

APPENDICES

Initial letters used for sample numbers trench, and gallery numbers are shown as follows :

T : indicates the trench and pit
G : indicates the gallery
S : indicates the outcrop where sketch is made.

A :	collected or surveyed by	Hajime TAKAHASHI
B :	"	Shigehisa FUJIWARA
C :	"	Kazuyoshi MASUBUCHI
D :	"	Kazuyasu SUGAWARA
M :	"	Mahir İZMİR
X :	"	İbrahim KOC
Y :	"	Nejdet YURDUSEV
Z :	"	Sadık AÇAN

APPENDIX 1

Photographs



Photo No. : 1
Date : 24/8/1978
Map No. and location : Tortum H-45, d4, No. 4., Kurugöl T., Aşkale, Erzurum
Explanation : View of Kopdağ. It is 2,918 m high and composed of limestone of Tertiary (Tkçt).
Remarks : Kopdağ itself is situated out of the survey area.

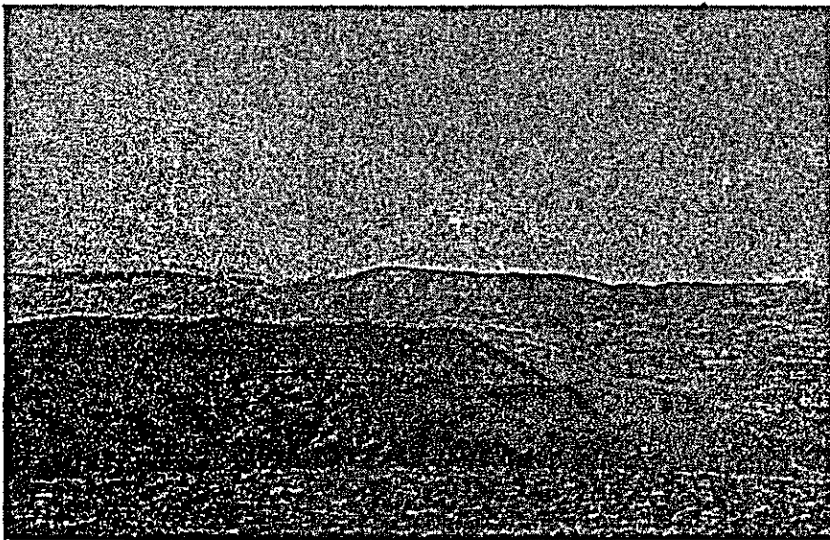


Photo No. : 2
Date : 9/8/1978
Map No. and location : Erzincan, i-44, a2, No. 4, Karakuş T., Doluhacı komu, Tercan, Erzurum
Explanation : View of Hihodağ. It is 1724 m high and composed of old terrace sediments (PQ), showing very gentle trend.

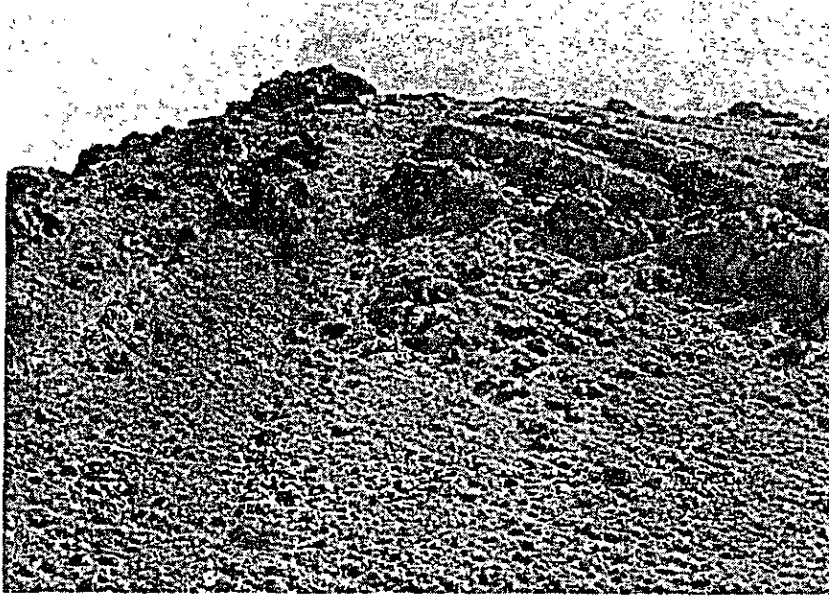


Photo No. : 3
Date : 9/8/1978
Map No. and location : Erzincan i-44, a2, No.4, Doluhacıkumu, Tercan, Erzurum
Explanation : Fault contact of harzburgite (left) with Kopdağ limestone (right). The latter covers the former unconformably.

