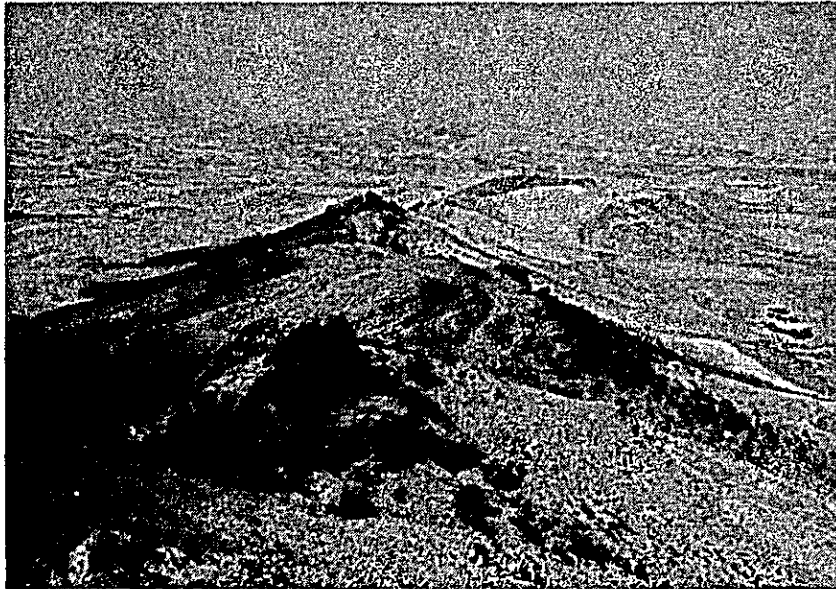


APPENDICES

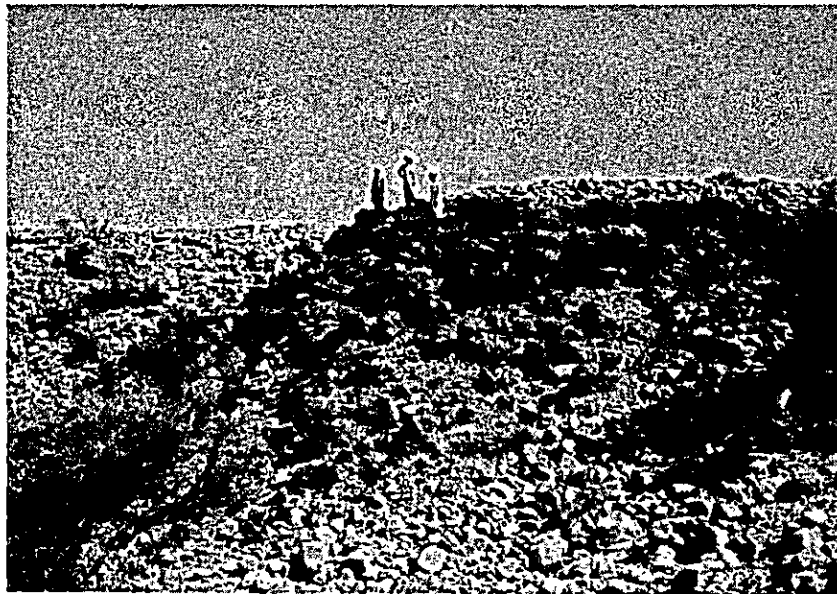
Fig. A-1 Photograph of the Outcrops



The biggest outcrop of manganese ore deposit in semi-detailed surveyed area

Location . N2485, E778

Manganese outcrop No. 110

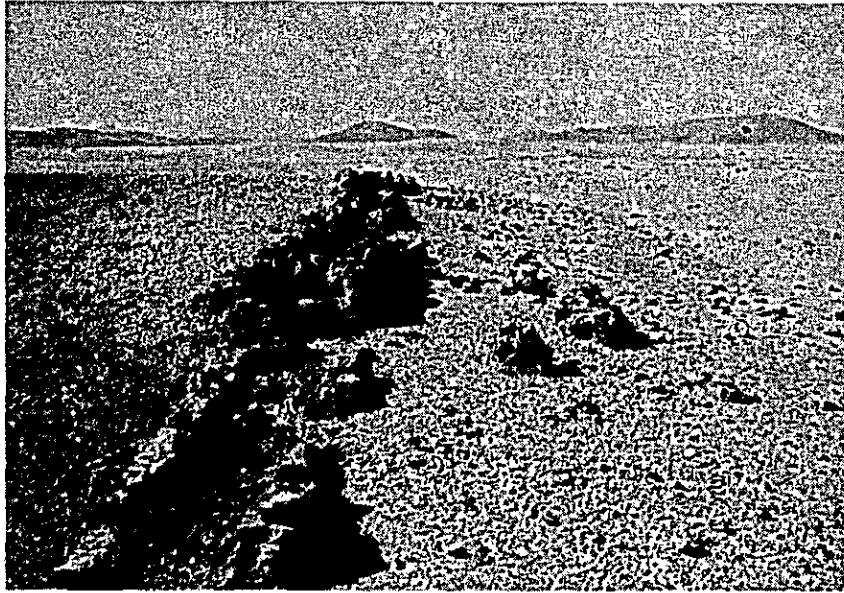


Outcrop of manganese ore.

It shows about 9 m in the thickness.

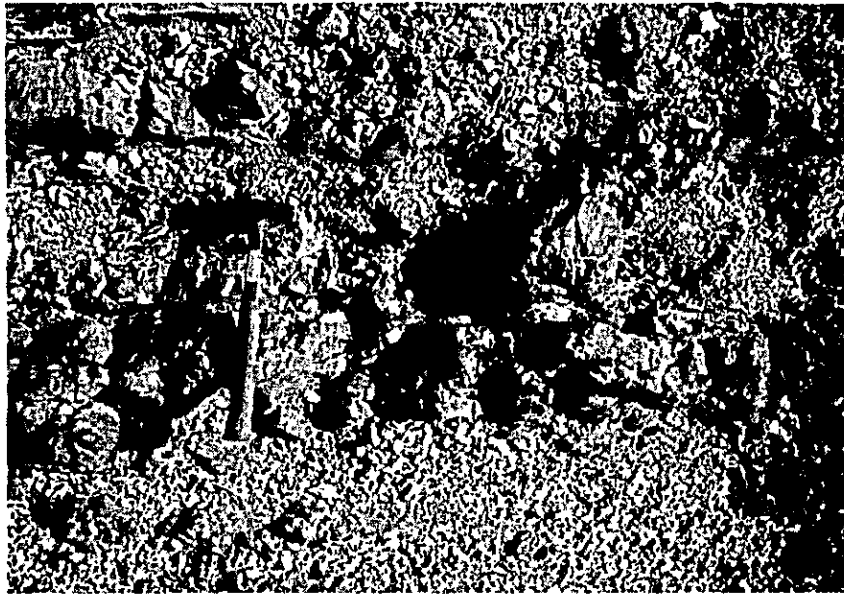
Location . N2460, E760

Manganese outcrop No. 159



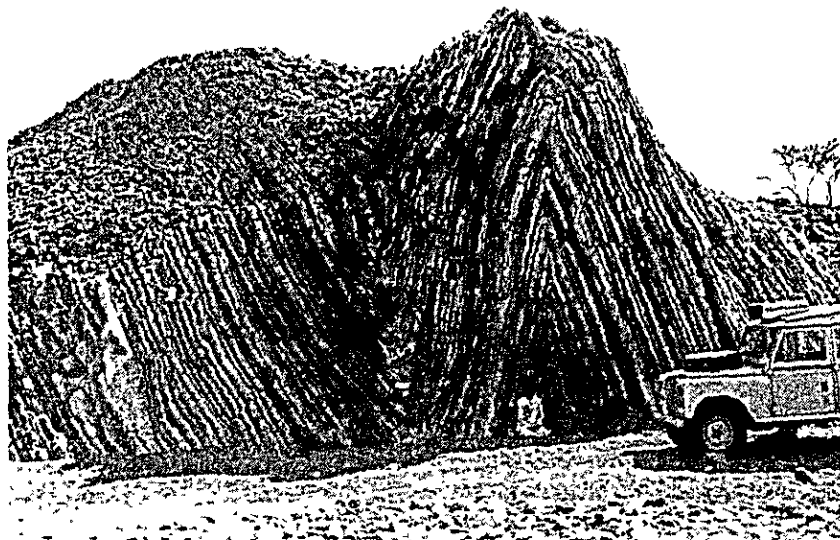
Outcrop of layered manganese ore in muddy chert.
This outcrop is thin, but continues in scores of meters.

