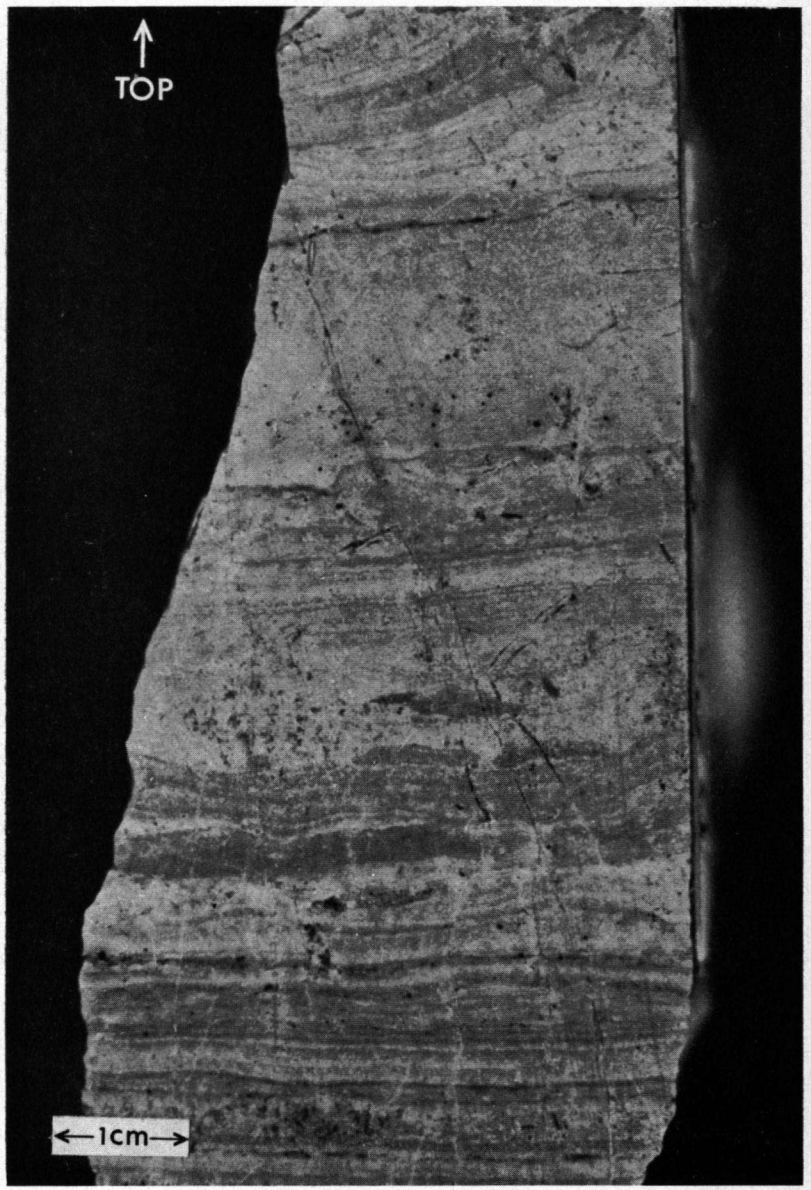
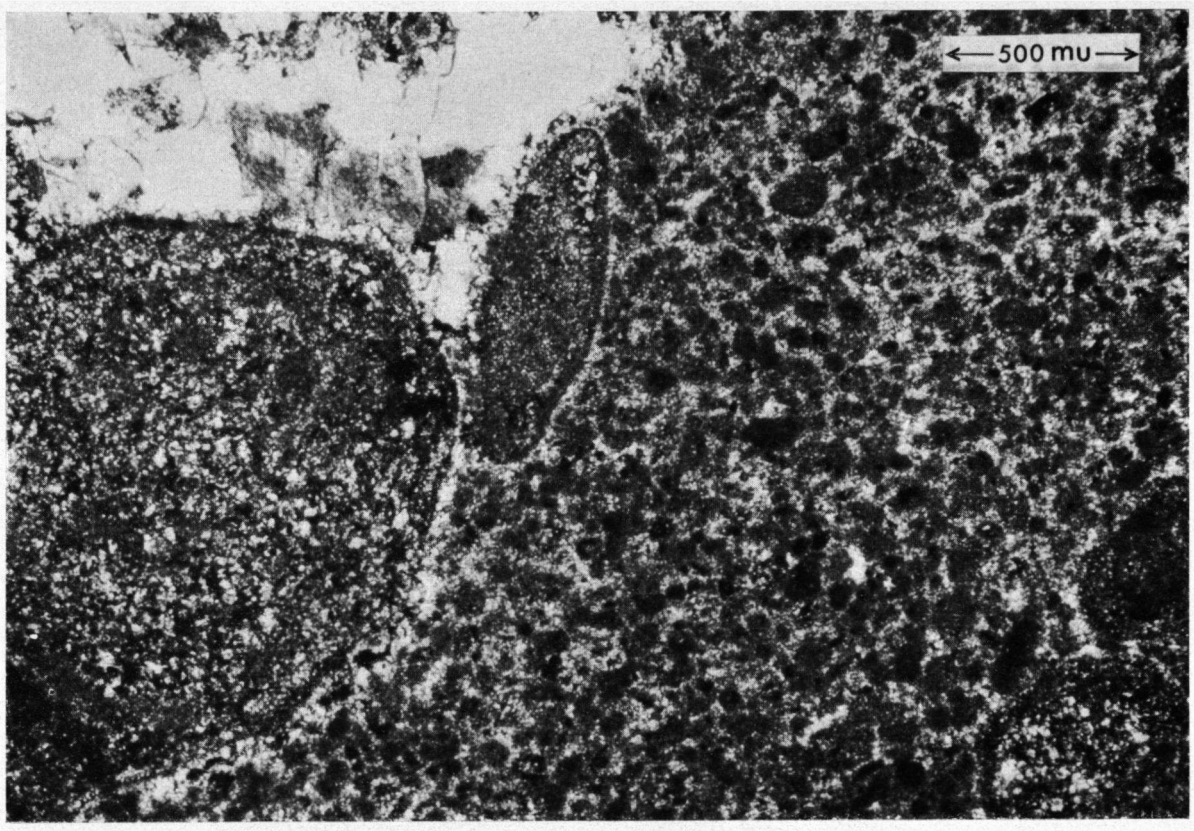

TOP
1cm

Fig. 20. Pelletal dolomite with large dolomitized clasts of unknown origin, outline of clasts resembles crystals. Section LSD, sample 35.

Fig. 21. Coarsely crystalline dolomite with authigenic quartz crystals. Section LSC, sample 24.


500 mu

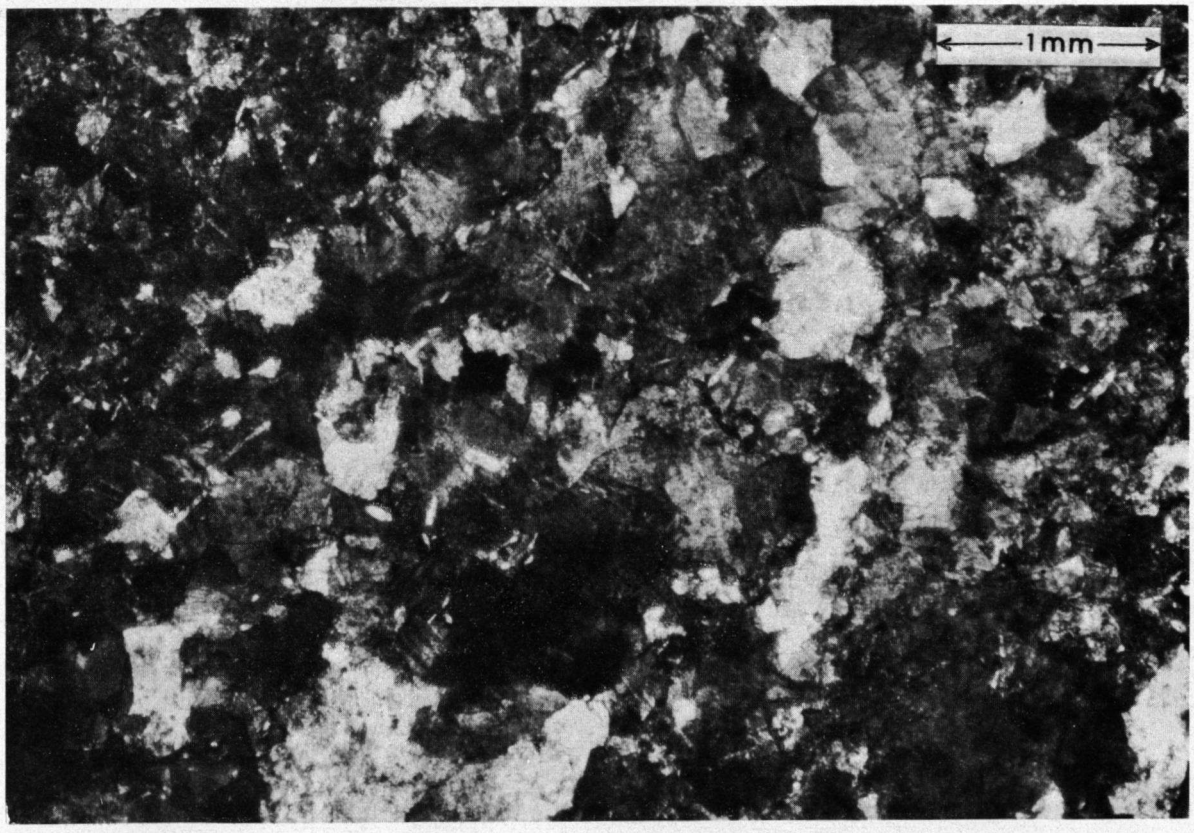
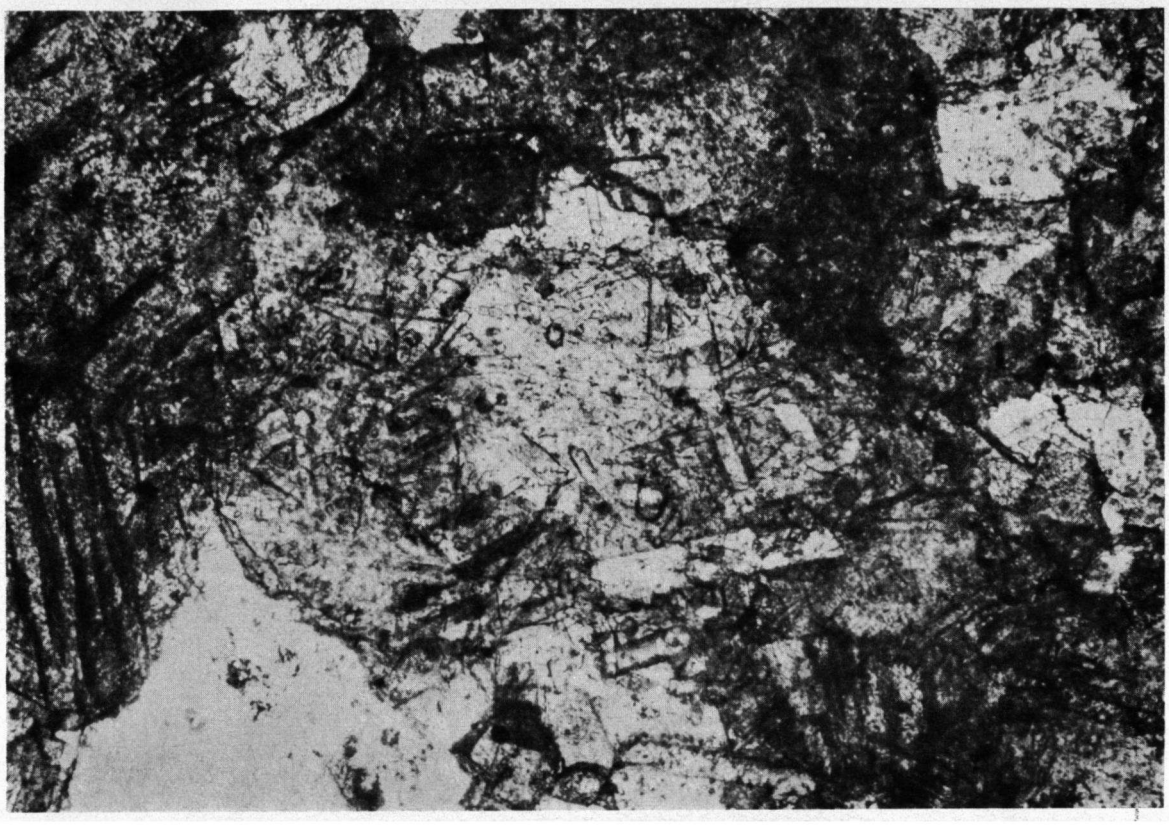

1mm

Fig. 22. Detail of figure 21 showing authigenetic quartz crystals in the dolomite.

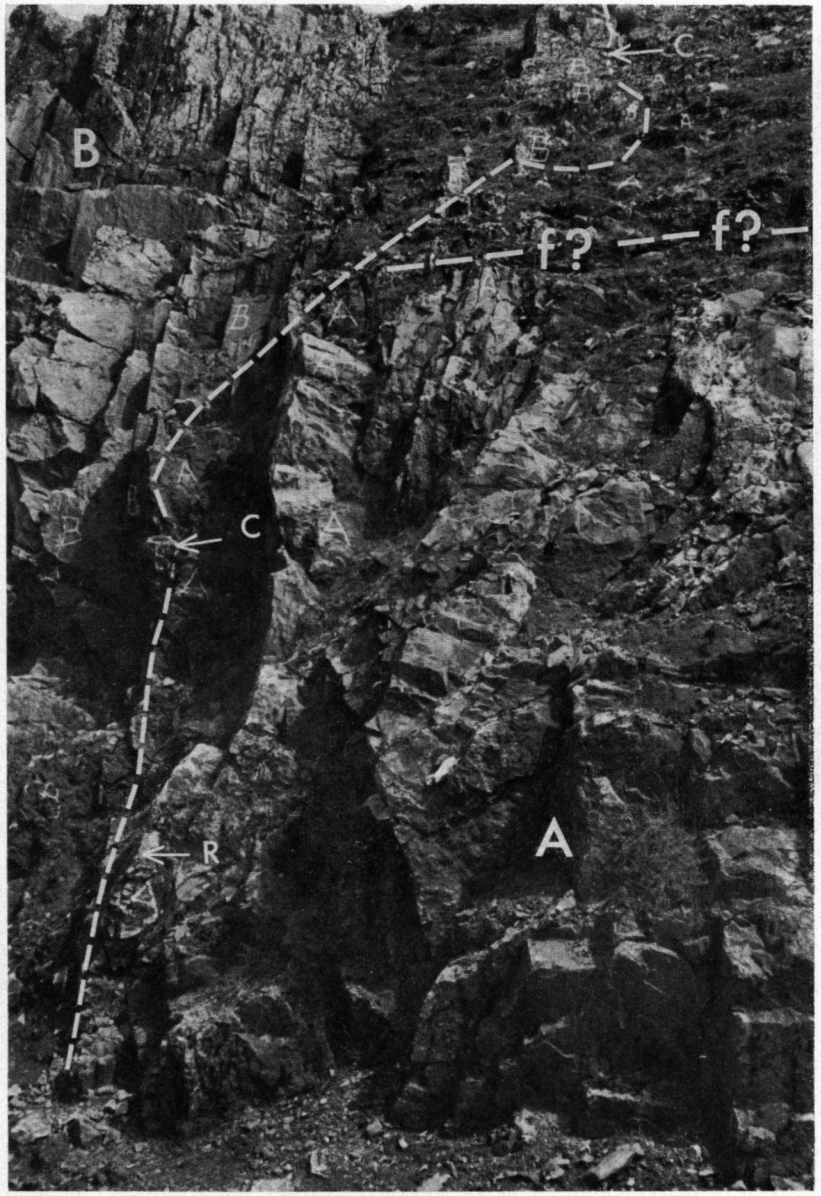
Fig. 23. Photomicrograph of the contact between the algal limestone (A) of the Limestone Member and the overlying biosparudite (B) with glauconitic pellets (p). Section LSC.




B
←3 mm→
p
p
A

Fig. 24. Pale red stromatolitic structures (r) in the Limestone Member from section LSD. The terra rossa-like color of the algal structures is due to subaerial weathering. The laminated fibrous calcite (fc) fills an dd fissure in the algal limestone.

Fig. 25. Contact between the algal limestones (A) and the biosparudite (B). Where the contact could be exposed by removing the weathered surface a white line was chalked on it (arrows with a c). R is a terra rossa colored zone.