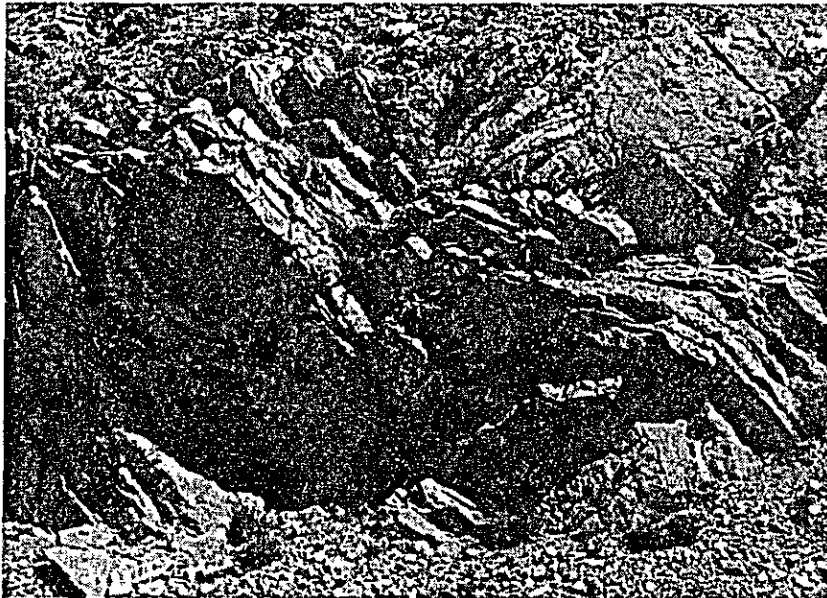


Photo No. : 4
Date : 24/8/1978
Map No. and Location : Tortum H-45, d4, No.4, Akdağ, Gülabikomu, Aşkale, Erzurum
Explanation : Meyramdağ limestone folds near the boundary with ultrabasic intrusive rocks.



Photo No. : 5
Date : 18/7/1978
Map No. and location : Erzincan, i-44, b1, No.1, Ezan, Sıçankale Y., Aşkale,
Erzurum
Explanation : B Kafa (upper) and C Kafa (lower) open cuts at Ezan mine.

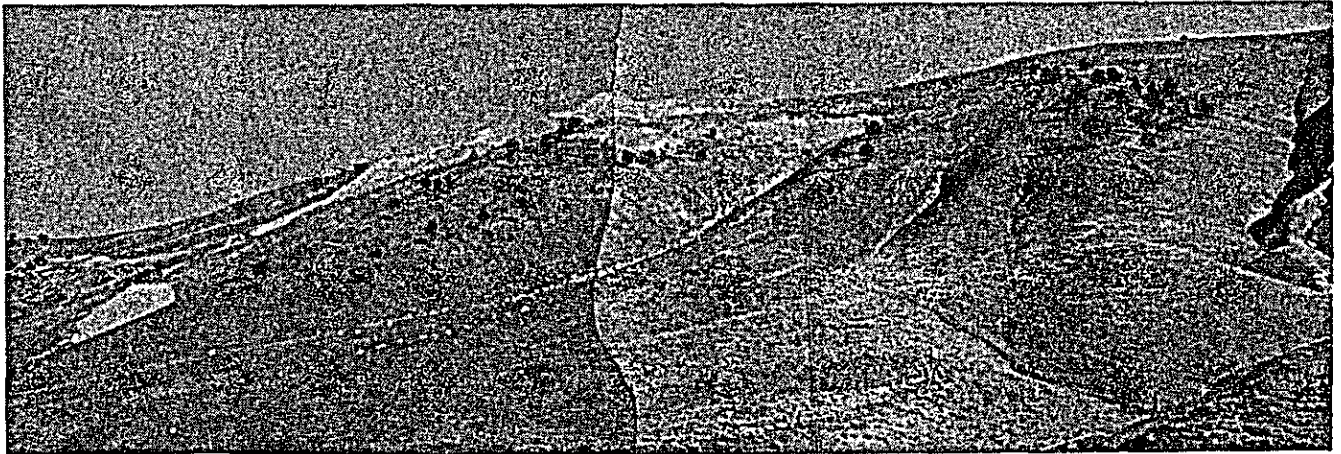
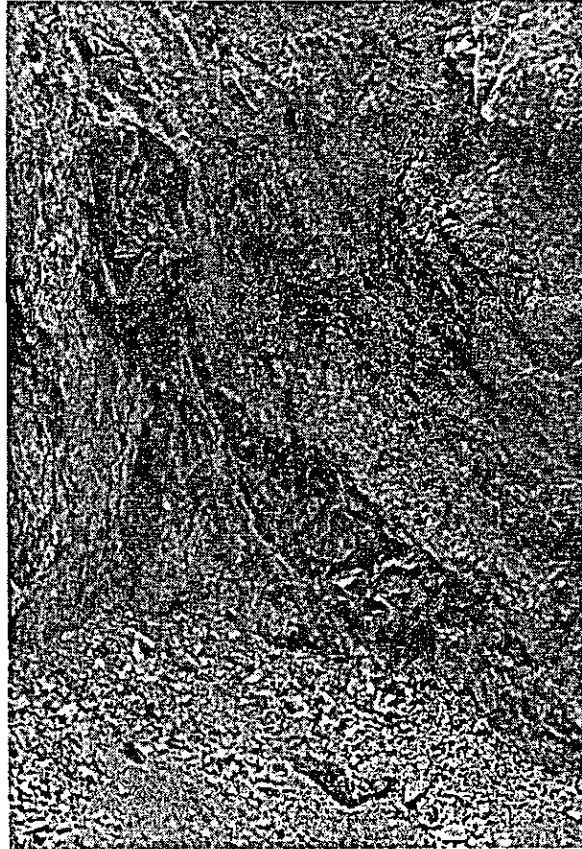