Location : N2481, E779
Manganese outcrop No. 81



Nodular manganese ore in muddy chert

Location . N2484, E778
Manganese outcrop No. 93



Strongly folded halfa formation
Location N2465, E755



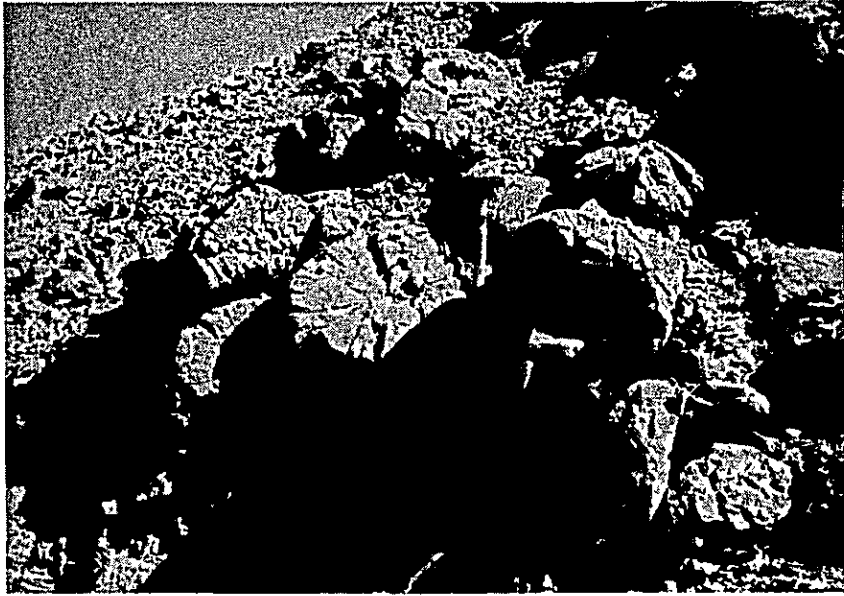
Brecciated halfa formation
Location N2486, E776



Folded alternation of chert and shale in halfa formation
Location N2486, E776



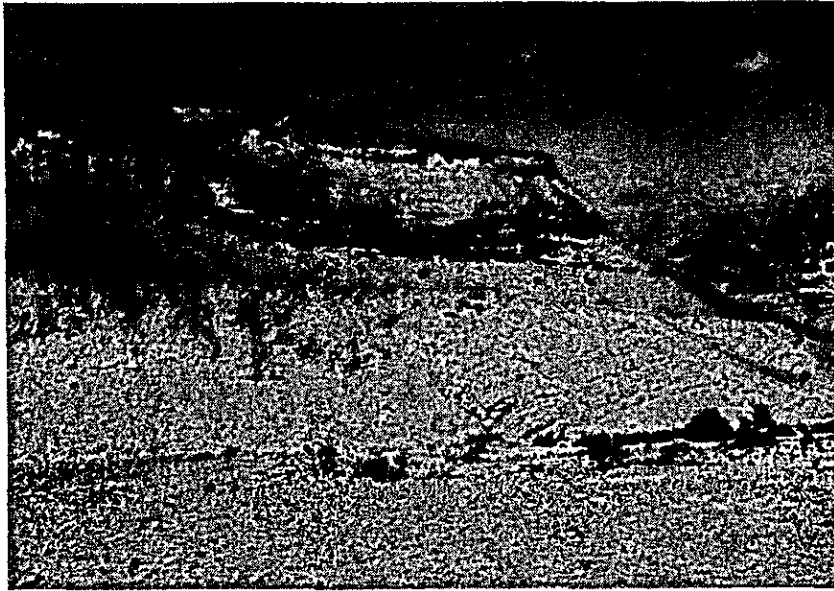
Alternation of red chert and brown shale
It has the rhythmical bands and red chert is bleached
Location : N2486, E776



Basalt lava in tertiary limestone.
It shows pillow structure
Location : N2440, E755



Basalt lava in the lower member of halfa formation
Location : N2481, E784



The lower member and the upper member of tertiary limestone

Location : N2490, E765



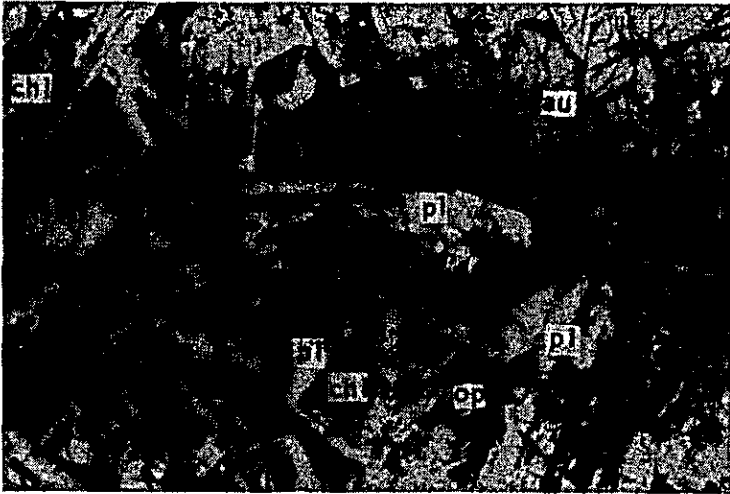
Gneiss and basic dykes of the J. Ja'alan Basement

Location : N2487, E782

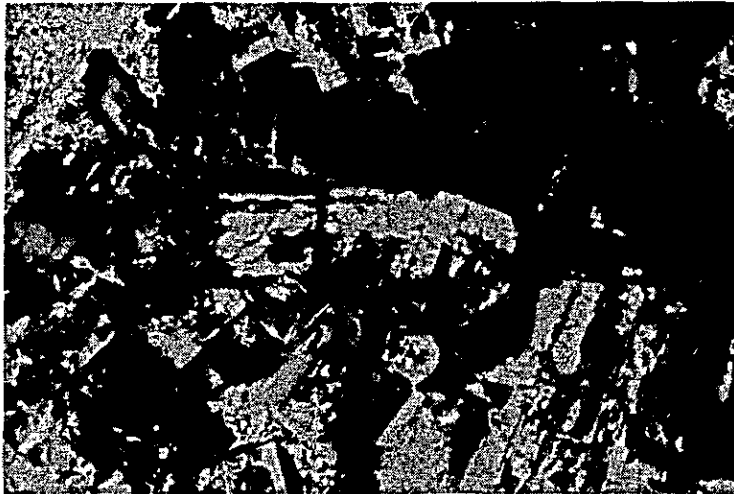
Fig. A-2 Microphotograph of Thin Section

Abbreviations

qz	:	quartz
pl	:	plagioclase
kf	:	potash feldspar
bt	:	biotite
hb	:	hornblende
au	:	augite
cal	:	calcite
chl	:	chlorite
Mn min.	:	manganese mineral
op	:	opaque mineral