C
B
f?
f?
C
A
R

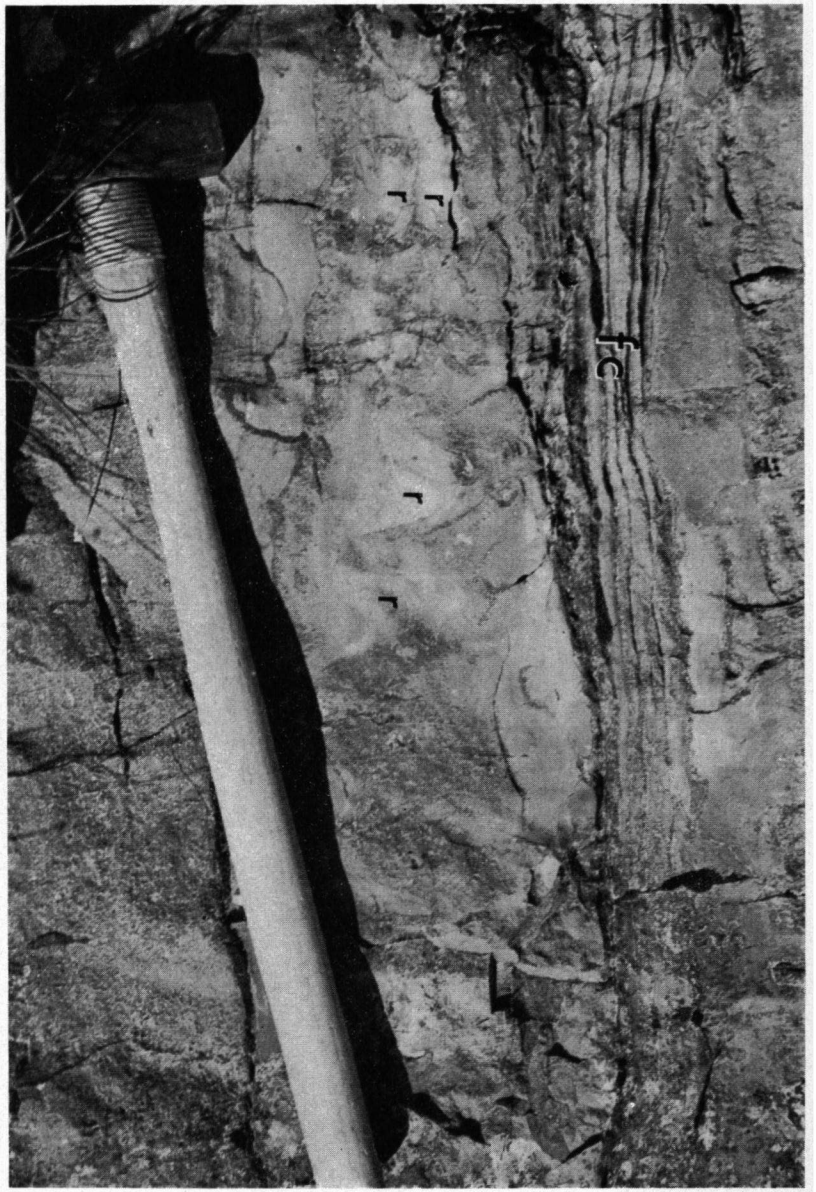

fc

Fig. 26. Some of the main lithological aspects of the Limestone Member. A are algal limestones with oncolites etc. C was a cavity in the reef. H are limeclasts and pellets which formed a floor in the cavity. F is fibrous calcite filling the upper part of the cavity. The stylolite S has cut off cavities with sparry calcite (D). Section LSF. Sample from loose debris.

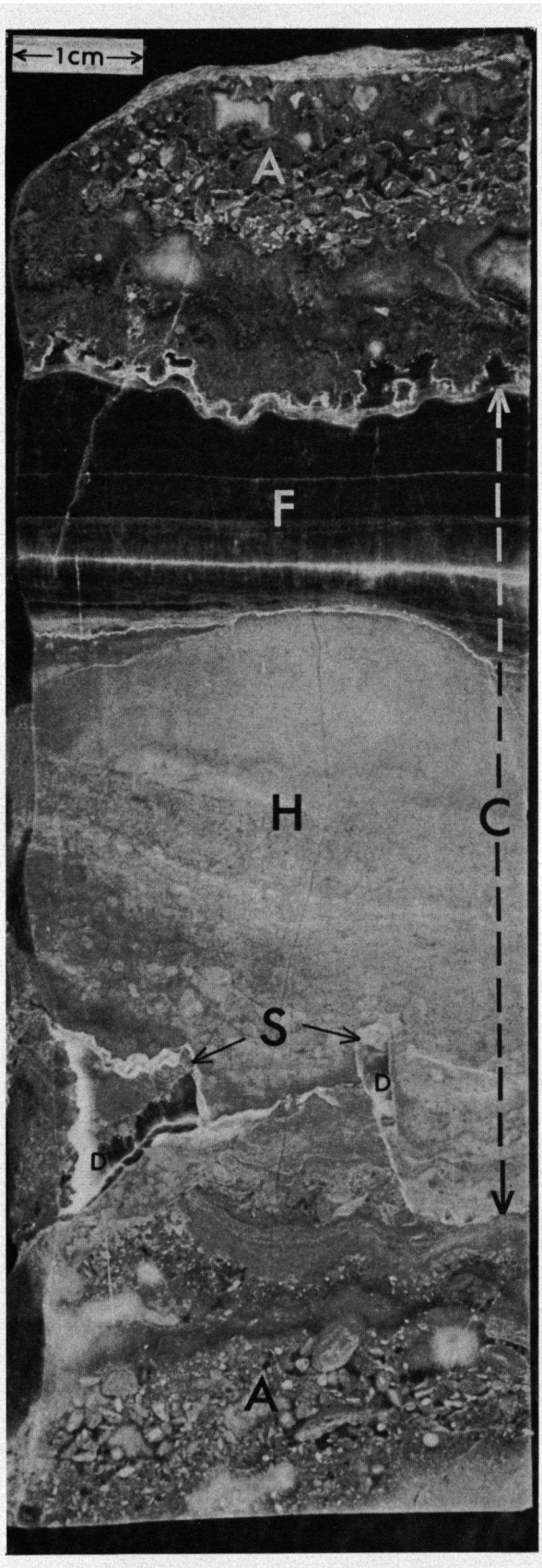

1cm
A
F
H
C
S
D
D
A

Fig. 27. Algal mats (M), oncolites (B) and algal debris in the Limestone Member. Section LSF. Compare with photos of recent algal crusts from the Bahamas, published by Shinn et al. (1965).

Fig. 28. Stromatolites from the Limestone Member. Section LSF. Same level as figure 27.

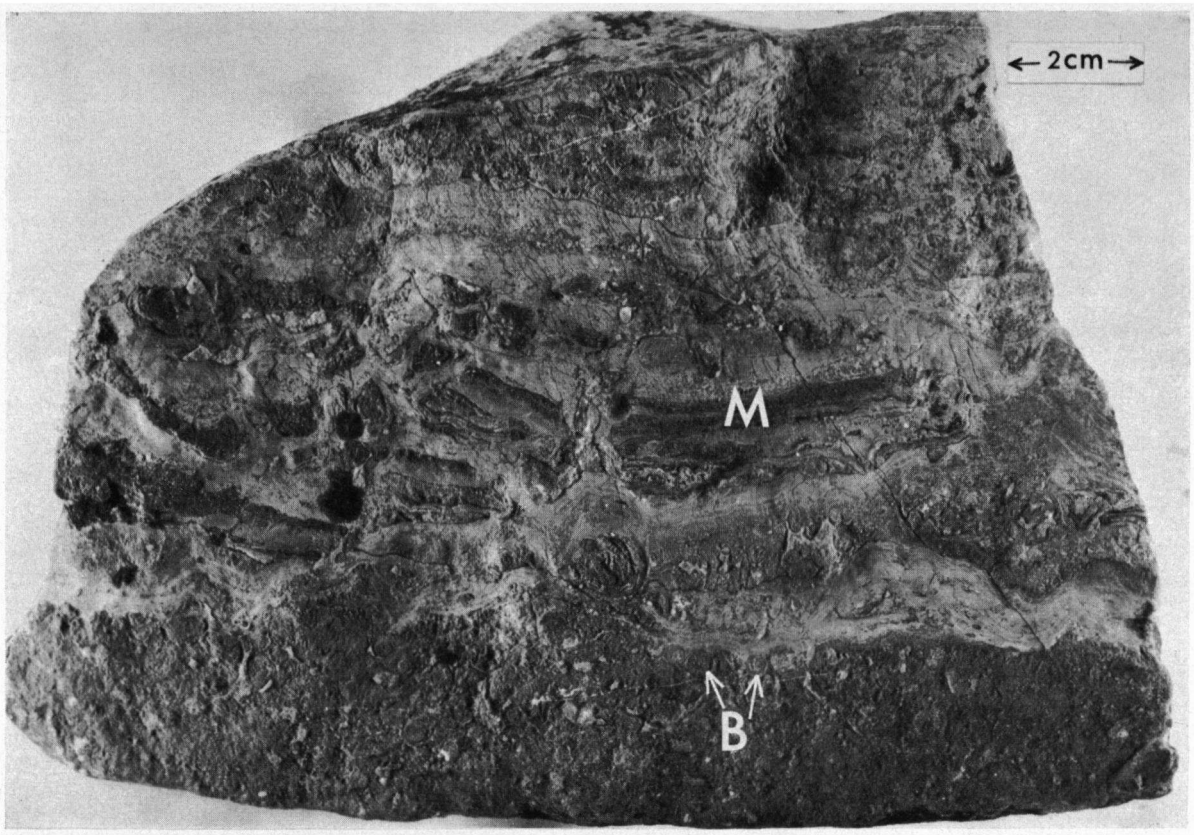
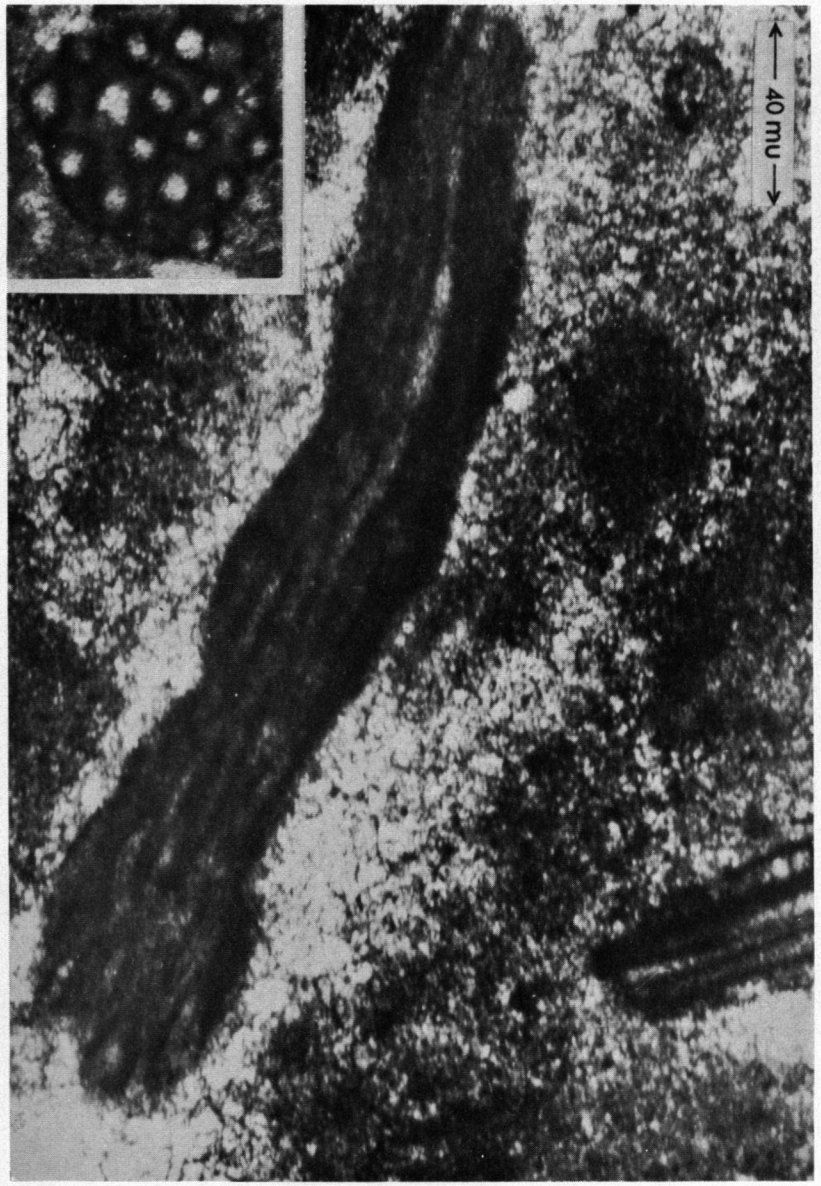

← 2cm →
M
B

Fig. 29. Algal limestone with abundant authigenetic quartz (qtz); cavity is filled with calcite (BC). Colored thin section. Section LSF.

Fig. 30. Algal 'sticks'. Inlay is a tangential cut through a 'stick'. Most 'sticks' have been altered by grain-diminution followed by dolomitization. Dark rings around the tubes contain slightly more iron and probably also remnants of organic matter from the tube's wall.


40 mu

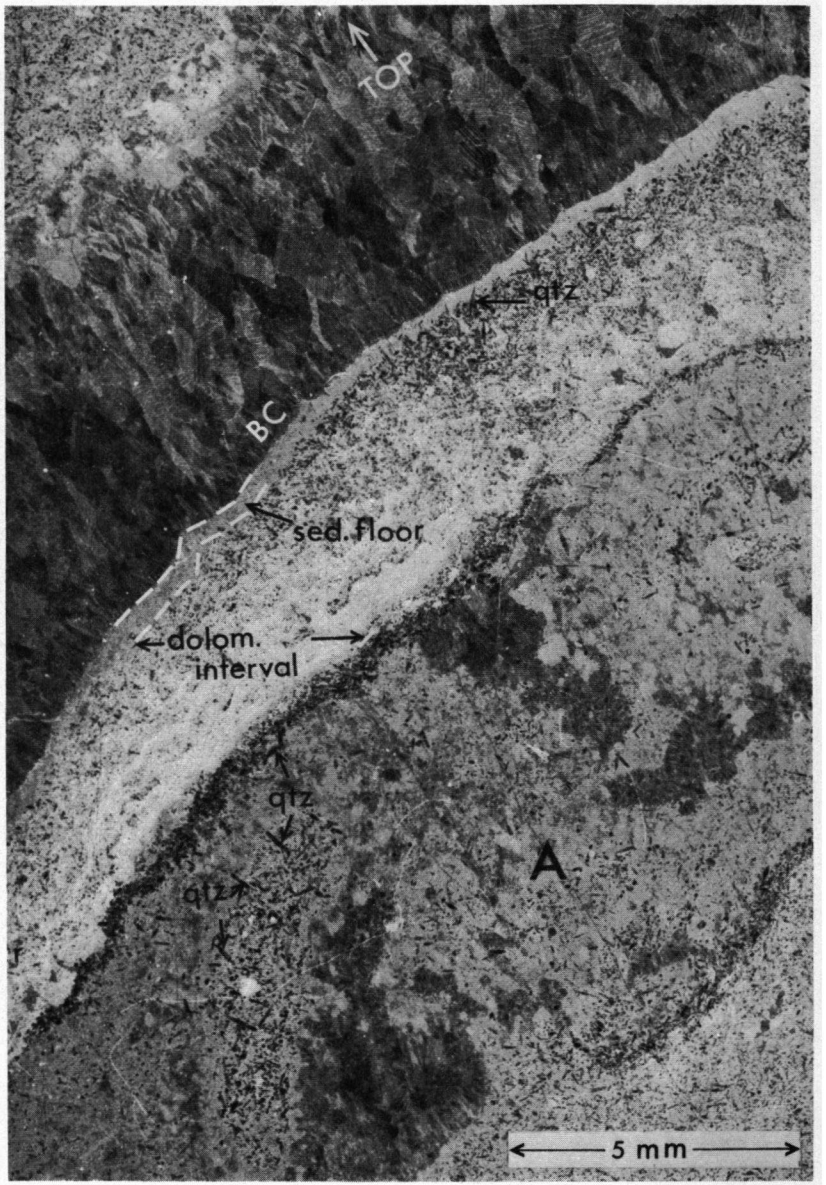
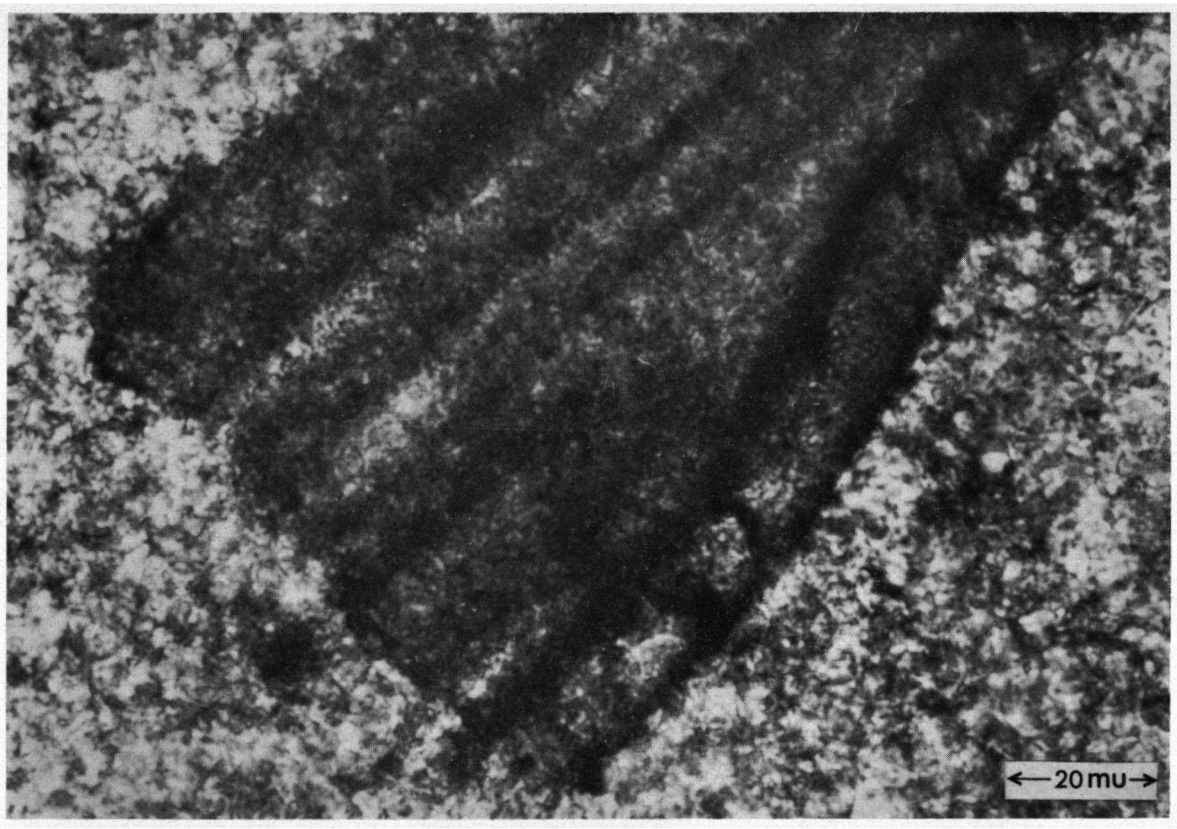

TOP
qtz
BC
sed. floor
dolom.
interval
qtz
qtz
A
5 mm

Fig. 31. Detail of an algal 'stick' showing the cell division in the strands.