Photo No. : 6
Date : 25/7/1978
Map No. and location : Trabzon, H-44, c3, No.4, Coşan, Kop, Bayburt, Gümü-
şhane
Explanation : Panoramic view of Coşan mine (from the north)
TC-30 open cut (upper) and wastes of GD-1 gallery (lower)
are shown.



Photo No. : 7
Date : 25/7/1978
Map No. and location : Trabzon H-44, c3, No.4, amlı T., Kop, Bayburt, Gümüřhane
Explanation : Chromite banding at eastern extension of Cořan deposit



Phot No. : 8
Date : 19/8/1978

Map No. and location : Trabzon H-44, c3, No.4, Cořan, Kop, Bayburt, Gümüřhane
Explanation : Chromite deposit in TD-32 open cut, Cořan mine.



Photo No. : 9
Date : 14/9/1978
Map No. and location : Erzincan i-44, a2, No.2, Baltadeğmez, Cancikkomu, Aşkale, Erzurum
Explanation : Trenches (TA-6, left, TA-5, right) at Baltadeğmez mine.



Photo No. : 10
Date : 26/9/1978

Map No. and location : Erzincan, i-44, a2, No.4, Mağaradere, Karaalikomu, Çayırılı, Erzincan
Explanation : Chromite deposit which is slightly dislocated by the minor fault, at TA-32 trench, Mağaradere mine.

Photo No. : 11
Date : 20/10/1978



Map No. and location : Erzincan i-44, b1, No.1, Tepebaşı, Ezan, Aşkale, Erzurum
Explanation : Multi-folded chromite banding near TC-3 trench at Tepebaşı mine