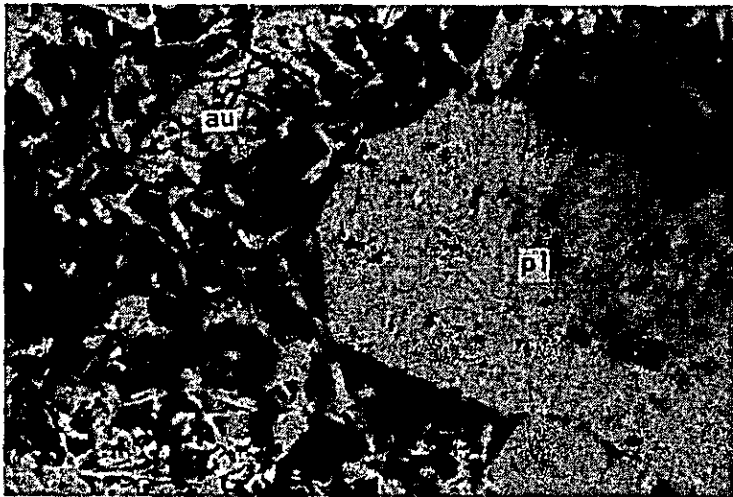
Only lower polar



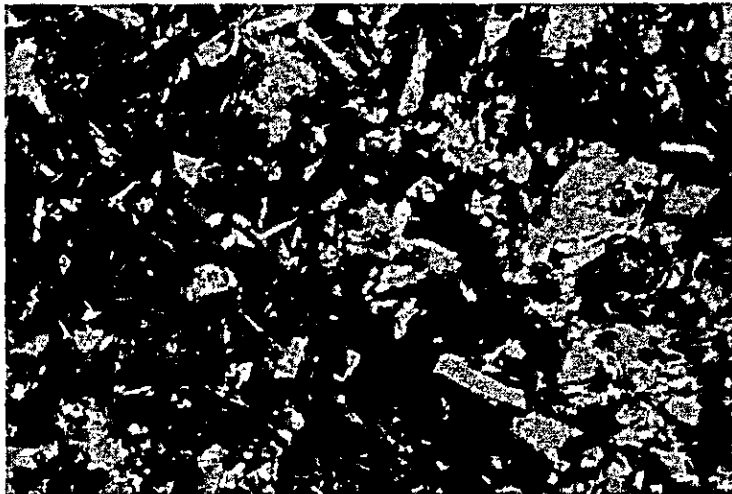
Crossed polars

0 0.5mm

Sample No. : B131 (1)
Location : N2478, E783
Rock name : diorite porphyrite



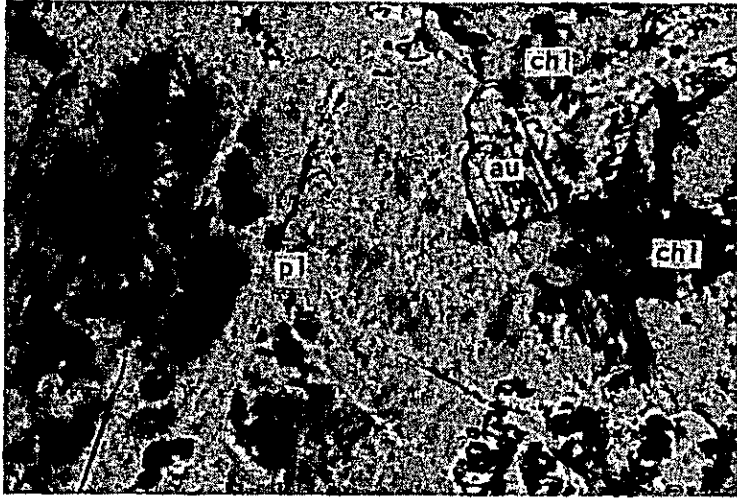
Only lower polar



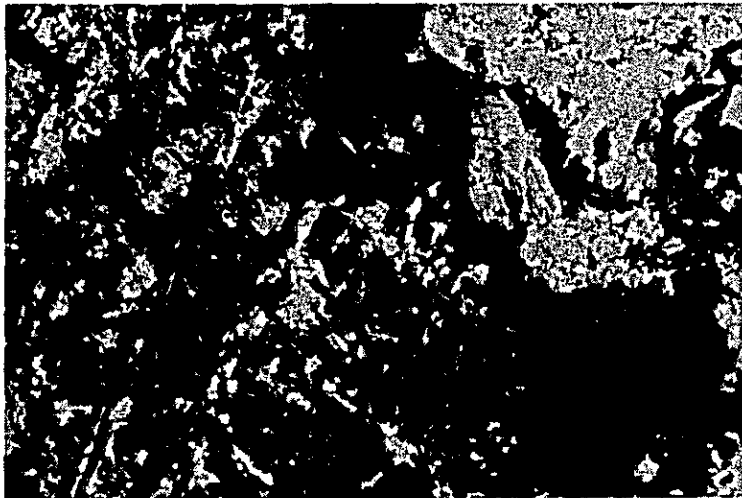
Crossed polars

0 0.5mm

Sample No. : E065
Location : N2440, E755
Formation : Limestone formation (MTI)
Rock name : basalt



Only lower polar

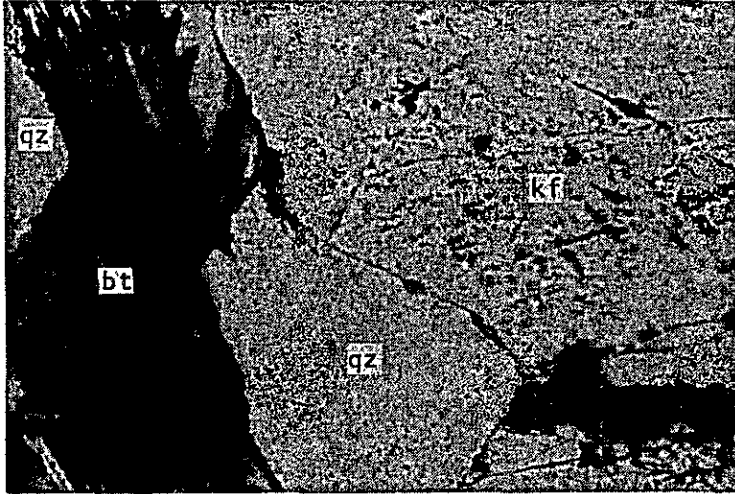


Crossee polars

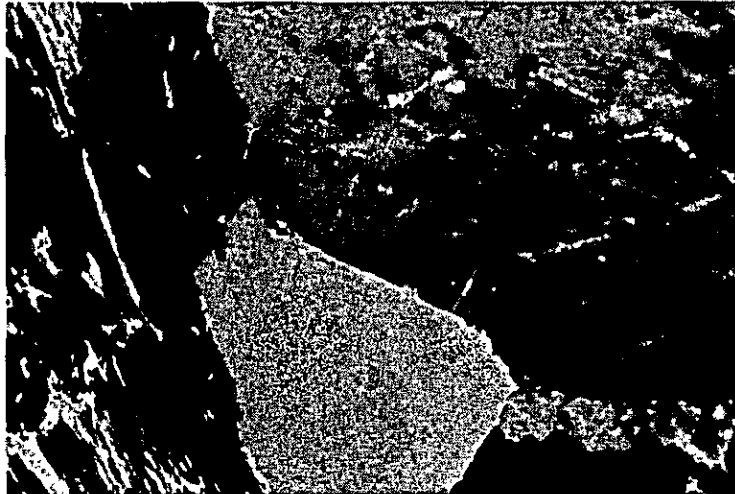
0 0.5mm



Sample No. : E066
Location : N2445, E750
Rock name : diorite



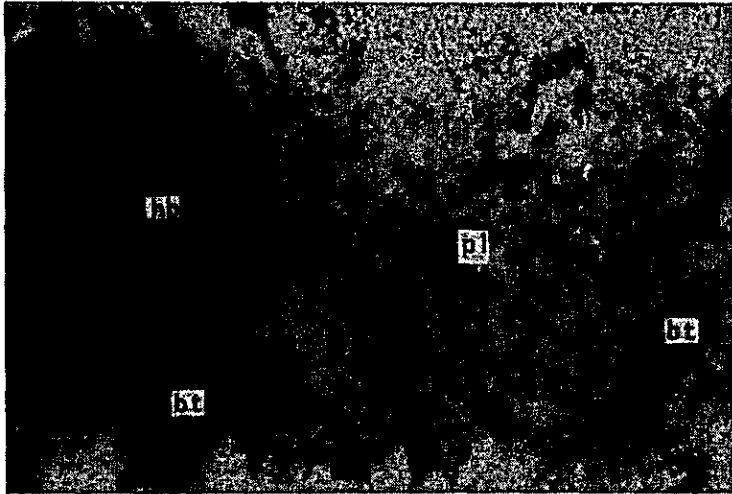
Only lower polar



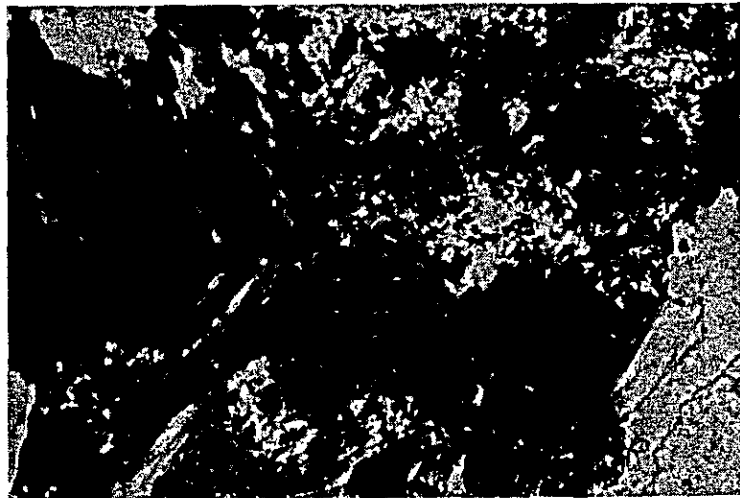
Crossed polars

0 0.5mm

Sample No. : E092
Location : N2445, E745
Rock name : granite



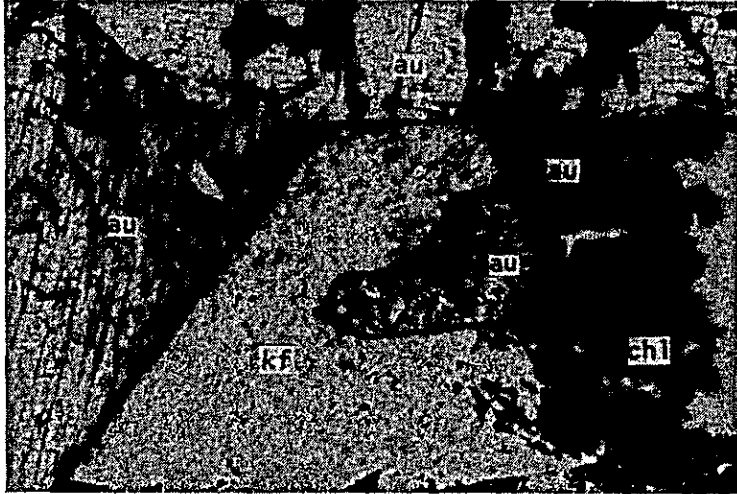
Only lower polar



Crossed polars



Sample No. : E096
Location : N2450, E745
Formation : J. Ja'alan Basement
Rock name : amphiborite