Fig. 32. Echinodermal(?) debris in a large, dolomitized limeclast. Section LSF.


20 mu

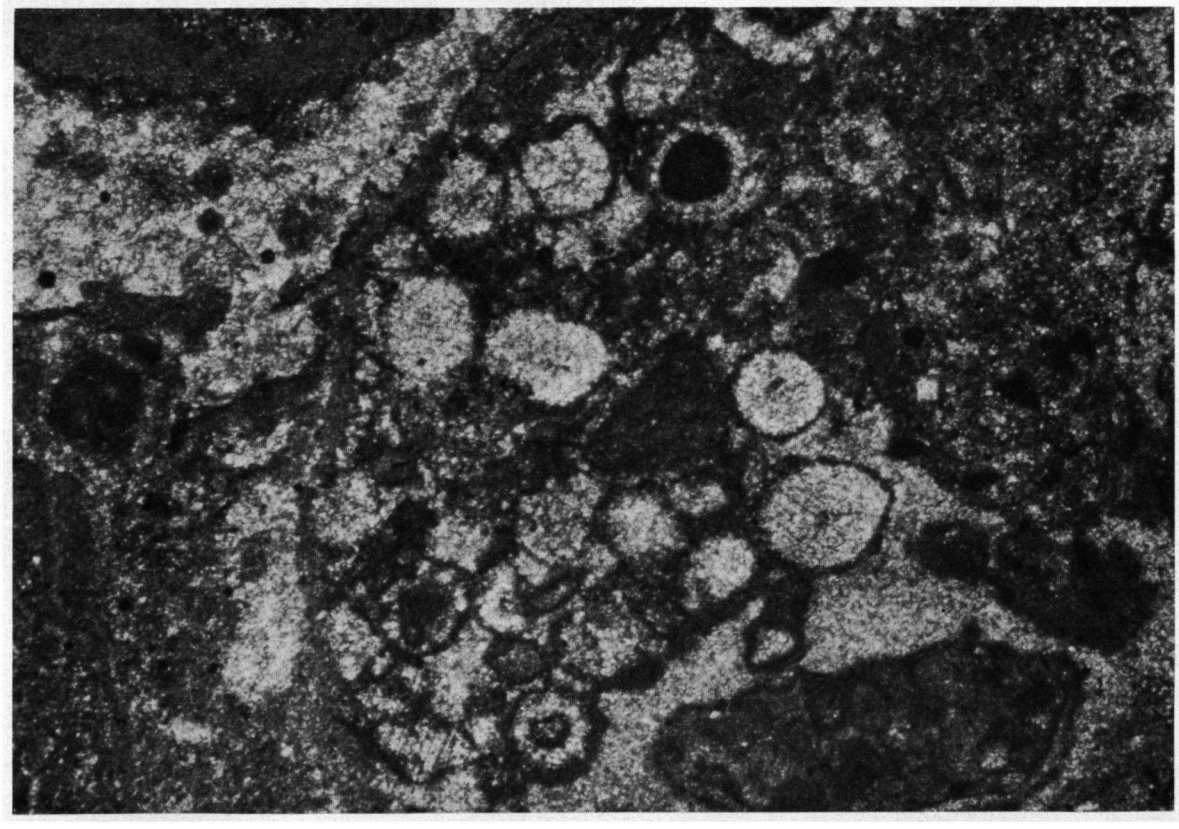
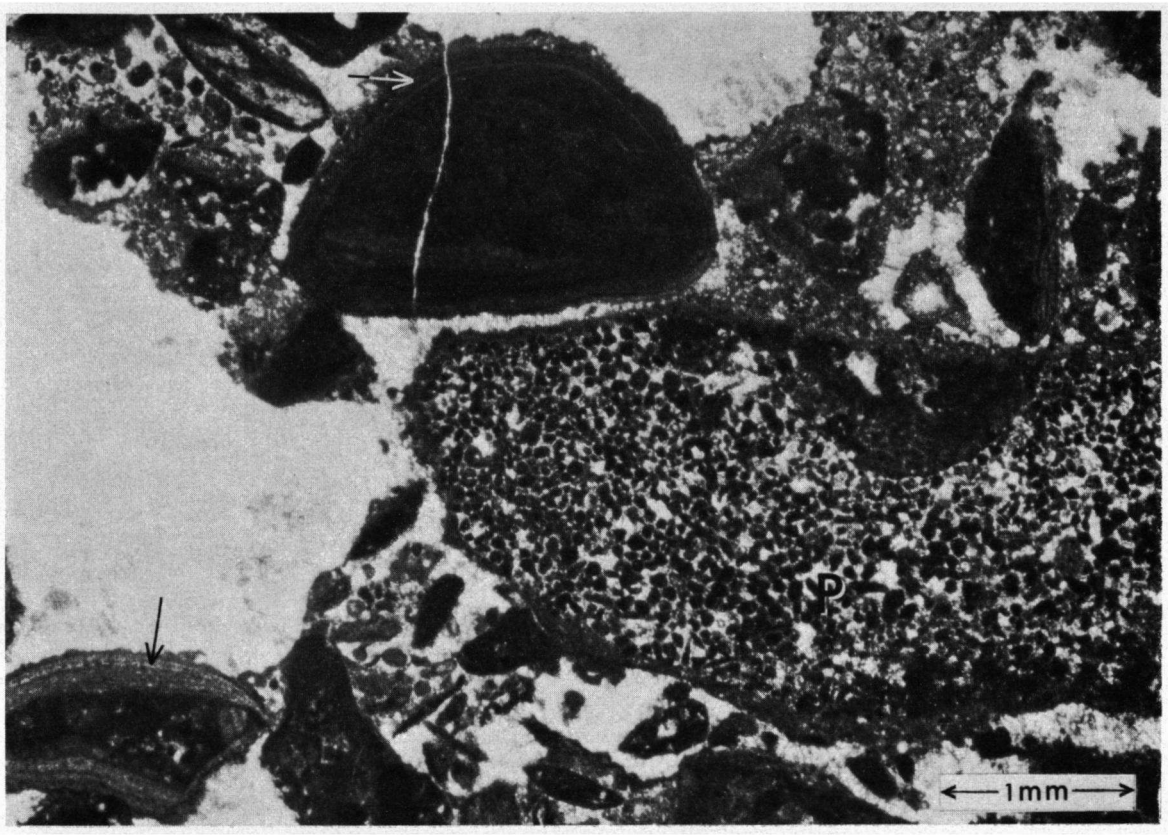


Fig. 33. Partly dolomitized pelsparite (P) and algal encrusted fragments, mostly dolomitized. Arrows point at a laminated crust. Section LSF.

Fig. 34. Composite allochem consisting of an agglomeration of smaller grains and surrounded by a dolomitized crust which shows faint lamination. C is calcite cement.


P
1mm

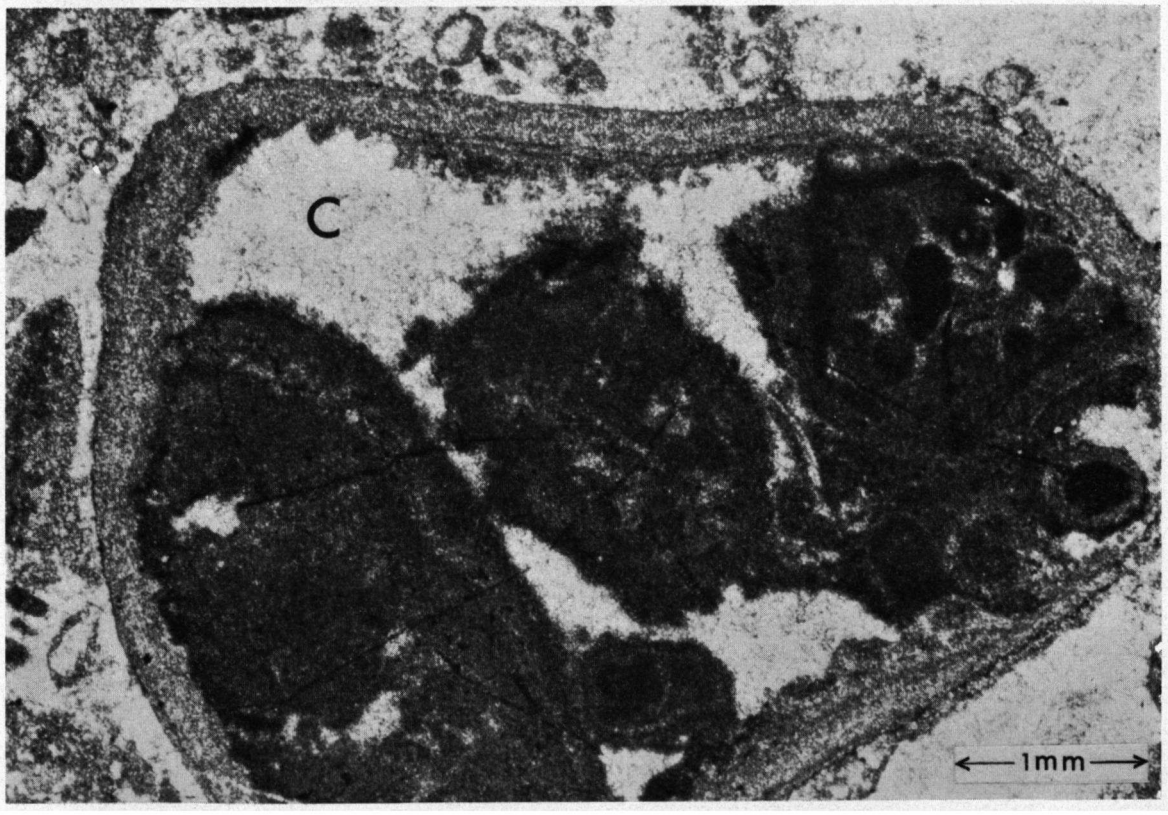
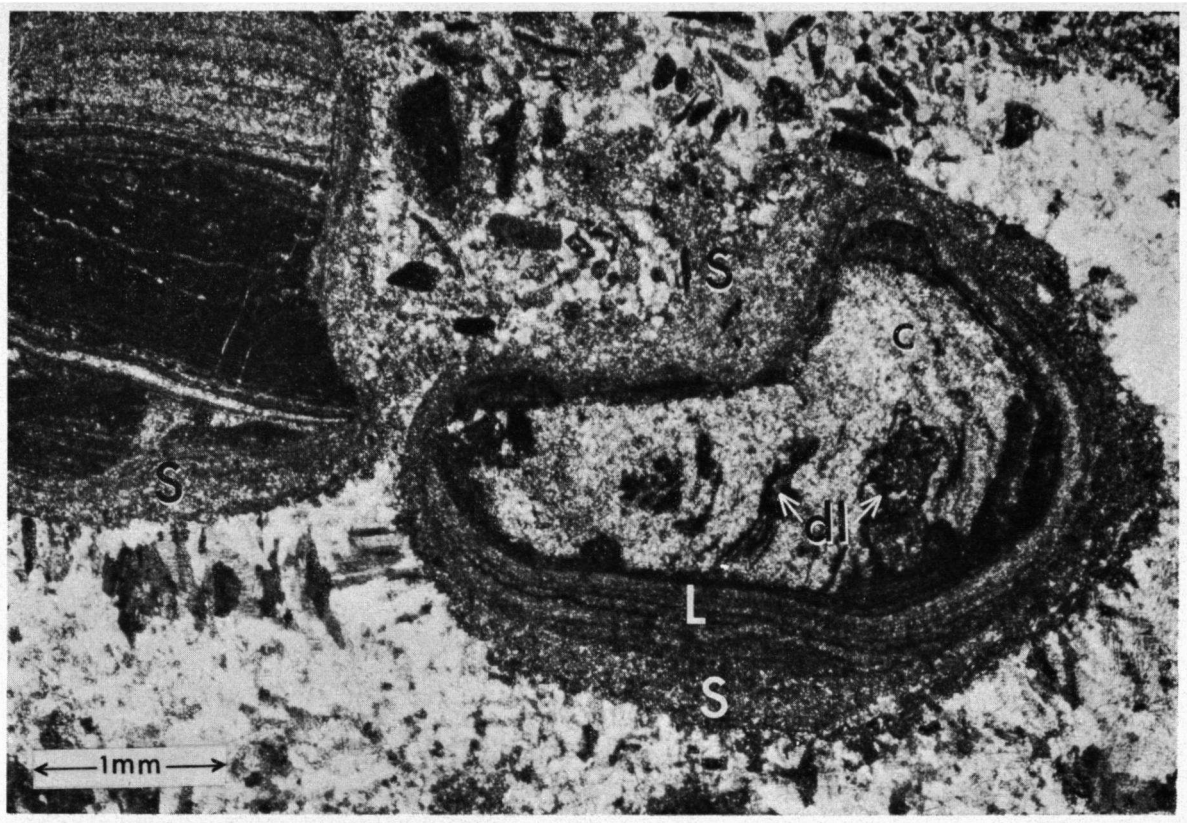

C
1mm

Fig. 35. Partly dolomitized fragments of stromatolites surrounded by laminated crusts (L) and spongy, dolomitic crusts (S). Dark laminae (dl) in the right allochem are dolomite (Monty's hyaline layers?). Clear patches (c) are calcite (calcified layers?). Section LSF.

Fig. 36. Oncolites from the Limestone Member. S is a spongy crust. Section LSF.