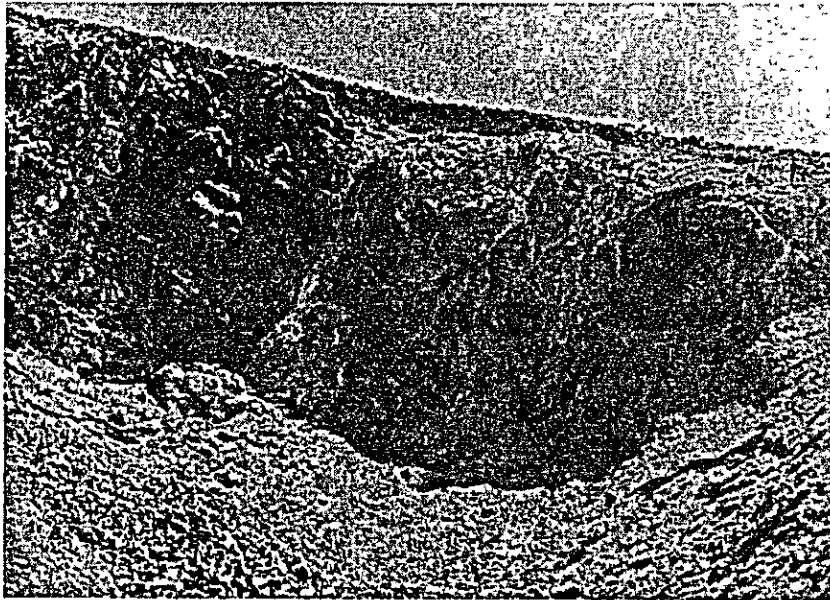


Photo No. : 12
Date : 18/8/1978
Map No. and Location : Erzincan i-44, a2, No.1, Hacıbektaşkomu, Çayırlı, Erzincan
Explanation : Chromite deposit at TA-19 trench, Hacıbektaşkomu mine.



Photo No. : 13
Date : 22/8/1978
Map No. and location : Tortum H-45, d4, No.4, Hasdıgın D. , Dencik, Aşkale,
Erzurum
Explanation : Calcareous sinter in Kopdağ limestone at the contact with
ultrabasic intrusive rocks.

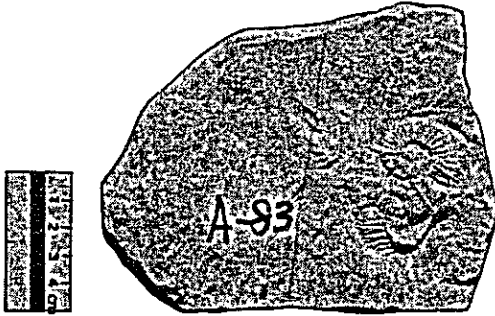


Photo No. : 14
Date : 24/8/1978
Map No. and location : Tortum H-45, d4, No.4, Han, Gülabikomu, Aşkale,
Erzurum
Explanation : Berriasella sp. in Meyramdağ limestone.
Remarks : refer Appendix 2-1.

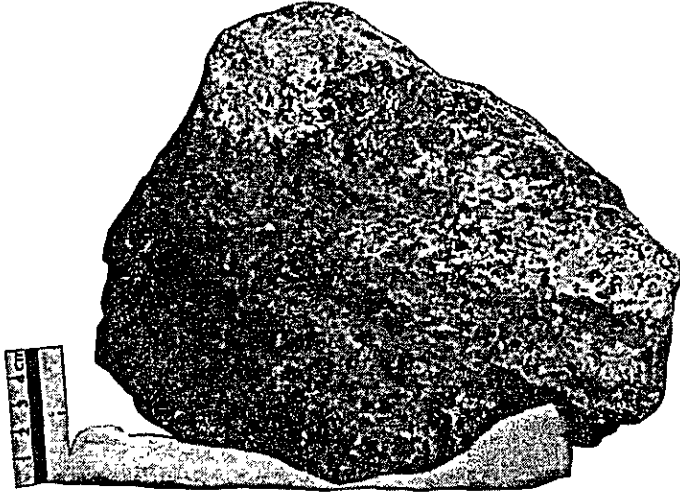


Photo No. : 15
Date : 18/7/1978
Map No. and Location : Erzincan i-44, b1, No. 1, Doğu Ezan, Sıçankale Y.,
Aşkale, Erzurum
Explanation : Kaemmererite from GC-3 gallery at Doğu Ezan mine.
(This gallery is closed on August, 1978.)



Photo No. : 16
Date : 24/8/1978

Map No. and location : Tortum H-45, d4, No.4, Orta Tepe, Dencik, Aşkale,
Erzurum
Explanation : Nonule chromite at ore stock of TA-42 trench, Ortatepe
mine.