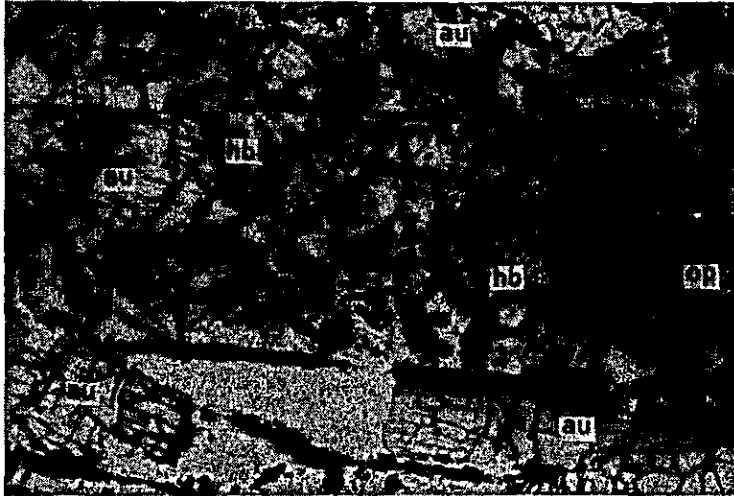
Only lower polar



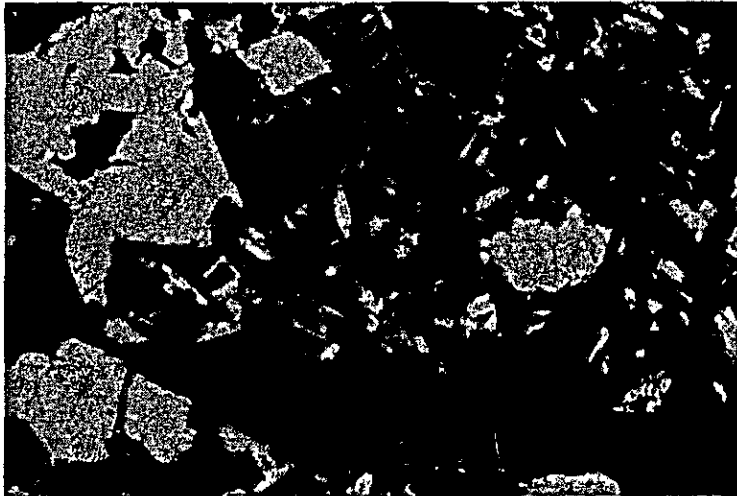
Crossed polars

0 0.5mm

Sample No. : E062
Location : N2445, E765
Rock name : Dolerite



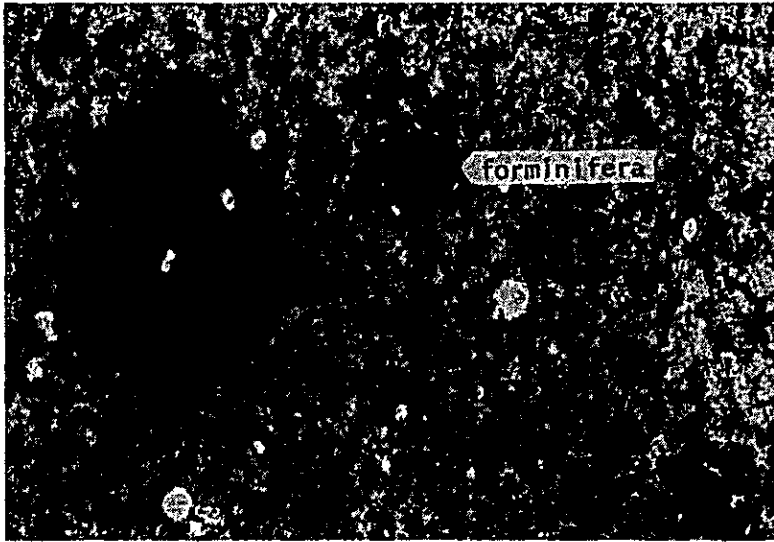
Only lower polar



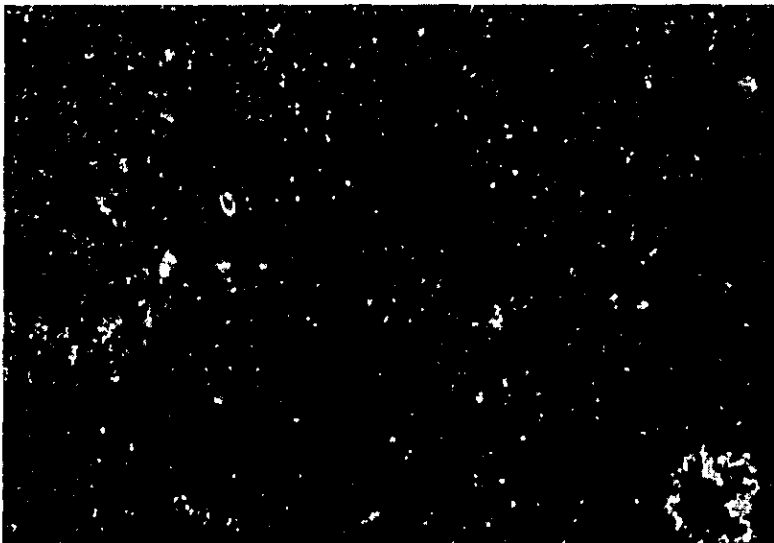
Crossed polars

0 0.5mm

Sample No. : D075
Location : N2480, E784
Rock name : Dolerite



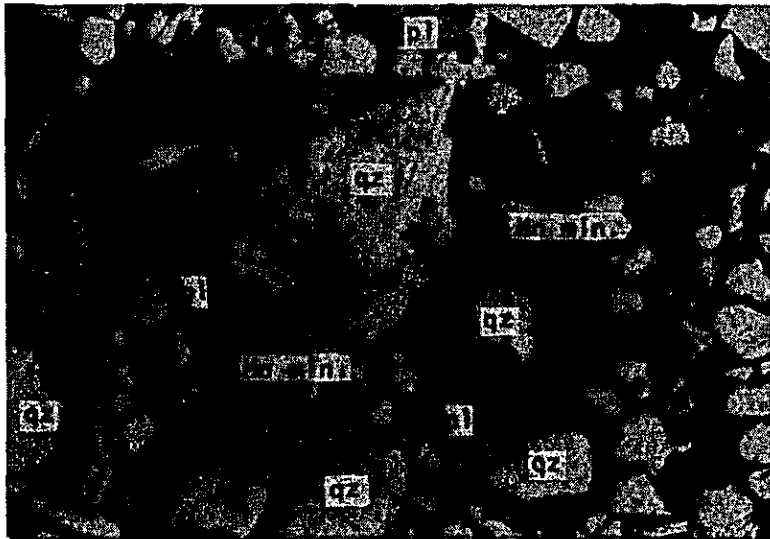
Only lower polar



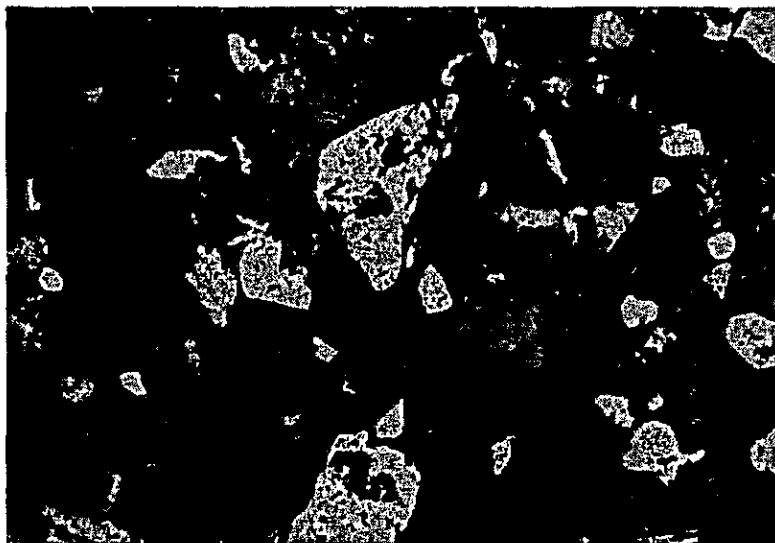
Crossed polars

0 1.0mm

Sample No. : A006 (b)
Location : N2482, E781
Formation : Halfa formation (Hm)
Rock name : shale