S
C
S
cl
L
S
1mm

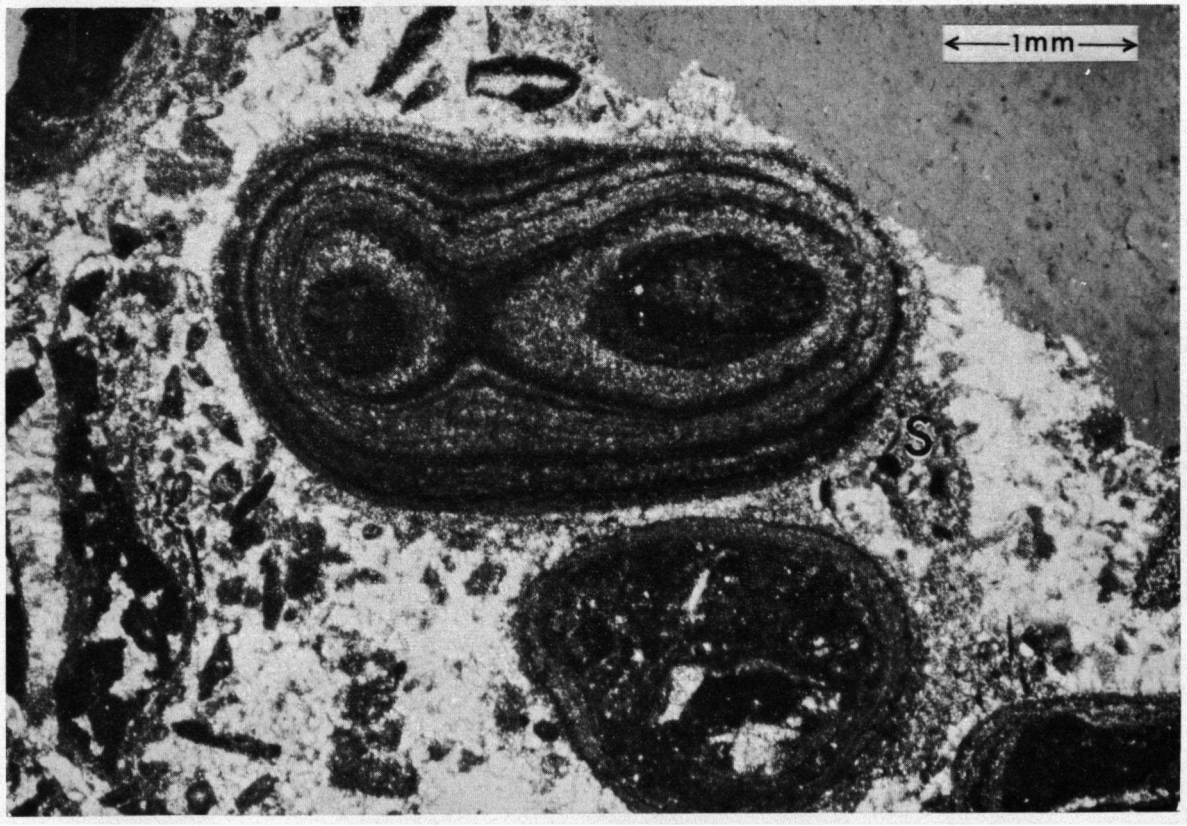
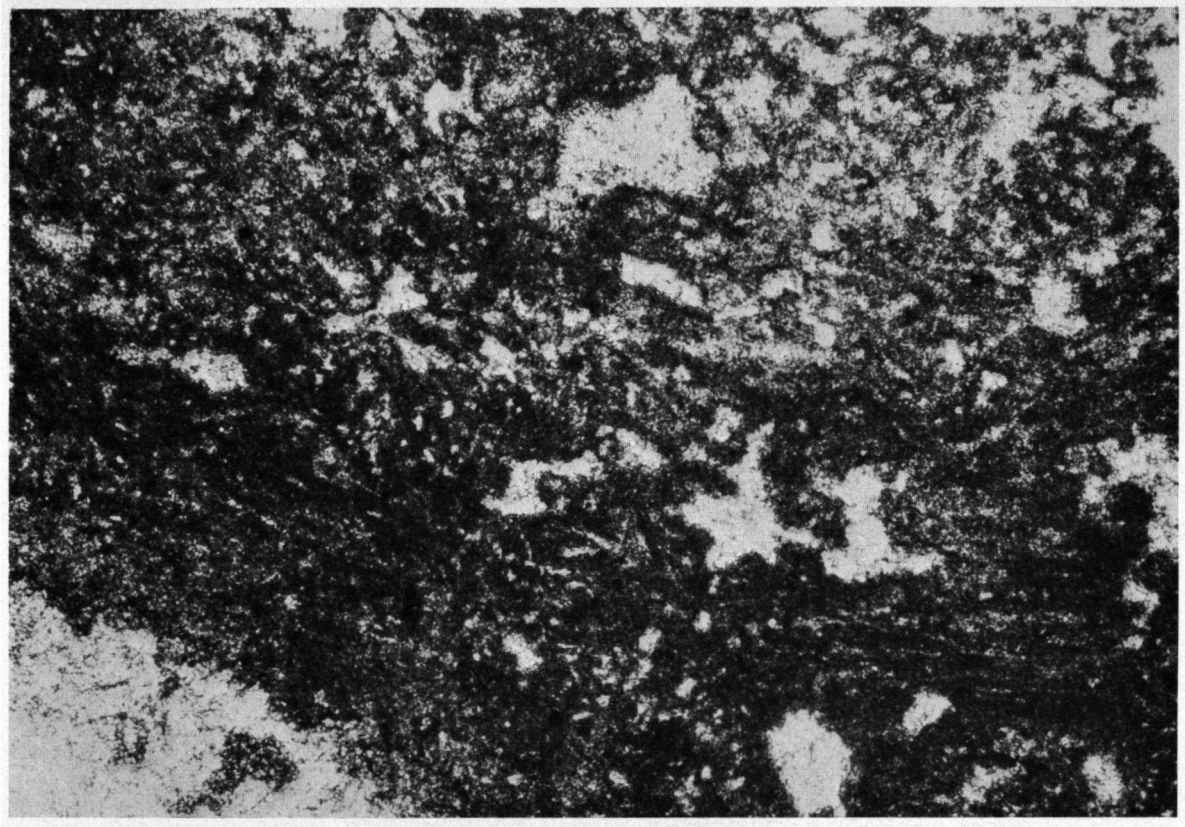

1mm
S

Fig. 37. *Girvanella*-like algae from a dolomitized limeclast. Section LSD.

Fig. 38. Dolomitized limeclast surrounded by a spongy crust (S). Arrow points at a dark coat (dolomitized micrite envelop). DRL is a calcite crust with dolomite rhombs. BC is bladed calcite, in sharp contact with DRL.



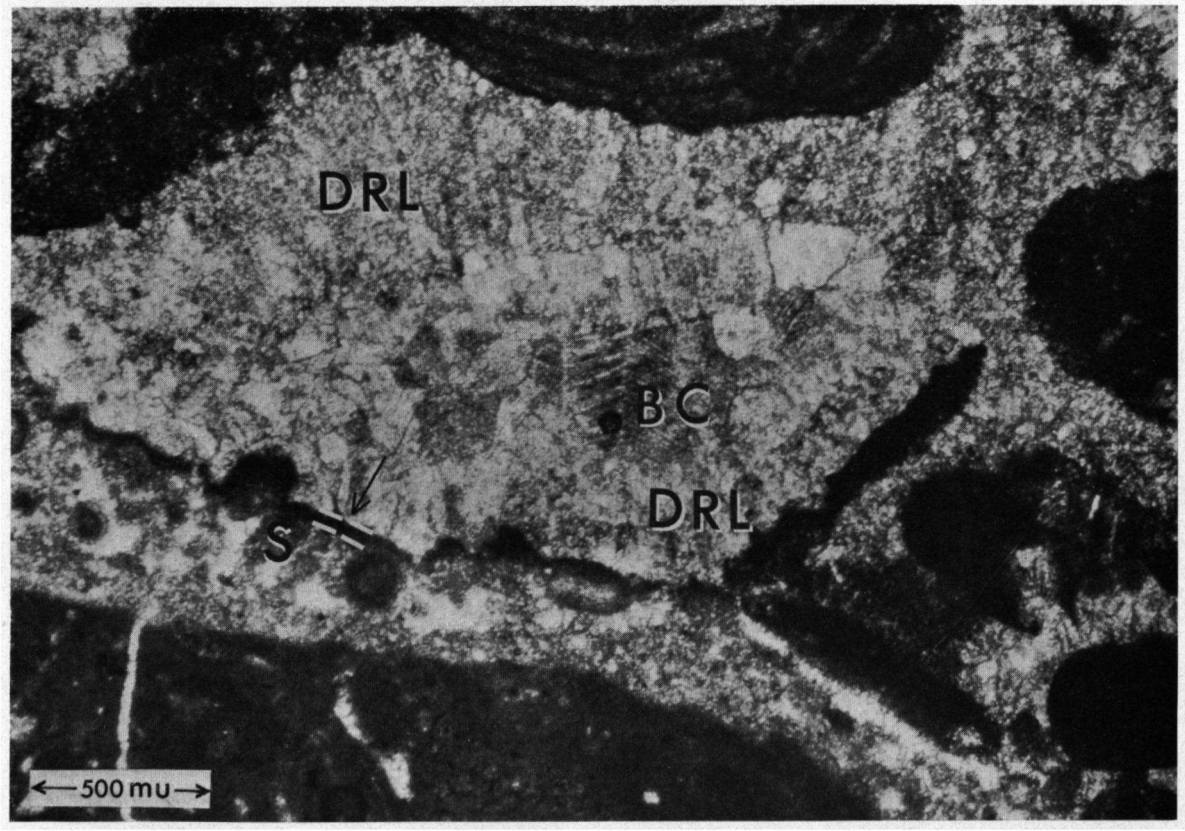
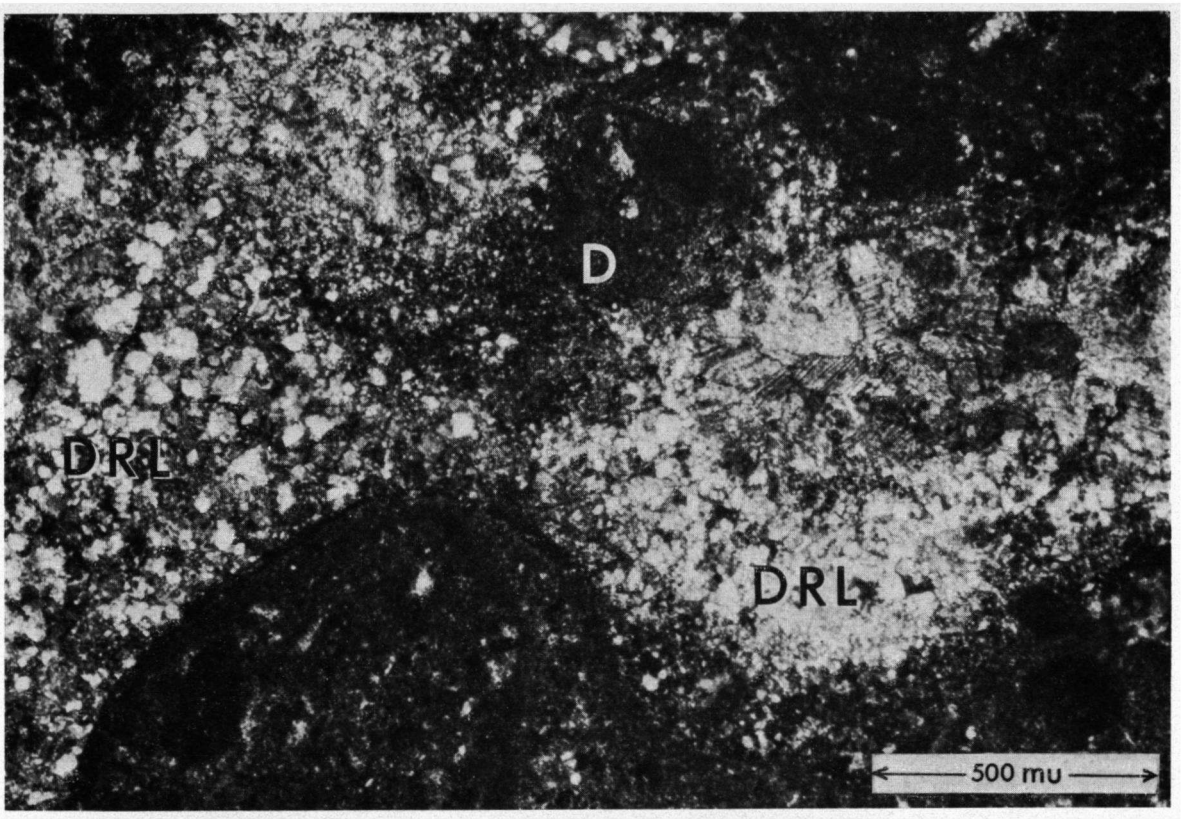

DRL
BC
DRL
S
500 mu

Fig. 39. Dolomite rhombs and sparry calcite (DRL) replacing brown dolomite (D) spongy crust. Section LSF.

Fig. 40. Dolomite rhombs and sparry calcite replacing a brown spongy crust (D) and an allochem (A). Colored thin section. Section LSF.


D
DRL
DRL
500 mu

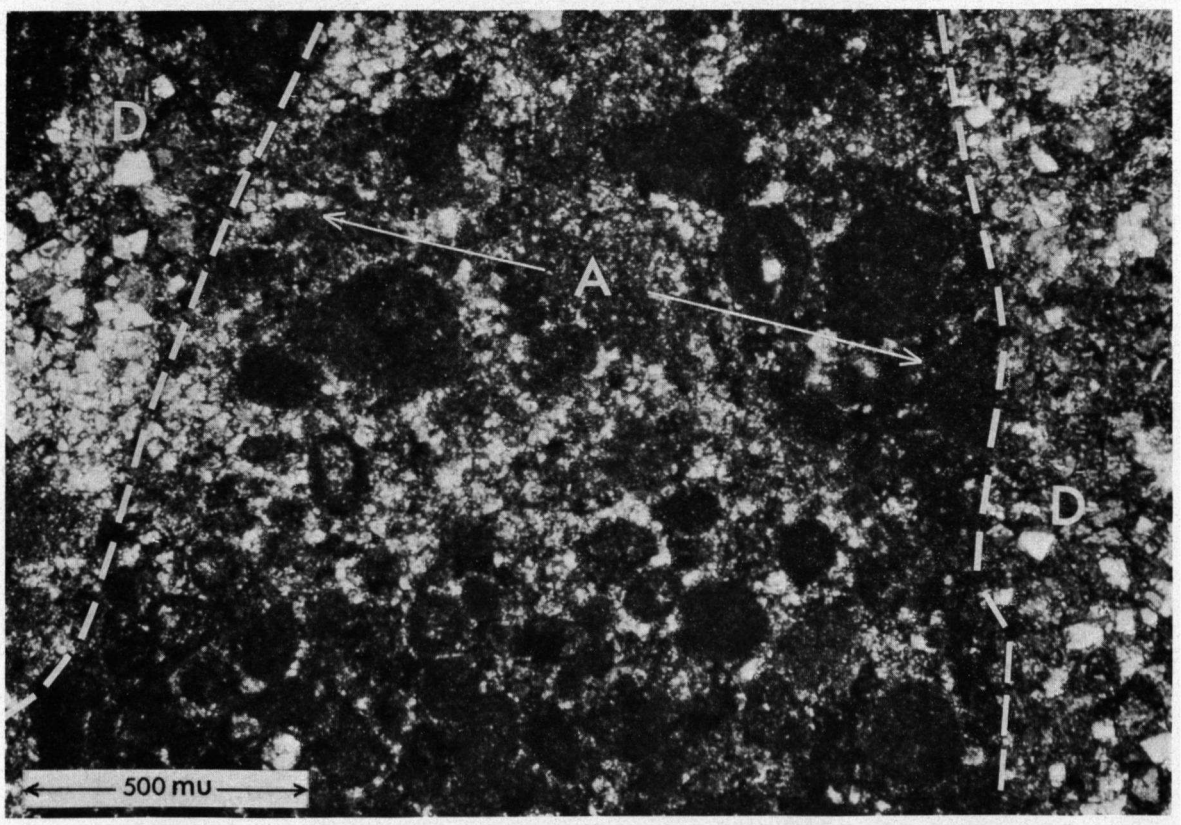
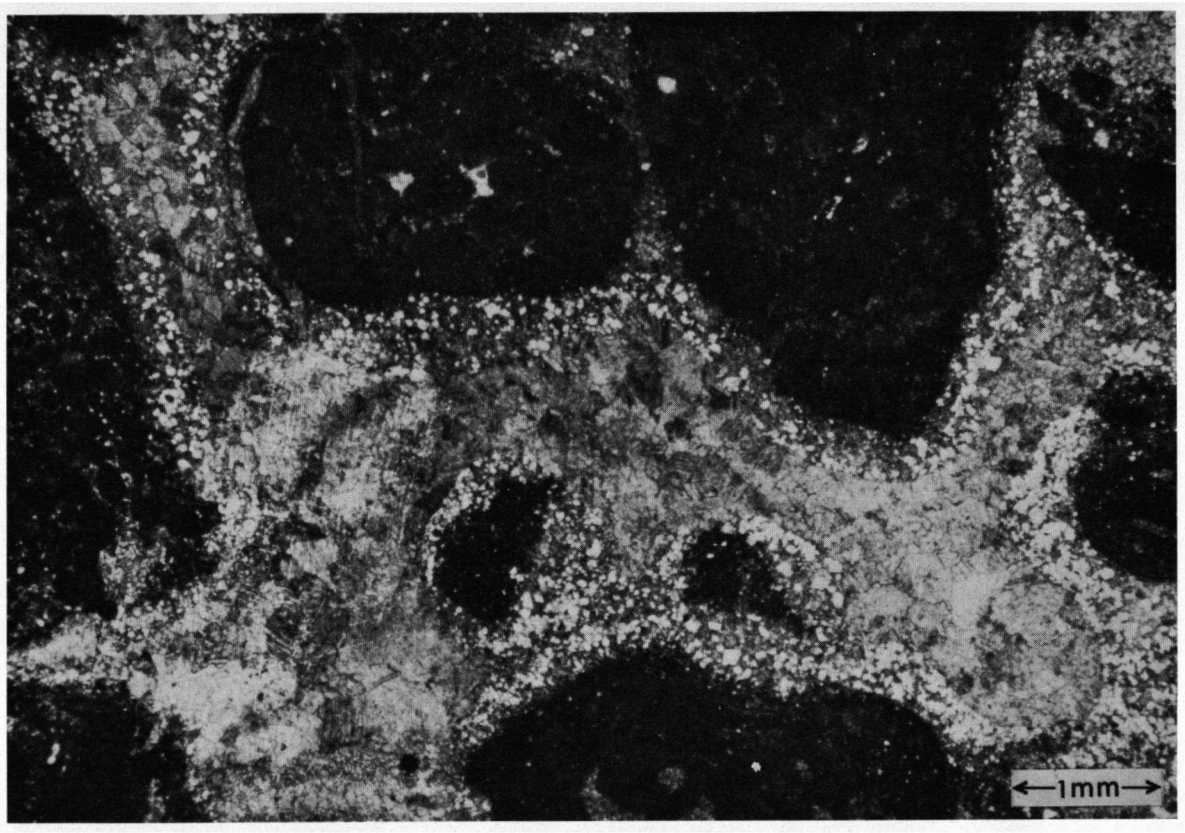

D
A
D
500 mu

Fig. 41. Layers of dolomite rhombs and sparry calcite forming an interfragmental lining around the allochems. Colored thin section. Section LSF.