APPENDIX 2

Paleontological report

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1. Sample No. : A-83
2. Laboratorial No. : 767
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Tortum H-45, d4, No.4
6. Coordinates : 30.01 N, 32.49 E
7. Date and number of report : 19/1/1979, 1979/19
8. Name of reporter : Orhan BATUR
9. Location : Akdağ, Gülabikomu, Aşkale, Erzurum
10. Lithostratigraphic unit : Meyramdağ limestone
11. Rock name : limestone
12. Occurrence : occurred in white colored, fine limestone which is intruded by ultrabasic rocks.
13. Name of fossils : Berriasella sp.
14. Age : Tithonian - Berriasian
(uppermost Jurassic - lower Cretaceous)

1. Sample No. : B-54
2. Laboratorial No. : 767
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum i-45, a1, No-2
6. Coordinates : 27.33 N, 34.63 E
7. Date and number of report : 27/11/1978, 11/1978
8. Name of reporter : Erden AĞALAR
9. Location : Ulsashatun D., Pirnakapan, Aşkale, Erzurum
10. Lithostratigraphic unit : Kopdağ limestone
11. Rock name : limestone
12. Occurrence : occurred in sandy, loose, biomicritic limestone, which makes small massif covering ultrabasic rocks
13. Name of fossils : Chlamys cf. varia LINNE
14. Age : Miocene ~ Pliocene (lower ~ middle Miocene in case)
15. Remarks : Microfossils (Miliolidae, alg, coral, age unknown) are identified by Biler SÖZERİ.
16. Literature cited : 1897-Chlamys varia LINNE, SAcco. Piemont 118 p.3, pl.1, fig.1-4. 1939-Chlamys varia LINNE, in RCGER p.157, pl. 22, fig. 21-23. 1960-Chlamys varia LINNE in I. Ose preghy-Meznerics. Pectinides du neogenede la Hongrie leur importance biostratigraphique p.22, pl.16, fig. 4-5.

1. Sample No. : D-46
2. Laboratorial No. : 785
3. Project No. : 78/26
4. Area : Kopdag
5. Map No. : Erzurum i-45, a4, No.1
6. Coordinates : 14.20 N, 32.65 E
7. Date and number of report : 29/12/1978, 1978/7
8. Name of reporter : Sefer ORÇEN
9. Location : Çam D. , Niğdere köyü, Aşkale, Erzurum
10. Lithostratigraphic unit : Aşkale sandstone
11. Rock name : sandstone
12. Occurrence : occurred in gray colored sandstone which covers ultrabasic rocks
13. Name of fossils : Nummulites sp.
Polipiye (Mercan), Pryozoa.
14. Age : Eocene

APPENDIX 3

**Microscopic observations
of thin sections**

Microscopic observation of thin section



pg : plagioclase
h : hornblende
il : ilmenite

Parallel nicol $\times 4$

0 0.75 1.5 mm



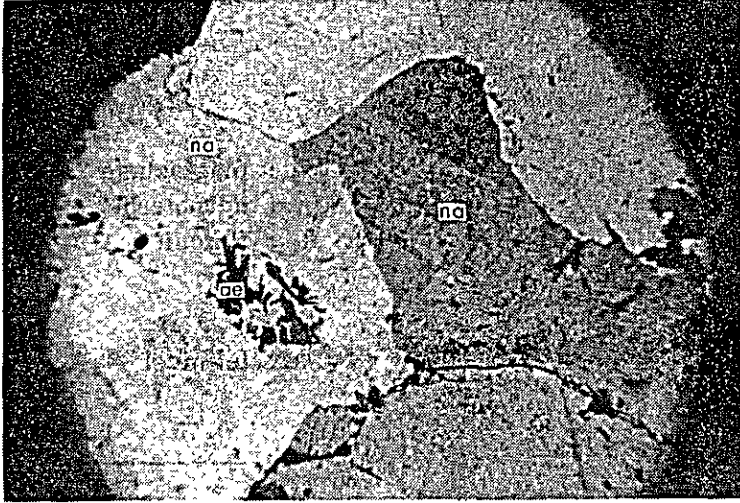
pg : plagioclase
h : hornblende
il : ilmenite

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-17
2. Laboratory No. : AR-10031
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 24.52N, 03.14E
7. Location : Cellonunkoyak Sr. , Kelvezikomu, Çayırh, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : hornblende gabbro
10. Occurrence : dyke
11. Description of specimen : This has dark greenish black color and comparatively fine grain size. Granular - tabular mafic minerals and felspar aggregates are observable. It is named as microgabbro.
12. Microscopy : This has coarse-grained subhedral texture. A large amount of brownish green hornblende shows anhedral form and 0.5 mm size. They include euhedral plagioclase occasionally. Rim of their crystals changes gradually to greenish color. Plagioclase (oligoclase-andesine) is abundant. It has subhedral prismatic form, 1 mm size, much amount of twinning and zoning in part. Some of it is altered to sericite, clinozoisite and saussurite. Ilmenite occurs commonly. It shows irregular shape of 0.3 mm size and distributes in and around hornblende crystals. It is altered partly into leucoxene.