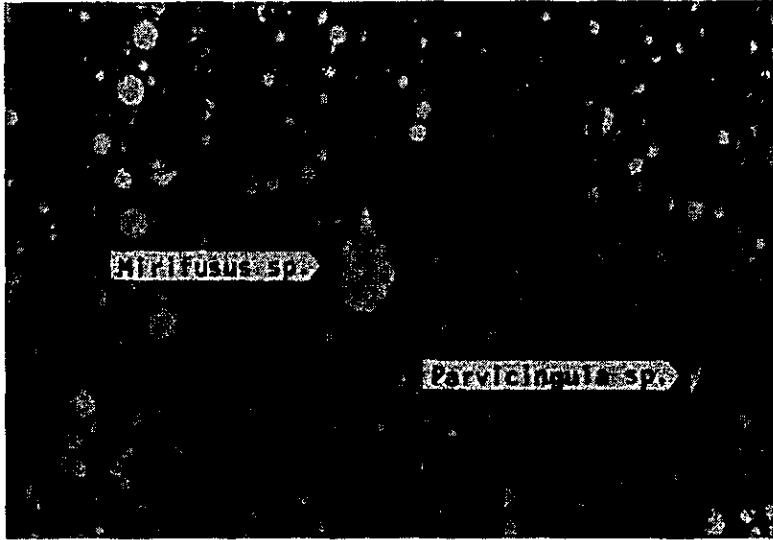
Only lower polar



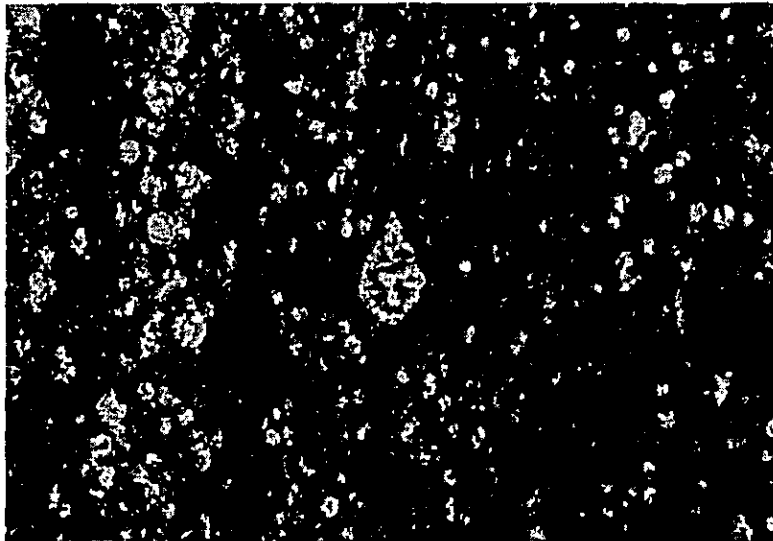
Crossed polars

0 1.0mm

Sample No. : A055
Location : N2438, N776
Formation : Limestone formation (MTI)
Rock name : coarse sandstone



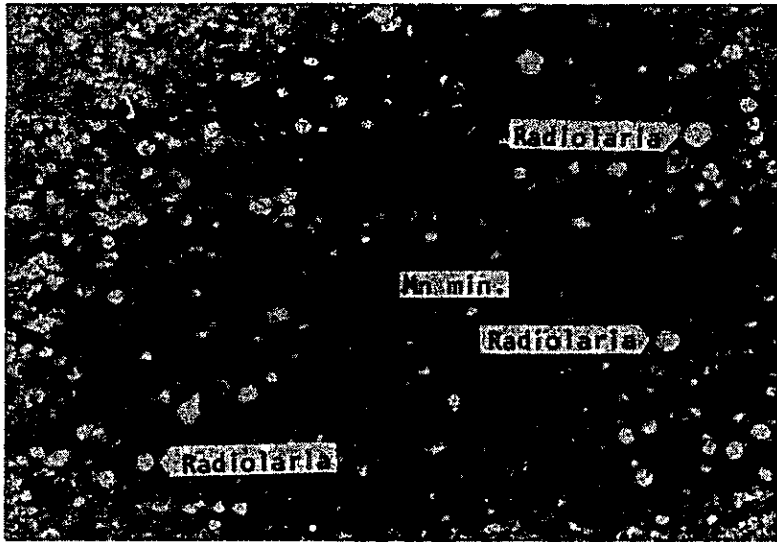
Only lower polar



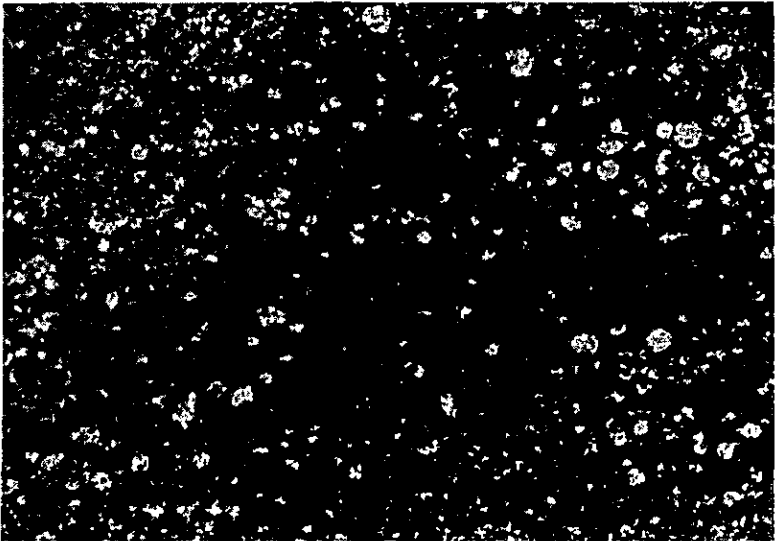
Crossed polars

0 1.0mm

Sample No. : CI23
Location : N2484, E779
Formation : Halfa formation (Hm)
Rock name : muddy chert



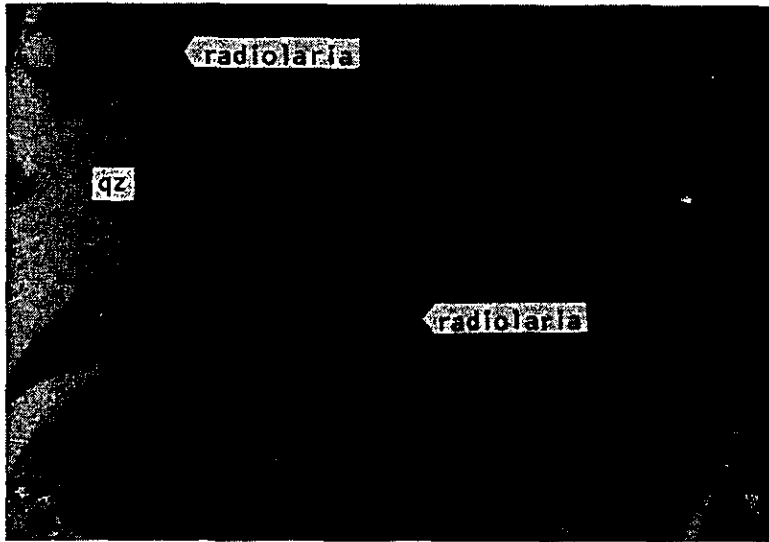
Only lower polar



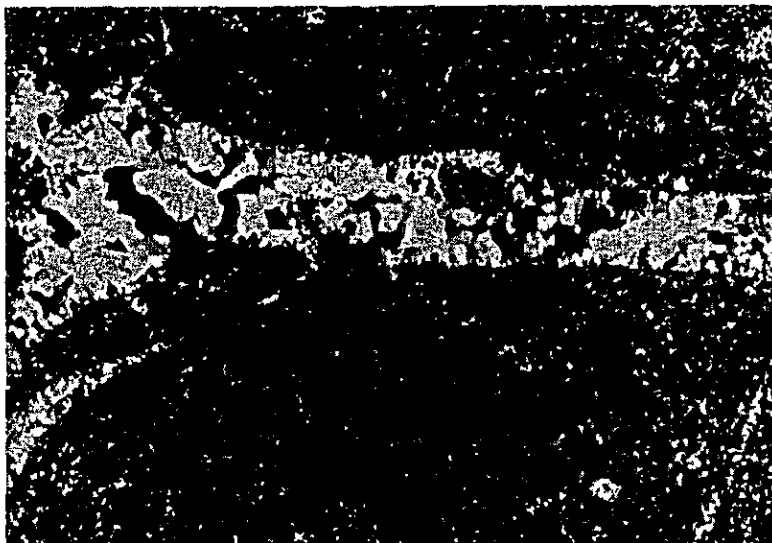
Crossed polars

0 1.0mm

Sample No. : C124
Location : N2484, E779
Formation : Halfa formation (Hm)
Rock name : muddy chert