Fig. 42. Contact (C) between a sparry calcite layer with dolomite rhombs (d) and the bladed calcite (BC). E is equant calcite. Crossed nicols. Section LSF.


←1mm→

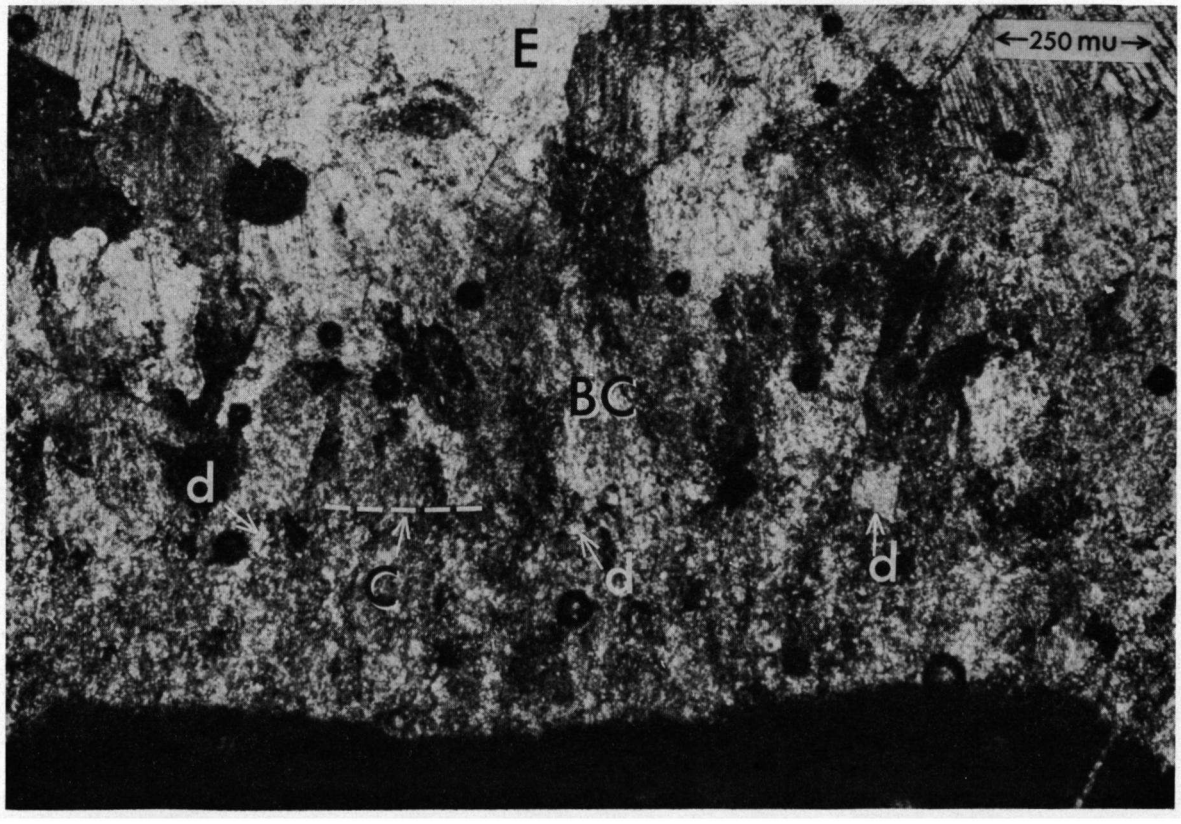

E
←250 mu→
BC
d
C
d
d

Fig. 44. Dolomitized intrasparudite with an algal mat. SS' is the original bedding plane. Long axis of most allochems is parallel to aa' ($\perp$ to SS'). This also holds for the bladed calcite cement (arrows).

Fig. 45. A network of fissures that were, subaerial, leached out of the sediments in the Limestone Member and have subsequently been filled up by bands of bladed calcite. Section LSF.

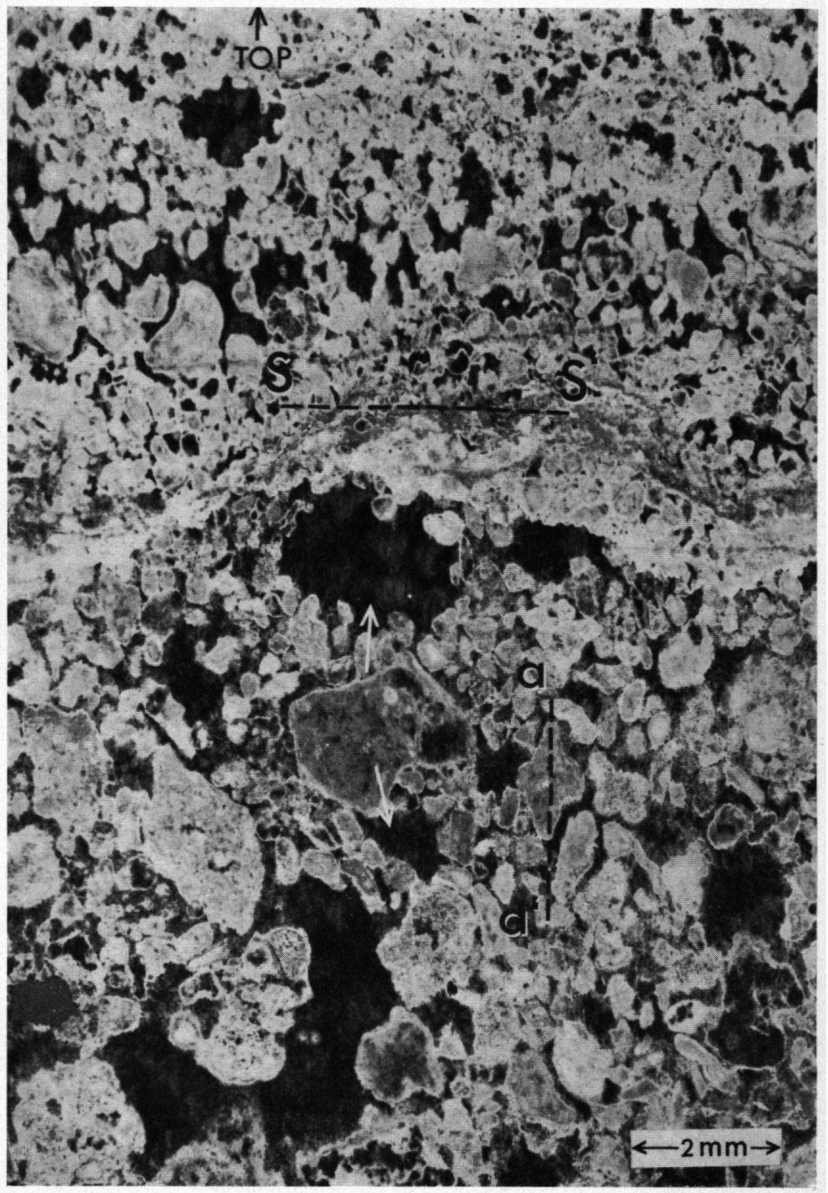
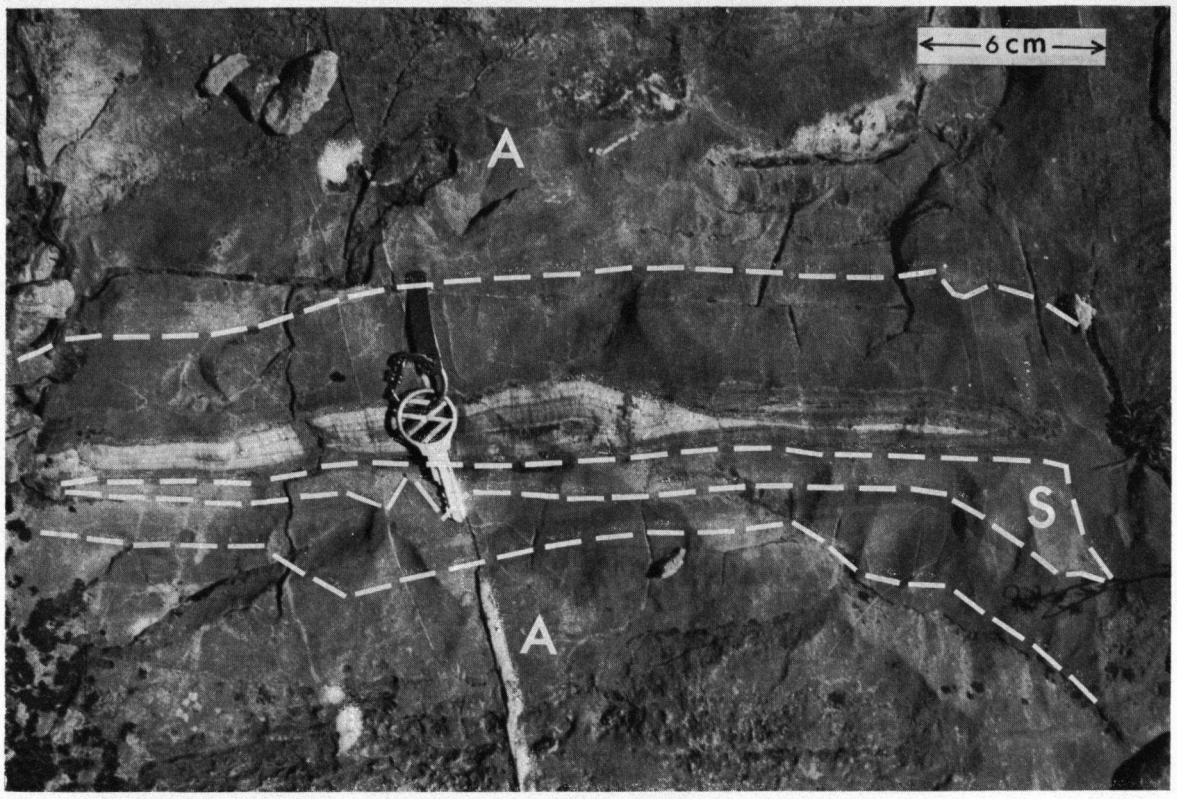

TOP
S
S
a
c
2 mm

Fig. 46. Lens of banded calcite in the Limestone Member of section LSC. Lens is interpreted as a cavity filled up by washed-in sediment (S) and bladed calcite bands. A is algal limestone.

Fig. 47. Lens and 'vein' of banded 'bladed' calcite. Notice how the algal (?) banding (arrow) more or less parallels the calcite bands. Perhaps the form of the cavity was also determined by the stratification. Section LSF.


6 cm
A
S
A

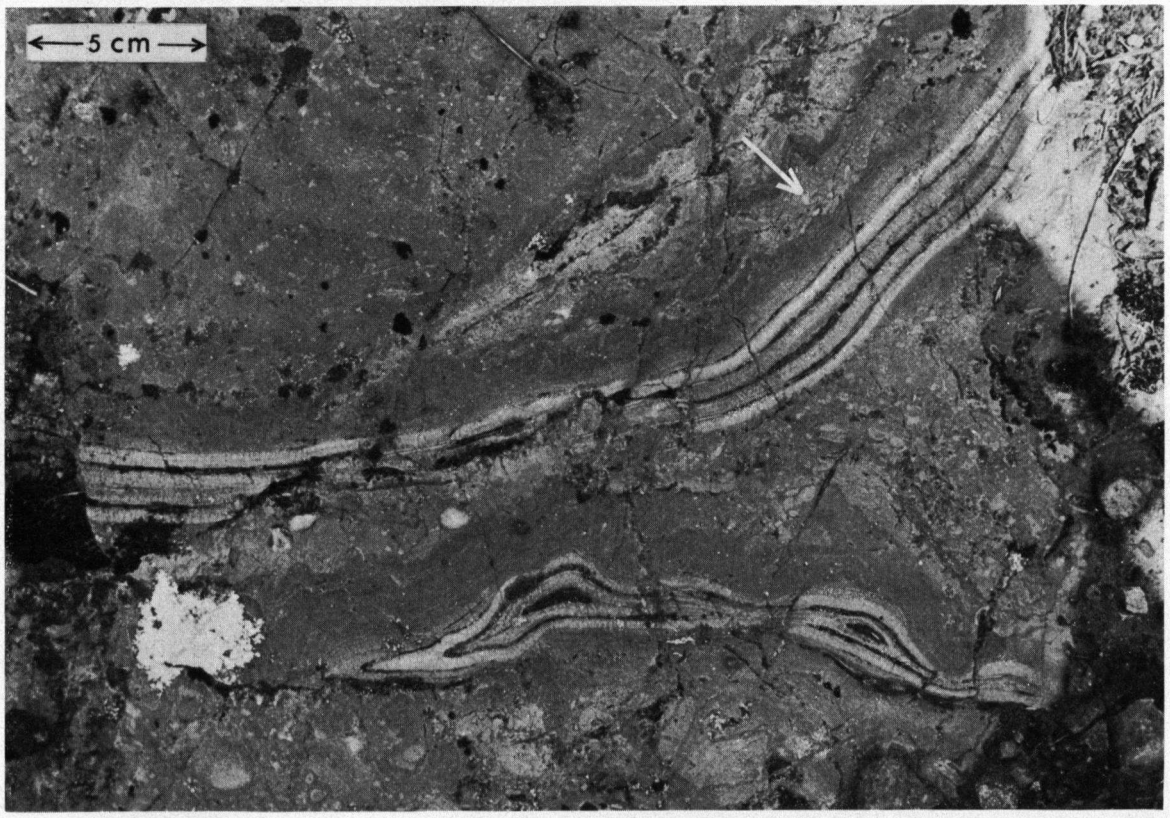

5 cm

Fig. 48. Highly irregular formed cavities in the Limestone Member of LSC. The cavities are much bigger than the birdseyes described by Ham (1952). Some of these cavities, particularly those in the lower part, might have been 'birdseyes' enlarged by subsequent leaching of the sediment.

Fig. 49. Thin section of the top of the sedimentary cone (SC) in figure 51. Strata in lower right part of the photo abud against coarse echinodermal(?) debris (ED). Inlay shows a calcite crystal with remnants of the pores of an echinoderm.