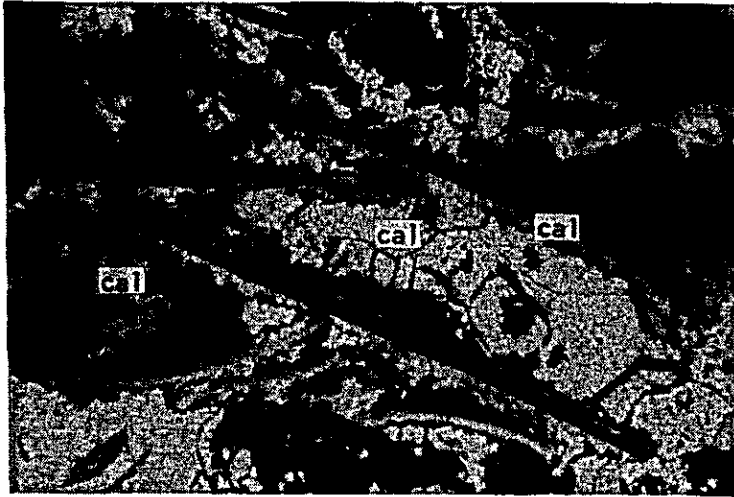
Only lower polar



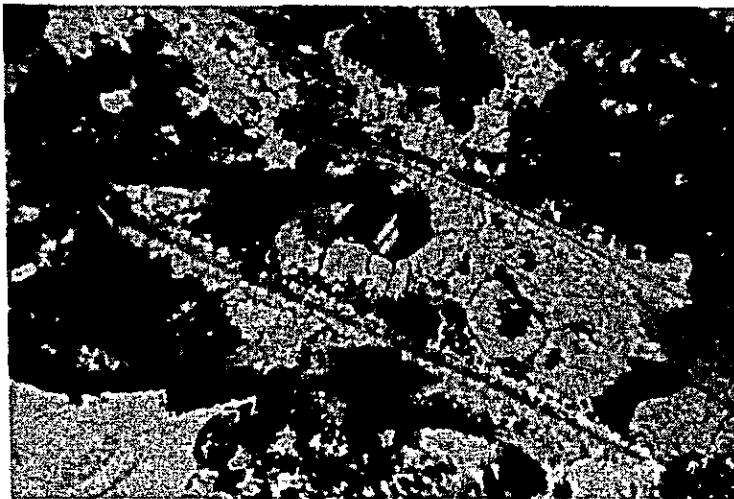
Crossed polars



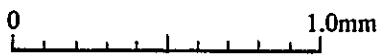
Sample No. : F001
Location : N2481, E782
Formation : Halfa formation (Hm)
Rock name : red chert



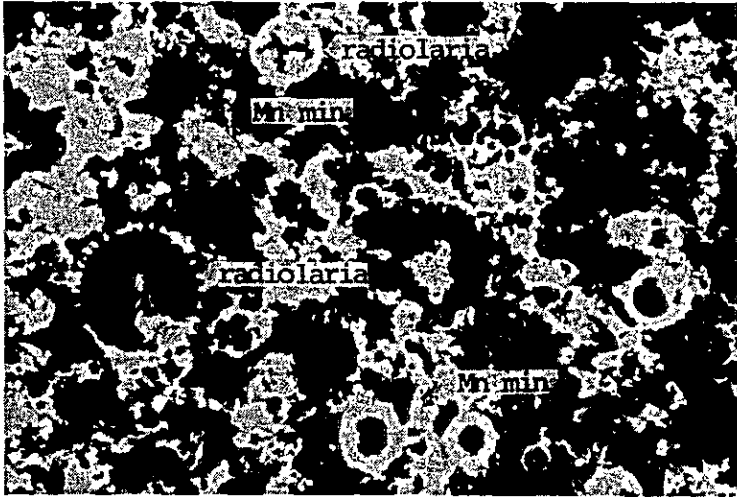
Only lower polar



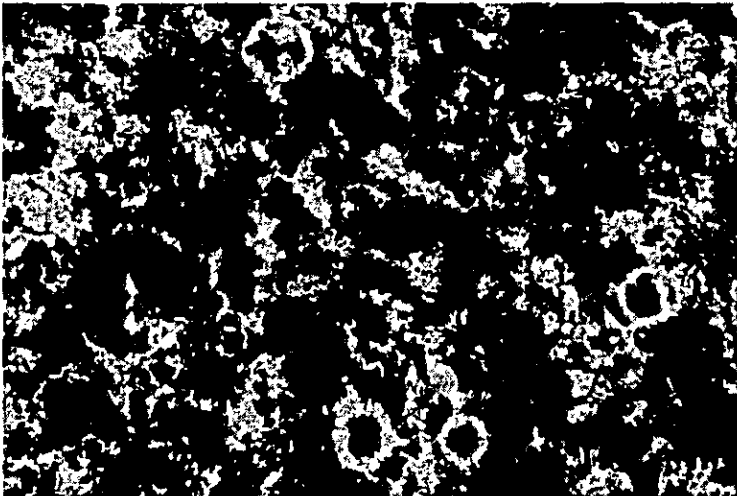
Crossed polars



Sample No. : F023
Location : N2485, E783
Formation : Limestone formation (MTI)
Rock name : sandy limestone



Only lower polar



Crossed polars

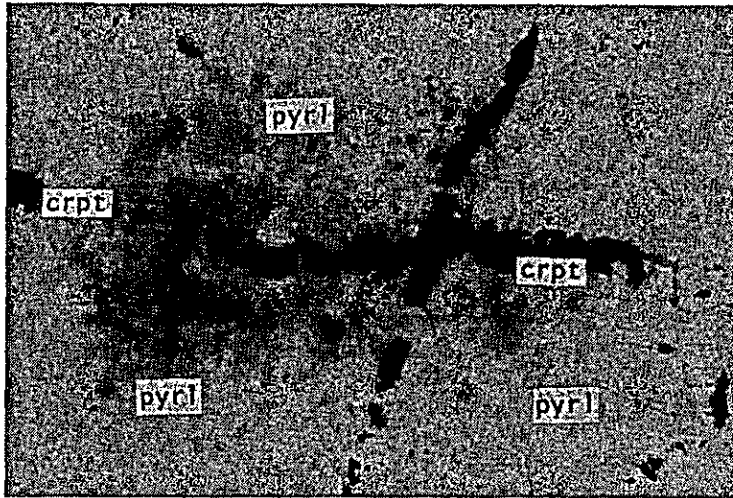
0 0.5mm

Sample No. : F049
Location : N2488, E777
Formation : Half formation (Hm)
Rock name : manganese ore

Fig. A-3 Microphotograph of Polished Section

Abbreviations

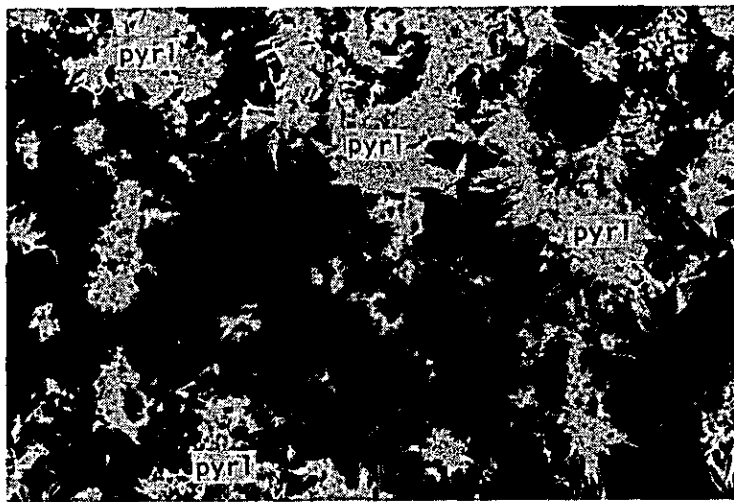
pyrl : pyrolusite
man : manganite
cryp : cryptomelane
Mn ore : manganese ore



Sample No. : A007
Location : N2487, E781
Formation : Halfa formation (Hm)
Rock name : Mn ore

Reflected light
Only lower polar

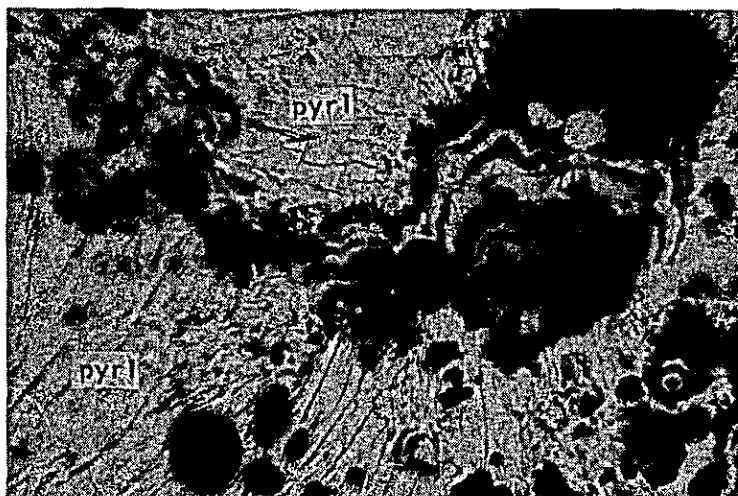
0 0.1 0.2mm



Sample No. : D026
Location : N2484, E780
Formation : Halfa formation (Hm)
Rock name : Mn ore