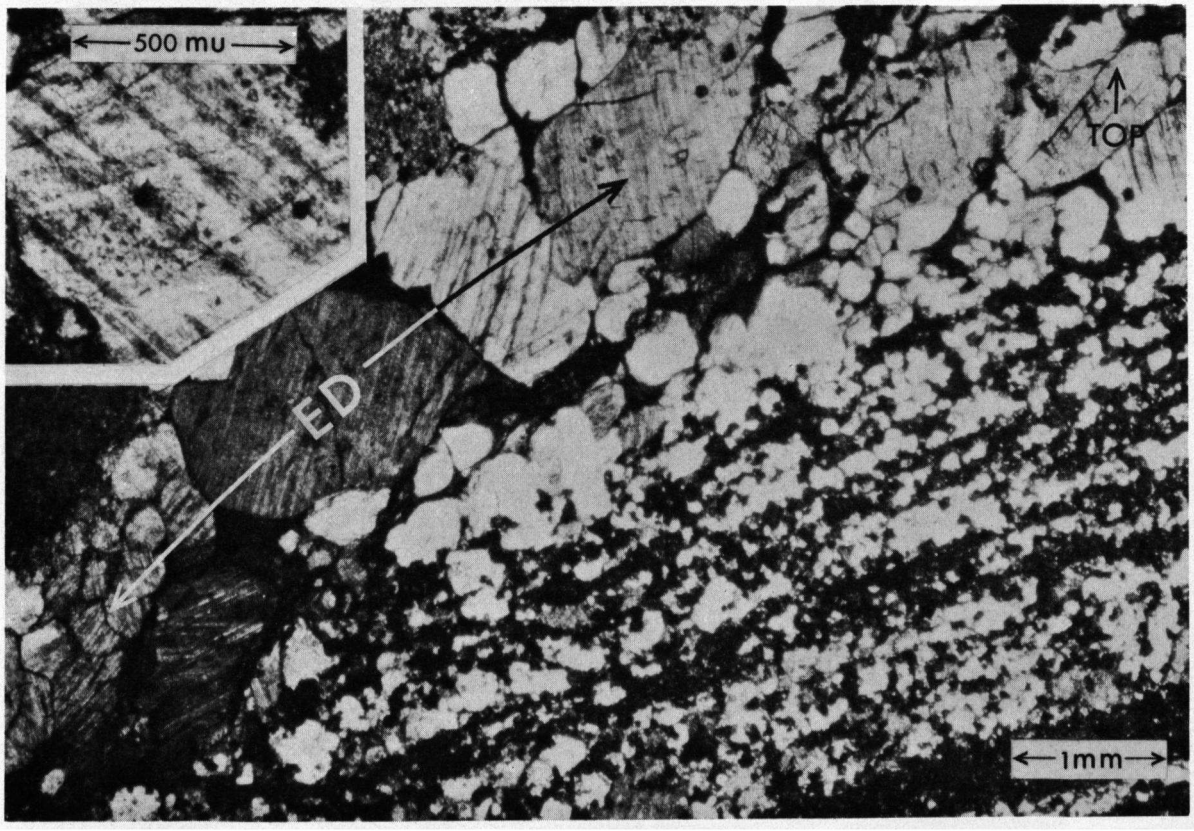

500 mu
TOP
ED
1mm

Fig. 50. Cavity in the Limestone Member. C is the cavity wall. SFl 1 is sediment (limestone) washed into the cavity (fo are fossil fragments). F 1 is fibrous calcite lining cavity wall after the deposition of SFL 1. SC is a sedimentary cone, well stratified, and composed of dolomite rhombs, fine echinodermal debris and corraded/corroded quartz crystals. Gl is a glauconitic pellet. (X-ray analysis of this pellet gave an identical picture as from the pellets in the Griotte Member). F 2 is bladed calcite with quartz detritus and hematite. Section LSF. Debris collected near the top of the section.

Fig. 51. This is the counterpart of figure 50. SFl 1 abuds against a pinnacle. F 1 curves from the pinnacle to cavity's roof and the bladed crystals in F 1 are cut here tangential to the c-axis. Notice the stromatolite (S) oriented perpendicular to SFl 1.

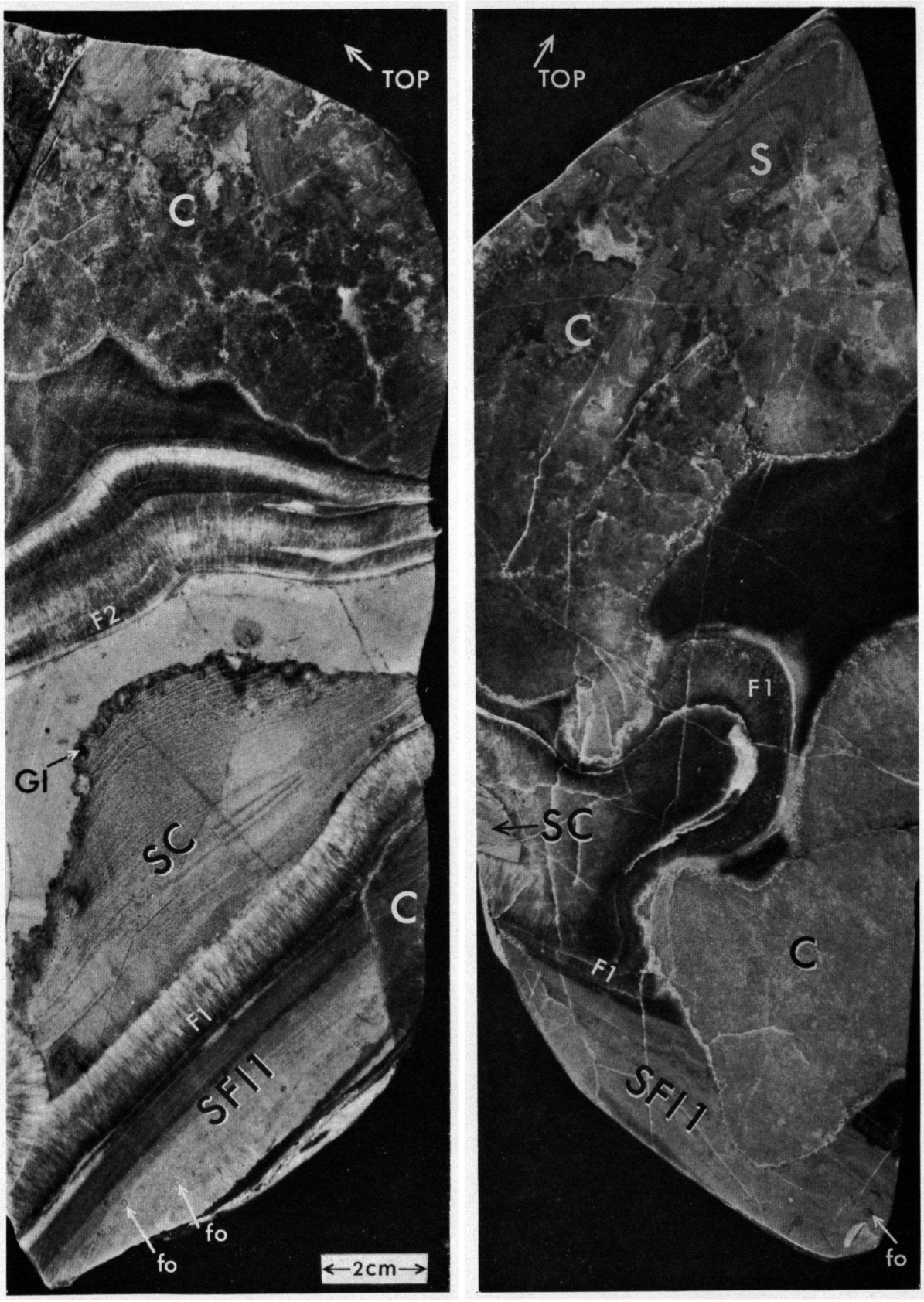
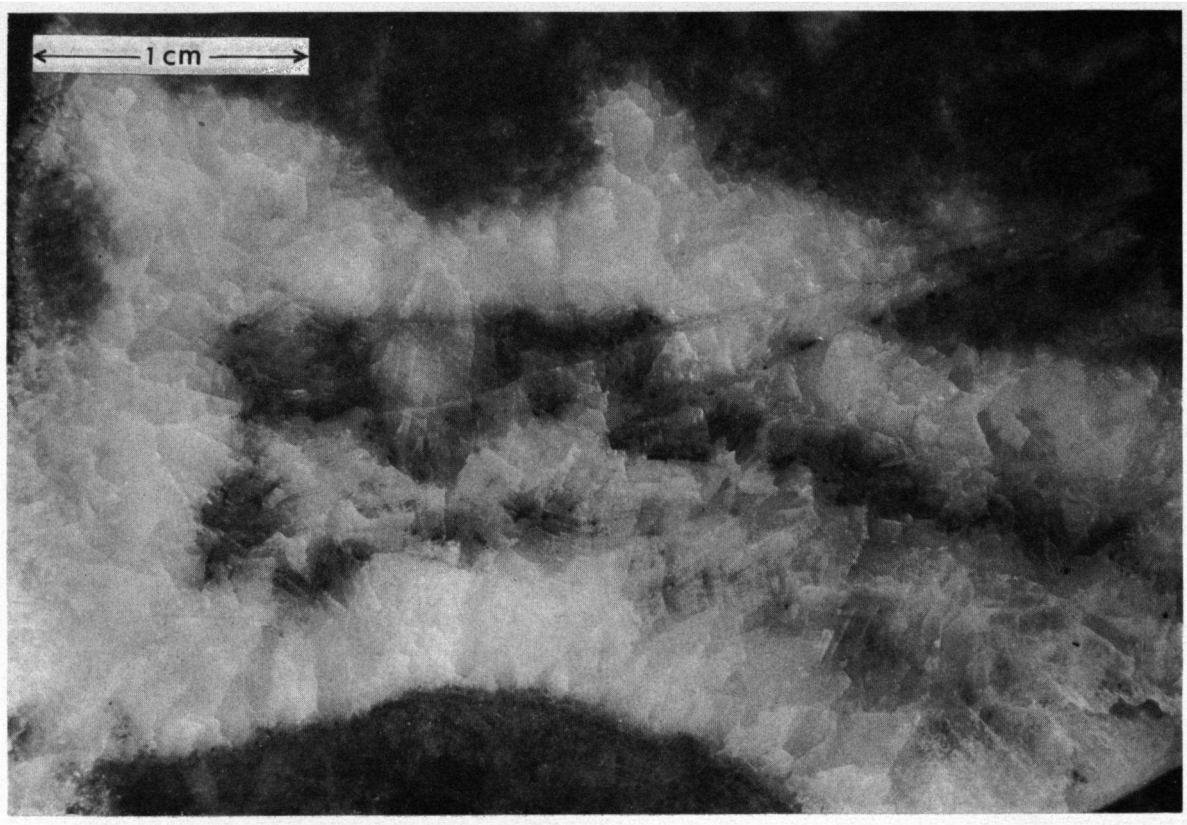

TOP
C
F2
Gl
SC
C
F1
SFI1
fo
fo
←2cm→
TOP
S
C
F1
SC
C
F1
SFI1
fo

Fig. 52. Dolomitized cavity filling from section LSI. Dark part in the centre of the cavity contains limonite(?).

Fig. 53. The nodular, argillaceous limestones of the Griotte Member. Section LSD.


1 cm

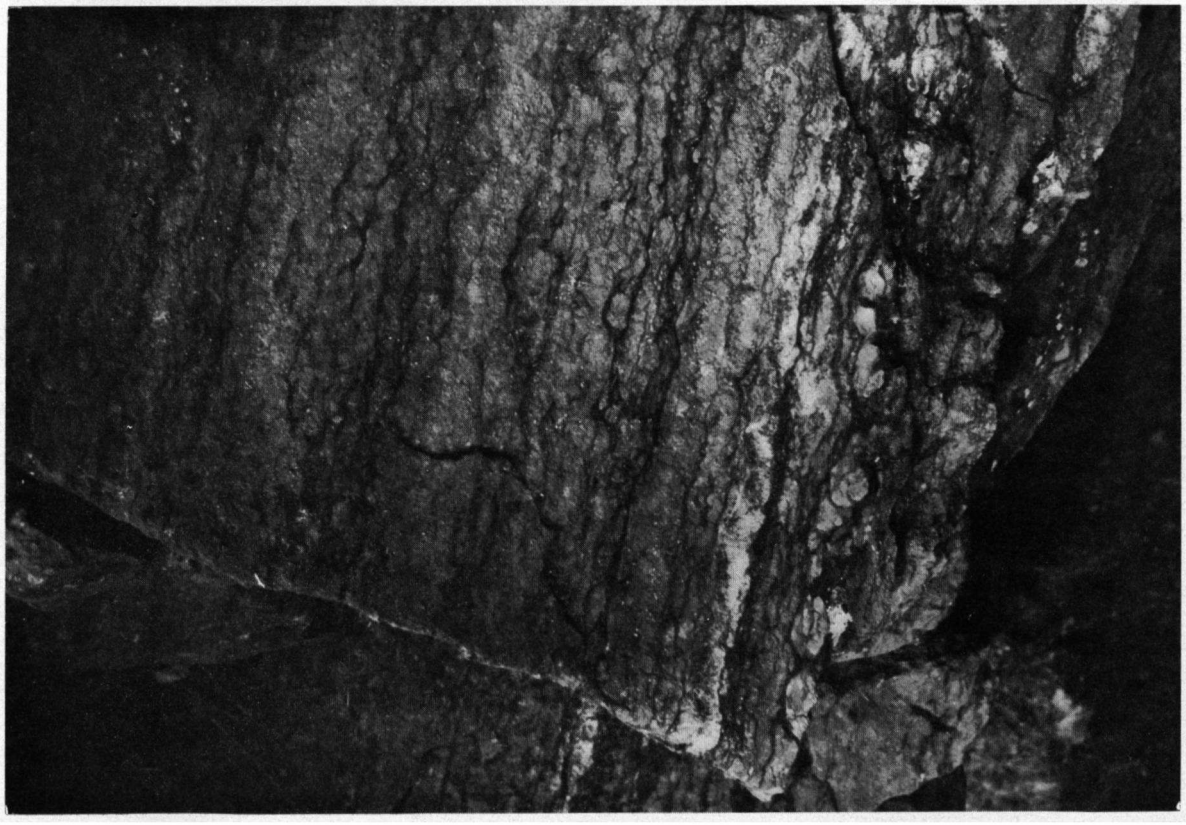
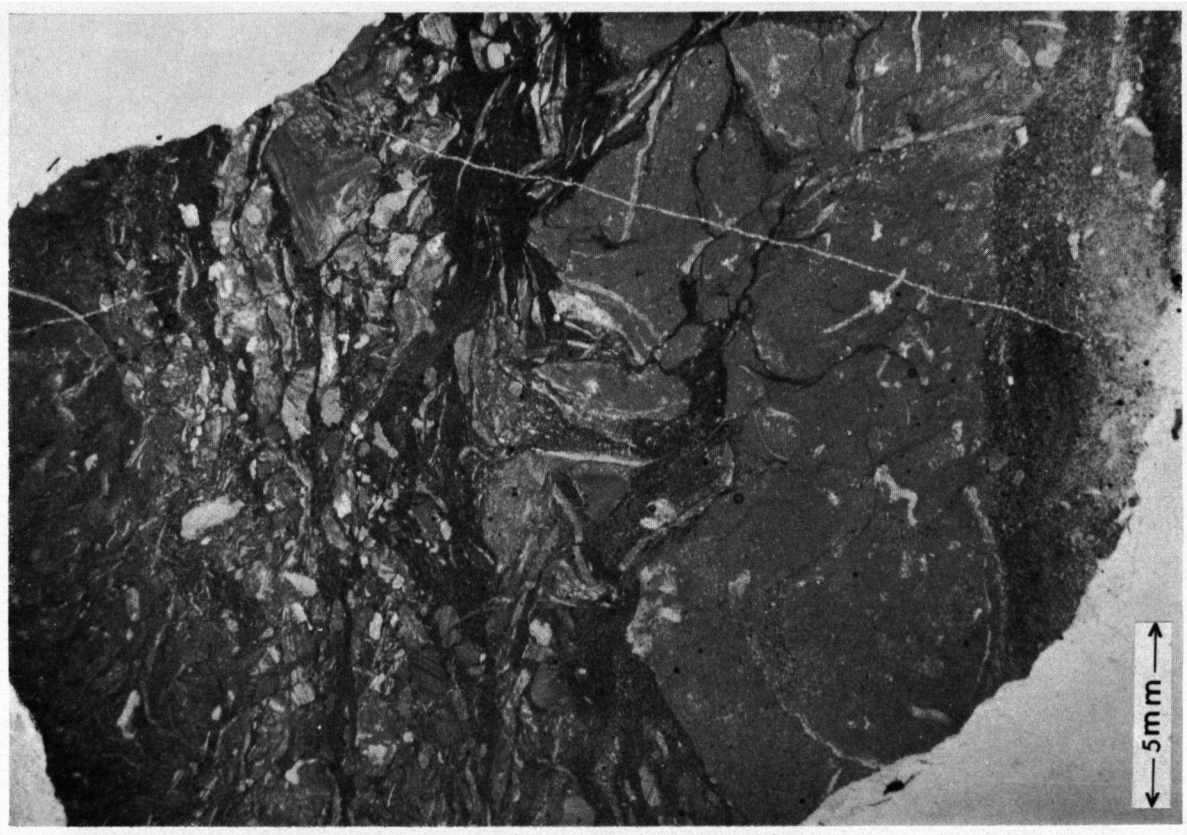


Fig. 54. This sample of the nodular limestone would give the impression that next to pressure solution there has been also a brecciation caused by lateral movement of the rock.

Fig. 55. Photomicrograph of the nodular limestone of the Griotte Member. The trilobite fragment (middle left of the photo) seems to have been pushed into the shale (white). Middle part of the photo shows brachiopod fragment partly dissolved by pressure solution. Lower right of the photo shows an echinodermal fragment with hematite in its pores (white). The right hand part of the photo shows an argillaceous interval with more bioclasts than there are in the limestone (central and left parts of the photo). This photo is a negative print of the thin section.


5mm

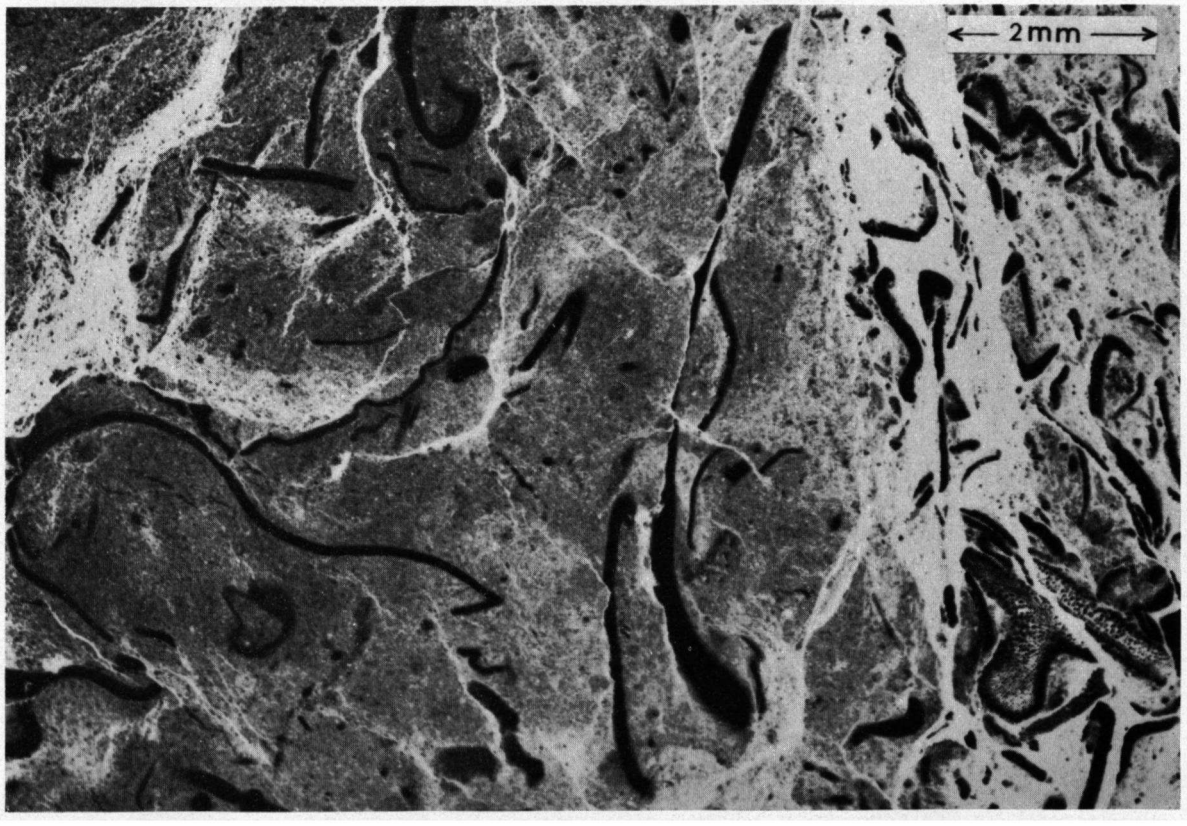

2mm

Fig. 56. *Stromatactis* in the Griotte Member. Section LSX.

Fig. 57. The outcrop of the Lancara Formation on the right bank of the Esla River near Valdoré. Arrow points at the place where a tectonic breccia was found containing Devonian corals.

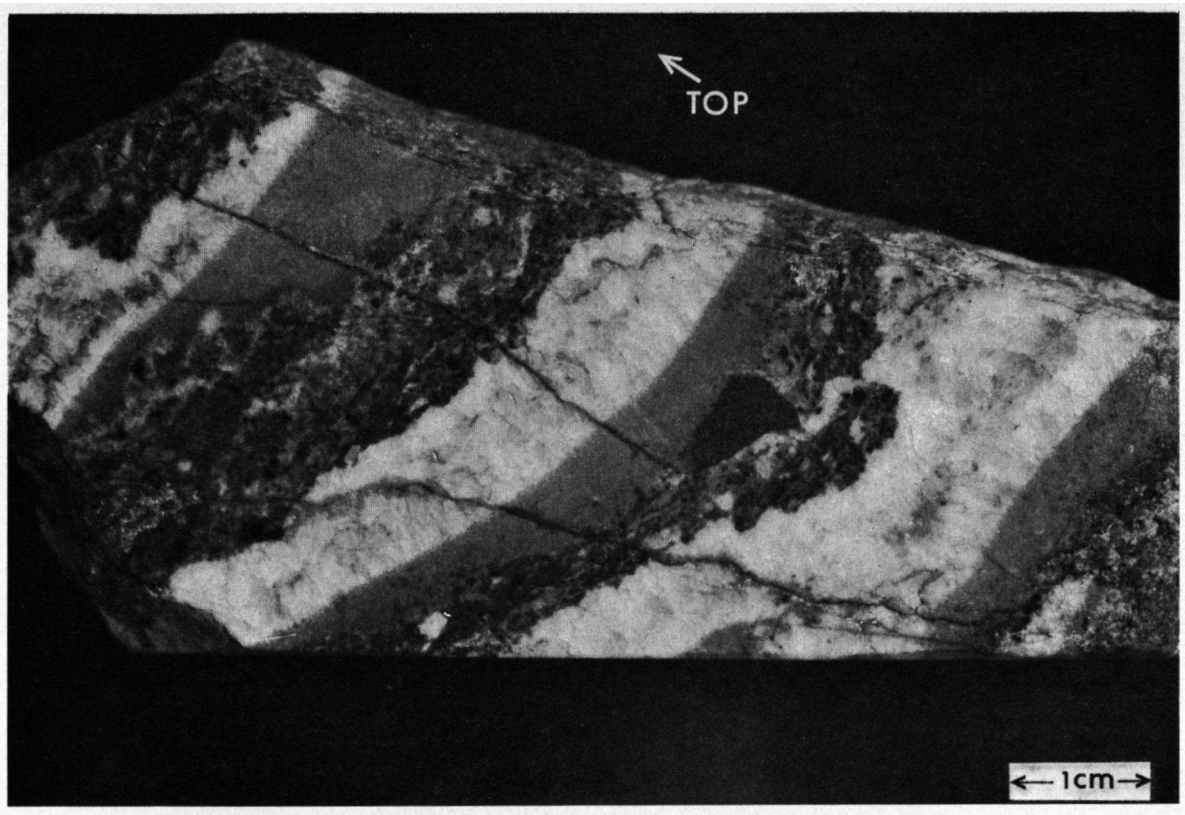
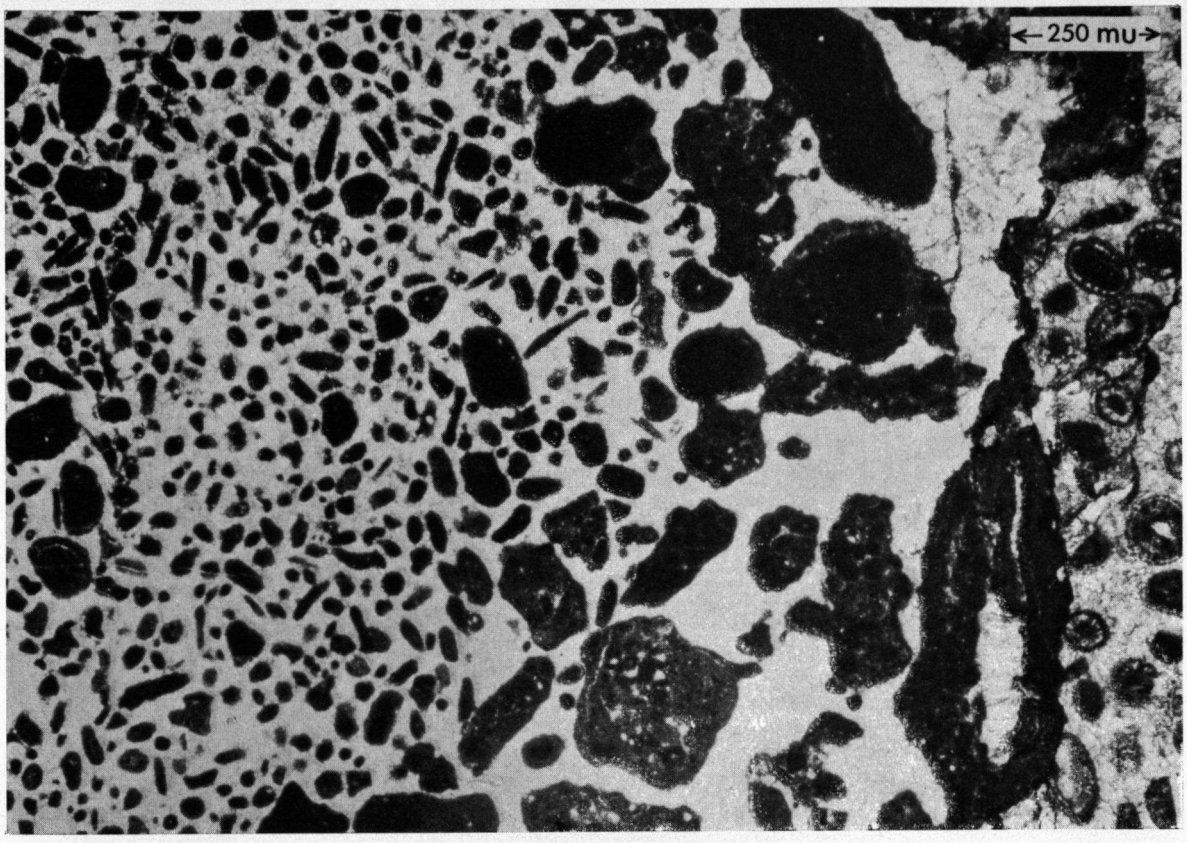

TOP
1cm

Fig. 58. Algal 'sticks', intraclasts containing algal 'sticks' and oölites from the limestones in Valdoré.

Fig. 59. Detail of figure 58 showing the algal 'sticks' which have been altered partly by grain-diminution.


←250 mu→

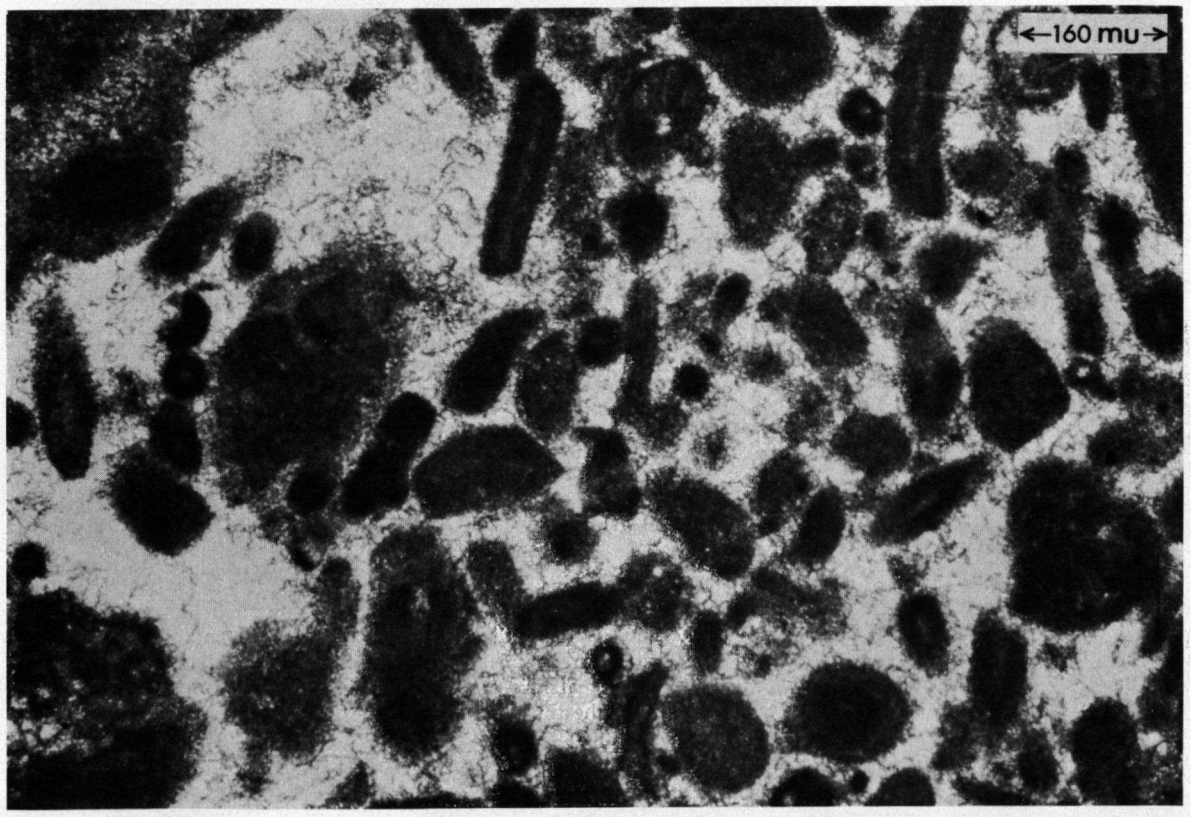
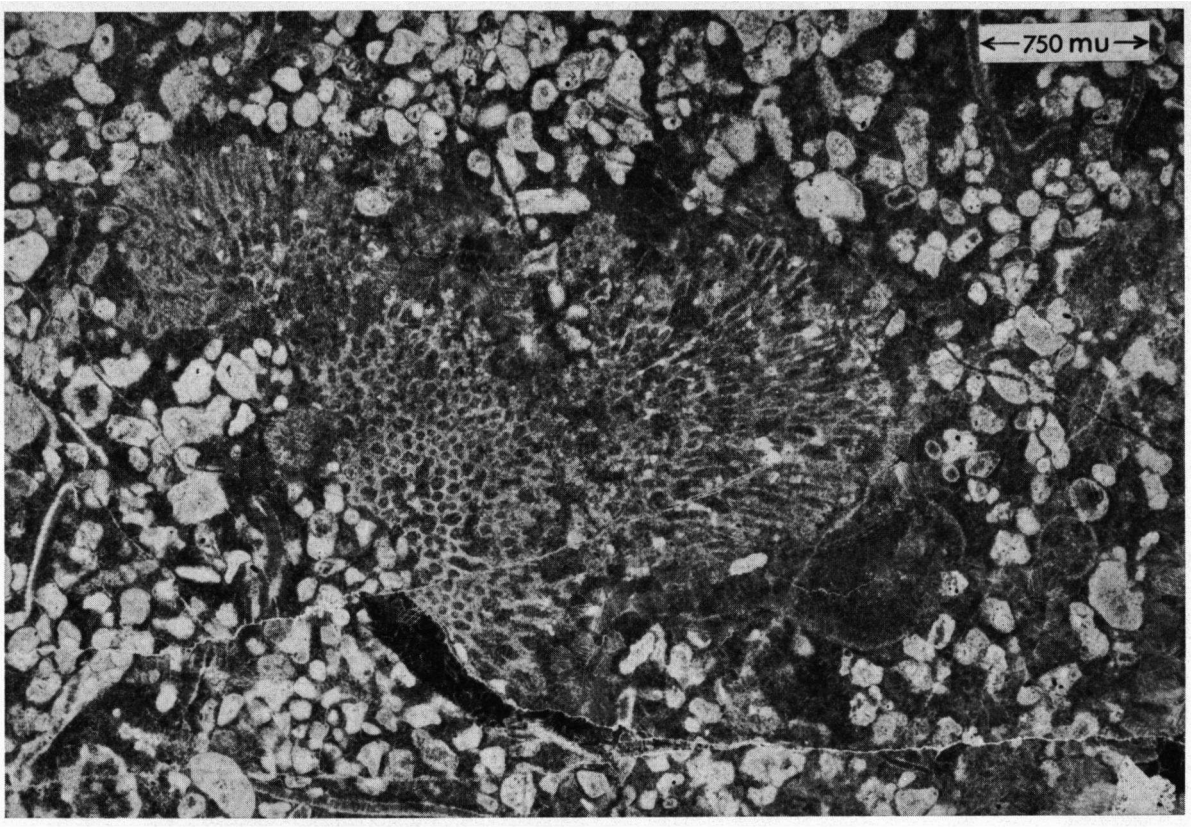
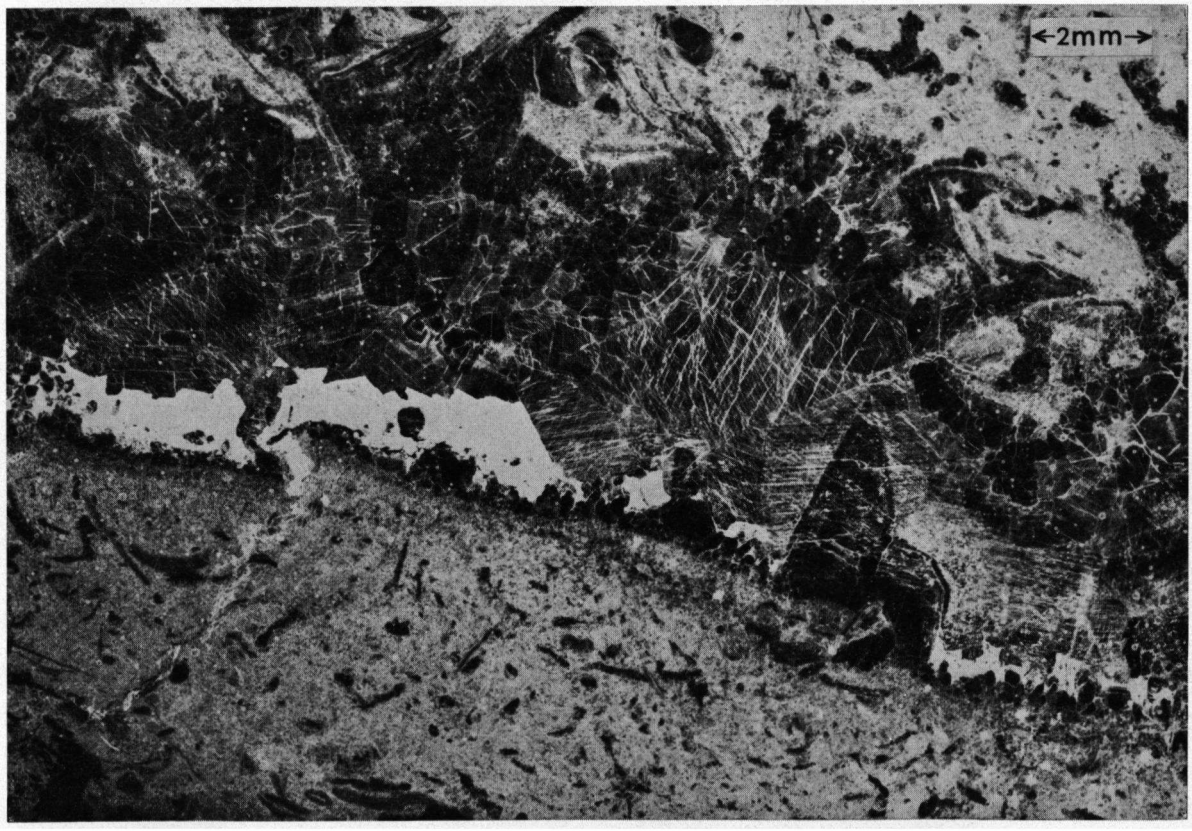
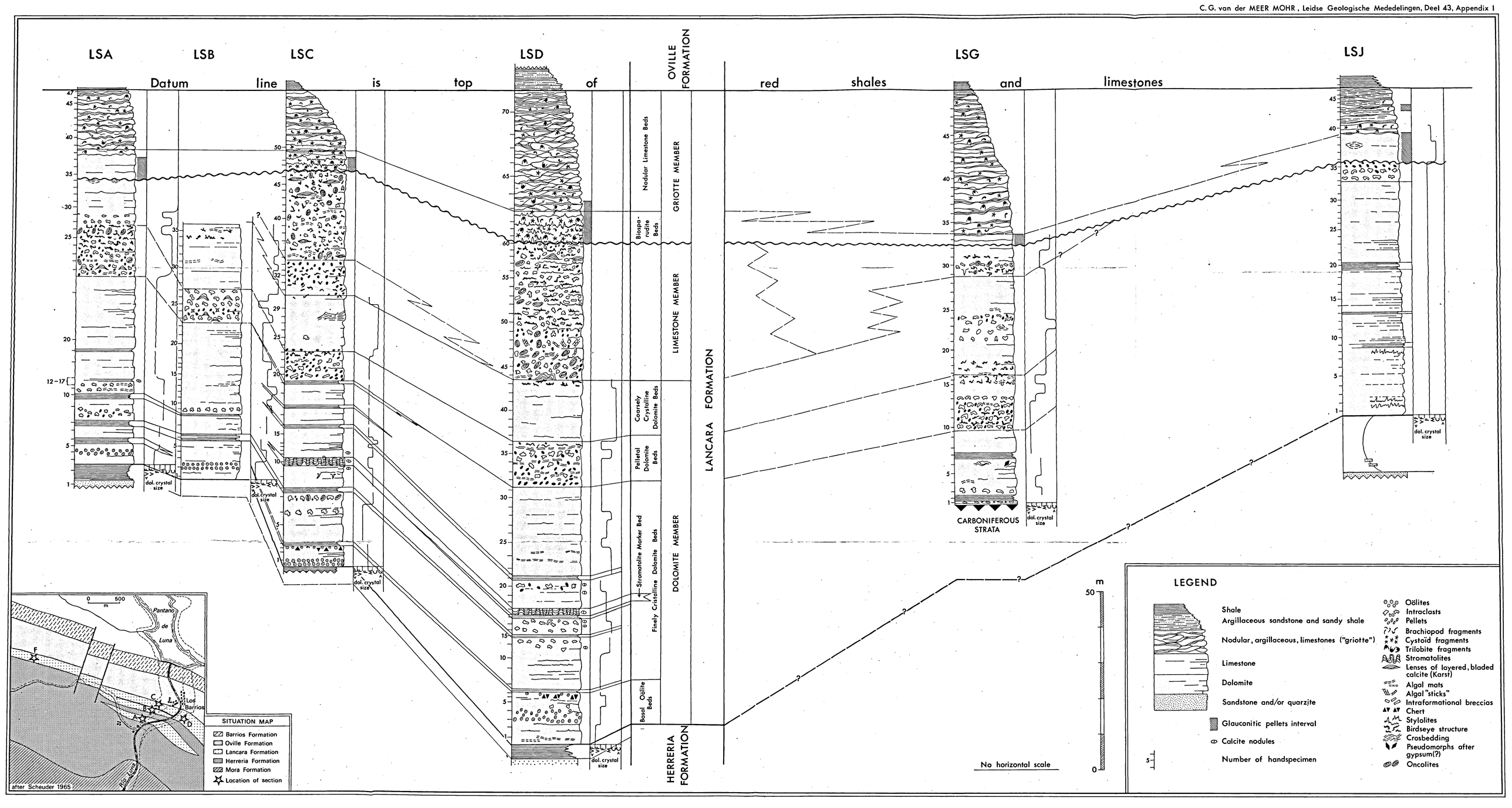