Reflected light
Only lower polar

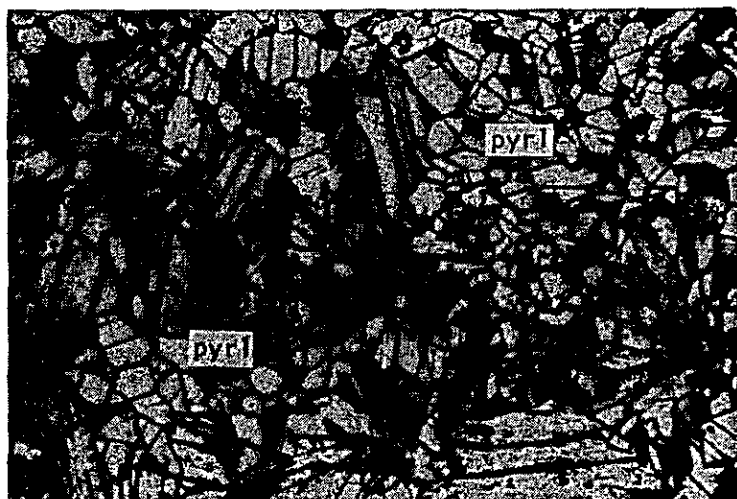
0 0.1 0.2mm



Sample No. : F007
Location : N2480, E781
Formation : Halfa formation (Hm)
Rock name : Mn ore

Refracted light
Only lower polar

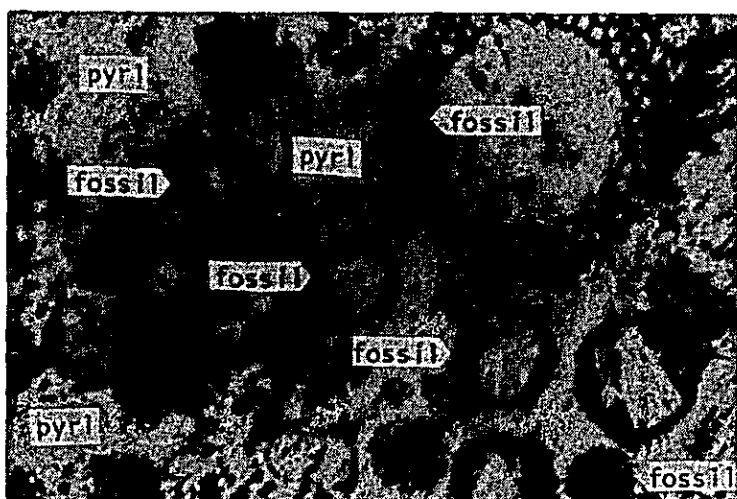
0 0.5mm



Sample No. : E010
Location : N2475, E770
Formation : Halfa formation (Hm)
Rock name : Mn ore

Refracted light
Only lower polar

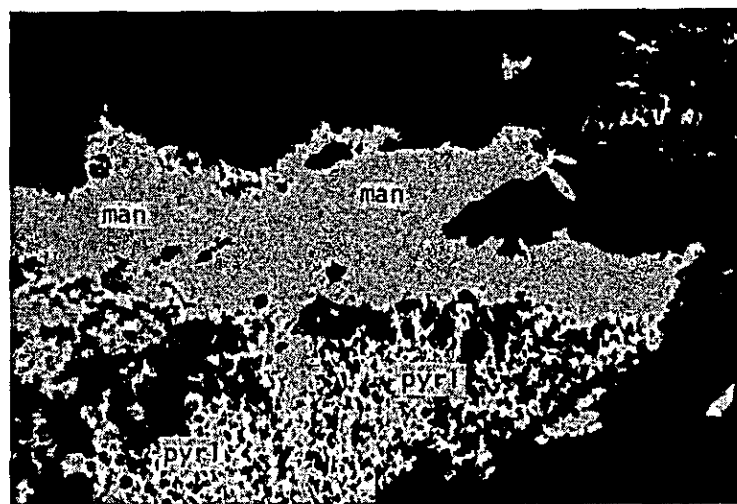
0 0.1 0.2mm



Sample No. : E023
Location : N2485, E770
Formation : Halfa formation (Hm)
Rock name : Mn ore

Reflected light
Only lower polar

0 0.1 0.2mm

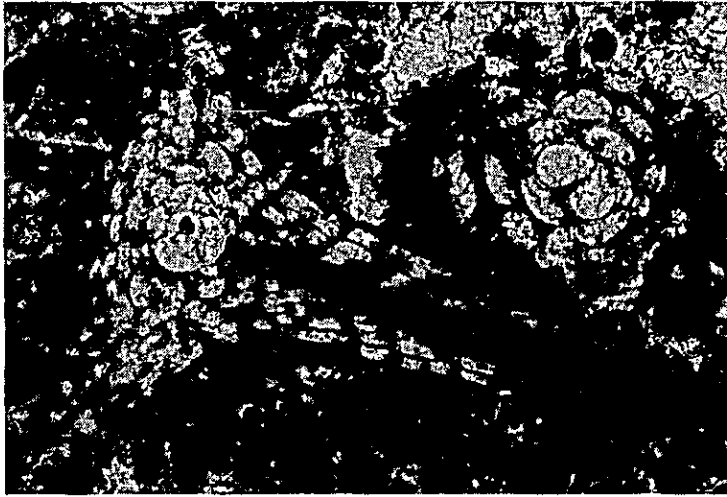


Sample No. : E030
Location : N2490, E770
Formation : Halfa formation (Hm)
Rock name : Mn ore

Reflected light
Only lower polar

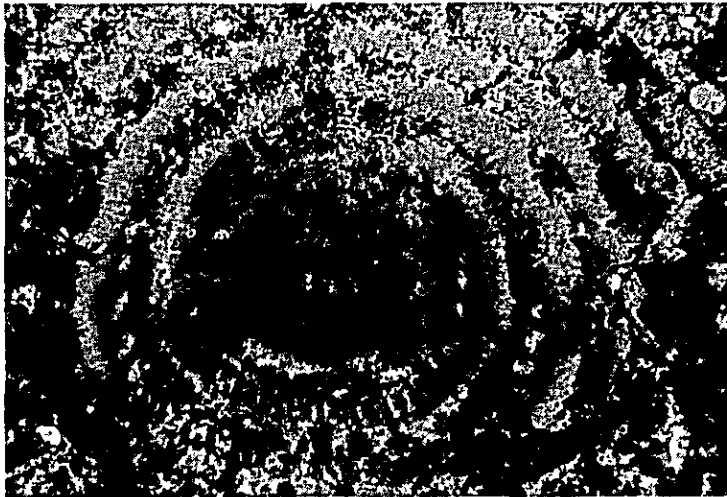
0 0.1 0.2mm

Fig. A-4 Microphotograph of Fossil



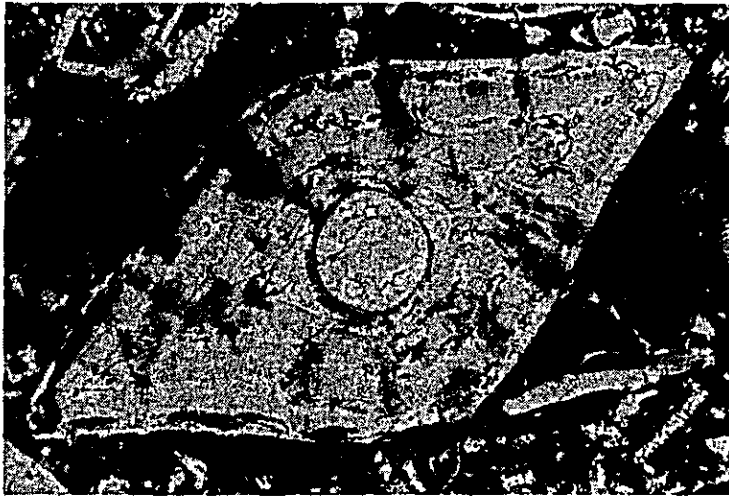
0 1.0 2.0mm

Sample No. : E053
Location : N2480, E755
Formation : Limestone
formation (MTu)
Rock name : limestone
Fossil : Siderolites sp.
Age : Lower Eocene
(Cuislan)



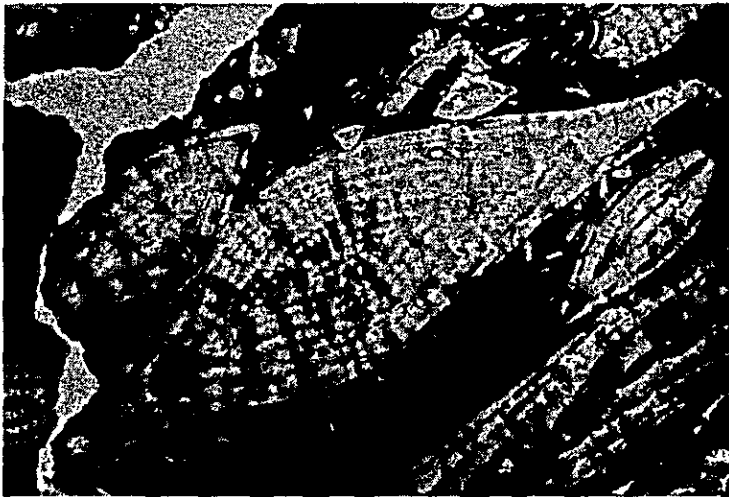
0 1.0 2.0mm

Sample No. : E034
Location : N2495, E770
Formation : Limestone
formation (MTu)
Rock name : limestone
Fossil : Nummulites sp.
Age : Lower Eocene
(Illerdian)