←160 mu→

Fig. 60. *Hedstroemia* sp. from sample LSN-17. Verdiago.

Fig. 61. Cavity in the Griotte Member near Verdiago. Photomicrograph shows well-developed calcite crystals with straight intercrystalline boundaries. Central part of the cavity contains ferroan calcite while the walls of the cavity are lined with iron-free calcite. White patch is probably limonite(?). Colored thin section. The photo is a negative of the thin section.


←750 mu→

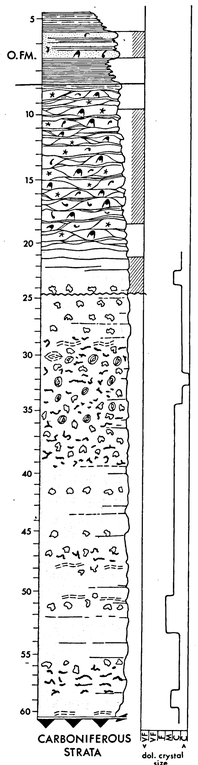

←2mm→


LSA
LSB
LSC
LSD
LSG
LSJ
Datum line is top of red shales and limestones
OVILLE FORMATION
GRIOTTE MEMBER
LIMESTONE MEMBER
DOLOMITE MEMBER
LANCARA FORMATION
HERRERIA FORMATION
Nodular Limestone Beds
Biospa-rudite Beds
Coarsely Crystalline Dolomite Beds
Pelletal Dolomite Beds
Stromatolite Marker Bed
Finely Crystalline Dolomite Beds
Basal Oölite Beds
CARBONIFEROUS STRATA
dol. crystal size
No horizontal scale
m
50
0
0 500 m
Pantano de Luna
Los Barrios
Río Lunas
SITUATION MAP
Barrios Formation
Oville Formation
Lancara Formation
Herreria Formation
Mora Formation
Location of section
after Scheuder 1965
LEGEND
Shale
Argillaceous sandstone and sandy shale
Nodular, argillaceous, limestones ("griotte")
Limestone
Dolomite
Sandstone and/or quarzite
Glauconitic pellets interval
Calcite nodules
Number of handspecimen
Oölites
Intraclasts
Pellets
Brachiopod fragments
Cystoïd fragments
Trilobite fragments
Stromatolites
Lenses of layered, bladed calcite (Karst)
Algal mats
Algal "sticks"
Intraformational breccias
Chert
Stylolites
Birdseye structure
Crosbedding
Pseudomorphs after gypsum(?)
Oncolites

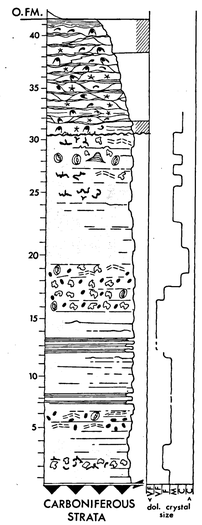

LSF
LSC
LSD
LSM
Datum line is top of red shales and limestones
dol. crystal size
OVILLE FORMATION
Nodular Limestone Beds
Biospa-rudite Beds
GRIOTTE MEMBER
Coarsely Cristalline Dolomite Beds
Pelletal Dolomite Beds
Stromatolite Marker Bed
Finely Cristalline Dolomit Beds
Basal Oölite Beds
DOLOMITE MEMBER
LANCARA FORMATION
HERRERIA FORMATION
LEGEND
Shale
Argillaceous sandstone and sandy shale
Nodular, argillaceous, limestones ("griotte")
Limestone
Dolomite
Sandstone and/or quartzite
Glauconitic pellets interval
Calcite nodules
Number of handspecimen
Oölites
Intraclasts
Pellets
Brachiopod fragments
Cystoid fragments
Trilobite fragments
Stromatolites
Lenses of layered bladed calcite (Karst)
Algal mats
Algal "sticks"
Intraformational breccias
Chert
Stylolites
Birdseye structure
Crosbedding
Oncolites
Pantano de Luna
Los Barrios
Rio Luna
SITUATION MAP
Barrios Formation
Oville Formation
Lancara Formation
Herreria Formation
Mora Formation
Location of section
after Schreuder 1965
0 500 m
m 50 0

LUNA- BERNESGA REGION

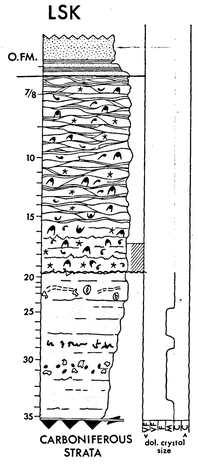
LSI



LSE

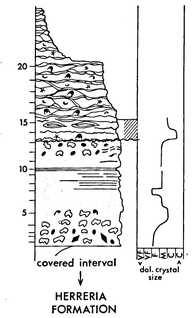


LSK

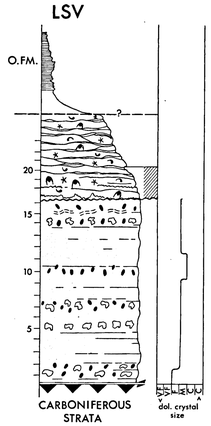


BERNESGA- PARDOMINO HIGH REGION

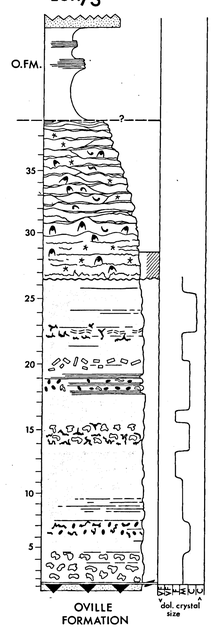
LSX



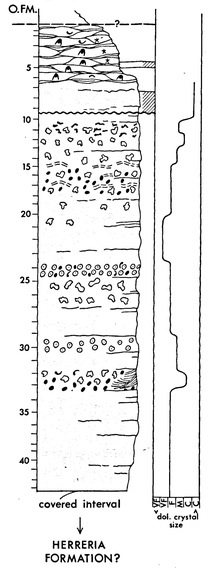
LSV



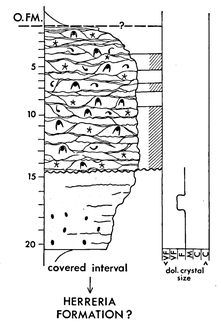
LSR/S



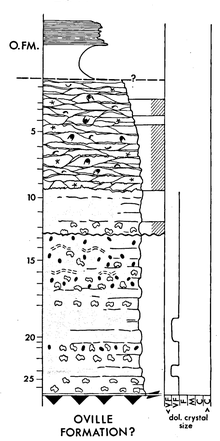
LSO



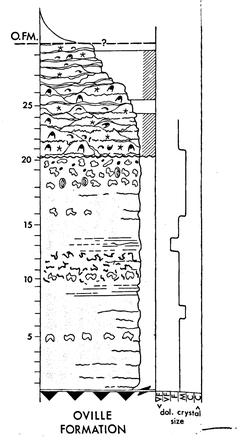
LSU



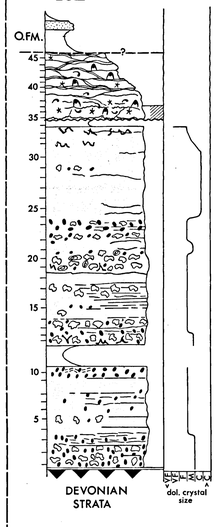
LSW



LSQ

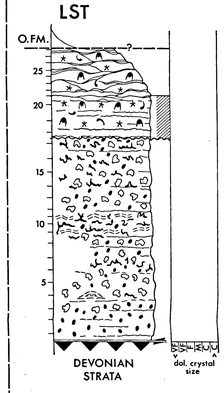


LSZ

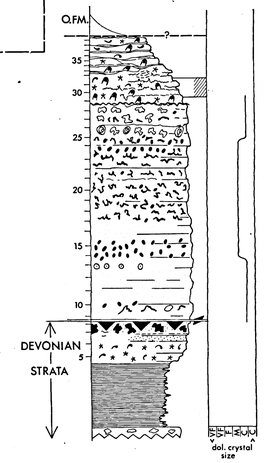


ESLA REGION

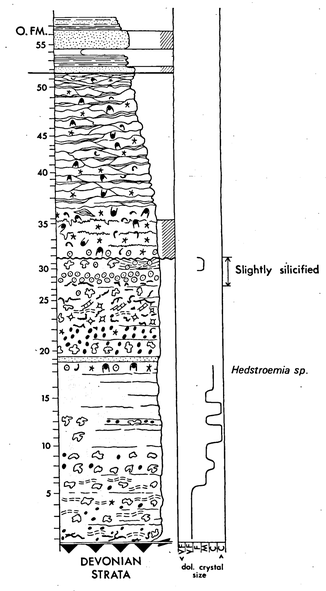
LST



LSP



LSN



LEGEND

- Shale
- Argillaceous sandstone and sandy shale
- Nodular, argillaceous, limestones ("griotte")
- Limestone
- Dolomite
- Sandstone and or quartzite
- Glauconitic pellets interval
- 5 — Number of handspecimen
- O.FM. — Oville Formation

- Oölites
- Intraclasts
- Pellets
- Brachiopod fragments
- Cystoïd fragments
- Trilobite fragments
- Stromatolites
- Lenses of layered, bladed calcite (Karst)
- Algal mats
- Algal "sticks"
- Intraformational breccias
- Chert
- Stylolites
- Birdseye structures
- Crosbedding
- Pseudomorphs after gypsum(?)
- Oncolites
- Breccia

m 50 — 0

OVILLE FORMATION

LANCARA FORMATION

GRIOTTE MEMBER

Nodular Limstone Beds

Biospa-rudite Beds

LIMESTONE MEMBER

DOLOMITE MEMBER

Coarsely Crystalline Dolomite Beds

Pelletal Dolomite Beds

Finely Crystalline Dolomite Beds

Stromatolite Marker Bed

Basal Oolite Beds

HERRERIA FORMATION

LSD

Sample number

70 65 60 55 50 45 40 35 30 25 20 15 10 5 1

Glauco-nitic pellets

Vuggy porosity

-Vf Vf f m c

dol. crystal. size

% terr. mat.

0 50%

ppm Cu

0 20 40 60

ppm Co

0 20

ppm Ni

0 20

ppm Sr

0 100 200 300

MgO/CaO x 1000

0 100 200 300 400 500 600 700

m 30 20 10 0

vertical scale

Tectonically distur- bed & dedolomitized interval

Fully dolomitized part yielded 0 ppm

Low ratio is due to the calcite nodules