0 1.0 2.0mm

Sample No. : E051
Location : N2480, E760
Formation : Limestone
 formation (MTu)
Rock name : limestone
Fossil : Nummulites
 perforatus Montfort
Age : Lower Eocene
 (Cuisian)



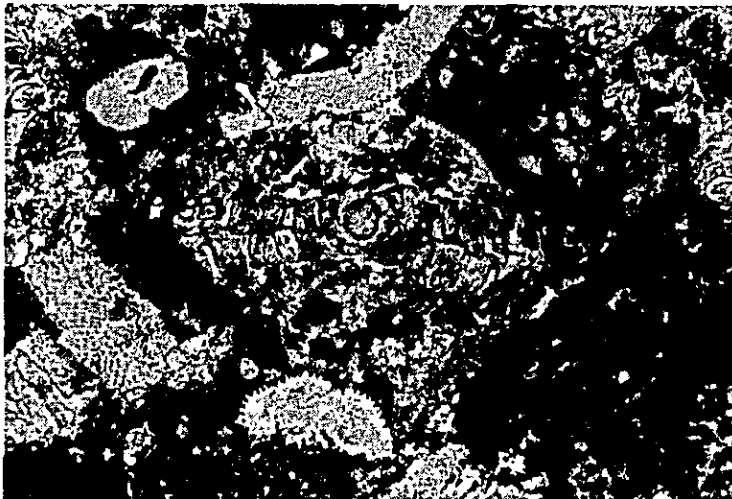
0 1.0 2.0mm

Sample No. : E051
Location : N2480, E760
Formation : Limestone
 formation (MTu)
Rock name : limestone
Fossil : Nummulites
 perforatus Mantfort
Age : Lower Eocene
 (Cuisian)



0 1.0 2.0mm
└───┬───┬───┘

Sample No. : E086
Location : N2460, E750
Formation : Limestone
 : formation (MTI)
Rock name : limestone
Fossil : Areolina corbarica
 : Hottinger
Age : Lower Eocene
 : (Illerdian)



0 1.0 2.0mm
└───┬───┬───┘

Sample No. : E072
Location : N2450, E745
Formation : Limestone
 : formation (MTI)
Rock name : limestone
Fossil : Omphaloazclus
 : macroporus (Lamark)
Age : Cretaceous
 : (Maastrichtian)

PLATE I

Sample No. F001-1, red chert

1. *Pantanellium corriganensis* Pessagno, x 175
2. *P. sp.*, x 175
3. *Acaeoniotyle umbilicata* (Rüst), x 175
4. *Archaeospongoprunum sp.*, x 100
5. *Alievium helenae* Schaaf, x 100
6. *Pseudocrucella (?) sp.*, x 100
7. *Parvingula boesii* (Parona), x 175
8. *P. cosmoconica* Foreman, x 175
9. *P. cf. citae* Pessagno, x 100
10. *P. cf. citae* Pessagno, x 175
11. *Hsuum sp.*, x 100
12. *Xitus (?) sp.*, x 175
13. *Archaeodictyomitra sp.*, x 175
14. *Mita sp.*, x 100

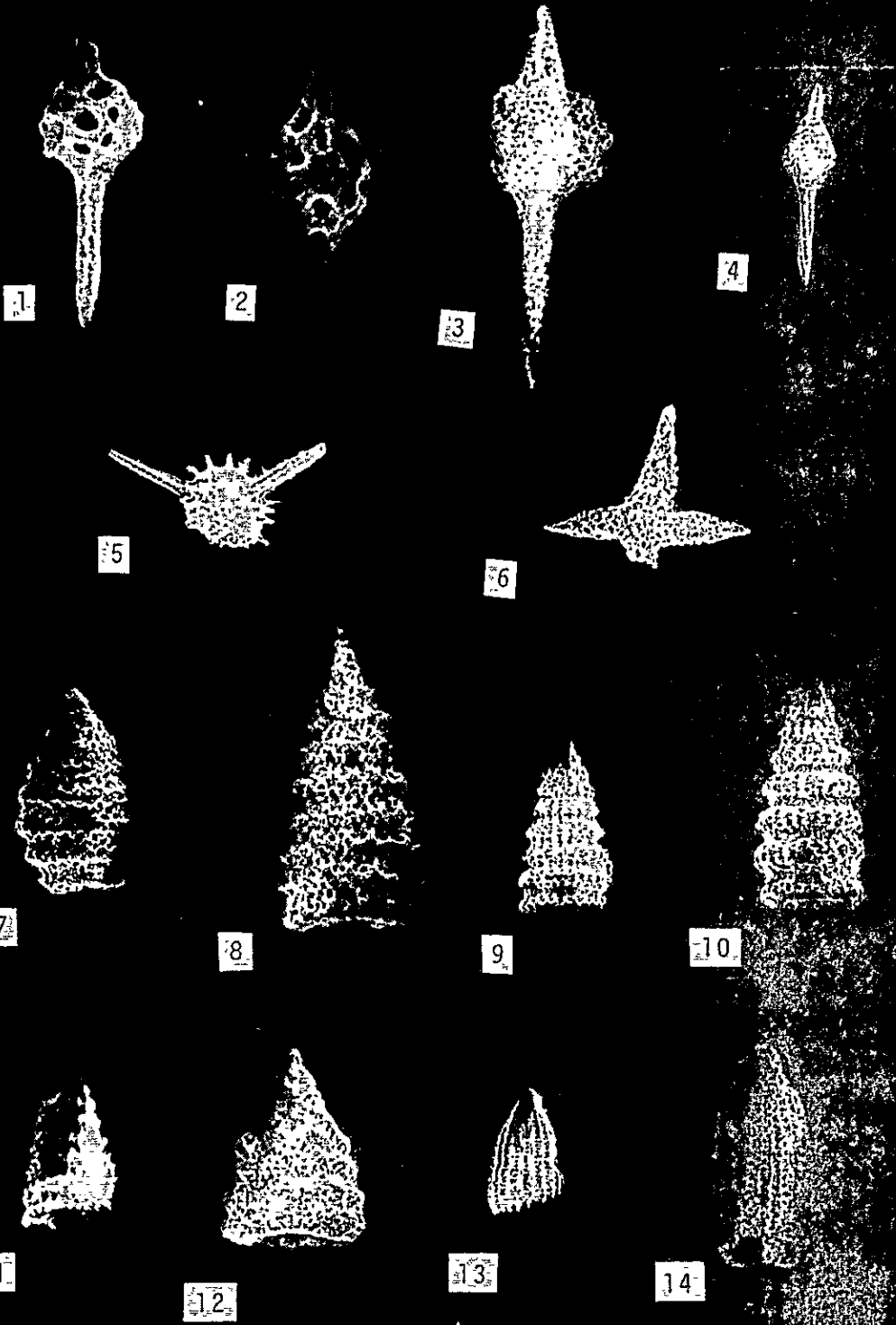


PLATE II

Sample No. F001-1, red chert

1. *Thanrla* aff. *conica* (Aliev), x 175
2. *T.* aff. *conica* (Aliev), x 175
3. *T.* cf. *conica* (Aliev), x 175
4. *Sethocapsa trachyostraca* Foreman, x 175
5. *S. trachyostraca* Foreman, x 175
6. *S. leiostraca* Foreman, x 100
7. *Syringocapsa agolarium* Foreman, x 175
8. *S. agolarium* Foreman, x 175
9. *S. agolarium* Foreman, x 100
10. *S. agolarium* Foreman, x 175

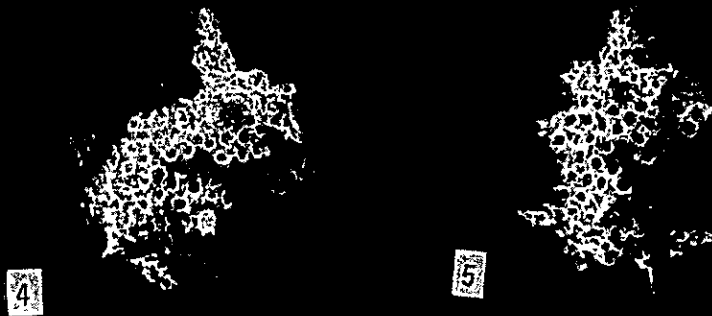


PLATE III

Sample No. C123 muddy red chert

1. *Pantanellium corriganensis* Pessagno, x 175
2. *P. sp.*, x 175
3. *Parvingula cosmoconica* (Foreman), x 100
4. *Mirifusus mediodilatatus* (Rust), x 100
5. *Pseudodictyomitra sp.*, x 175
6. *Mita sp. B* Pessagno, x 175
7. *Thanarla aff. conica* (Aliev), x 250

1

2

3

4

5

6

7