Microscopic observation of thin section



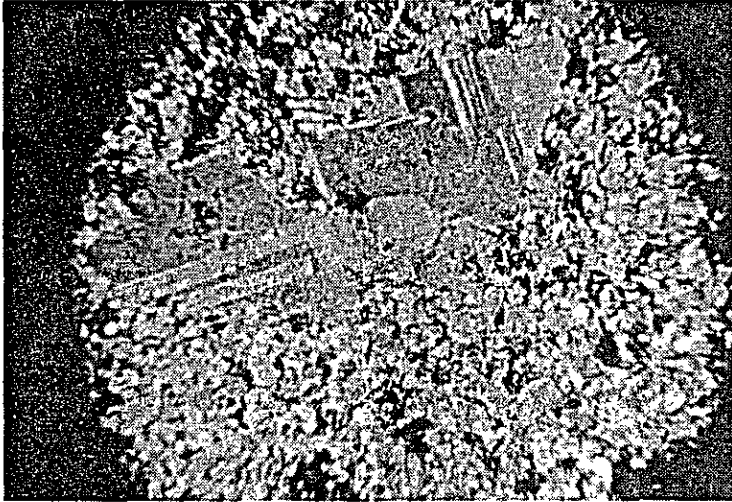
na : natrolite
ae : aegirine

Crossed nicols × 4

0 0.75 1.5 mm

1. Sample No. : A-21
2. Laboratory No. : AR - 10027
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.1
6. Coordinates : 22.35 N, 00.76 E
7. Location : Kanlıkuzeydere, Harabekomyeri, Çayırılı, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : natrolite rock
10. Occurrence : dyke
11. Description of specimen : This specimen has pale greenish white color and coarse, granular grain. Greencolored mafic minerals are dotted commonly.
12. Microscopy : This shows coarse grained, granular texture. Very large amounts of natrolite are present with euhedral shape and more than 4 mm size. Plagioclase is commonly observable. Granular mafic mineral (aegirine augite) occurs commonly at interstices of natrolite.
13. Remarks : refer Appendix 6-2

Microscopic observation of thin section



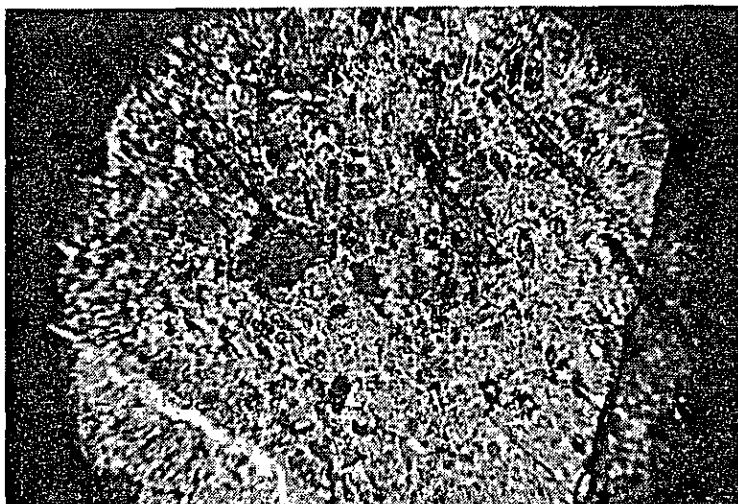
Twinned plagioclase phenocrysts are shown.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-24
2. Laboratory No. : AR - 10082
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.1
6. Coordinates : 22.23N, 98.61E
7. Location : Kayınlidere, Hacibektaşkomu, Çayırılı, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : diorite porphyrite
10. Occurrence : dyke
11. Description of specimen : This specimen has pale green color and slight porphyritic texture. Coarse plagioclase phenocrysts are found in abundance.
12. Microscopy : This shows porphyritic texture of plagioclase phenocryst. Plagioclase phenocrysts are euhedral - subhedral, of 2 mm size and albitized.
No mafic minerals are observable as phenocryst. Groundmass is composed of anhedral plagioclase (albite) of 0.2 mm size.
As accessory minerals, aegirine, apatite and sphene are found.
Aegirine is green colored, fine-grained and of columnar crystals.
Montmorillonite is present as alteration product.

Microscopic observation of thin section



Phenocrysts of hornblende and plagioclase are mostly altered to chlorite, etc.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-44
2. Laboratory No. : AR - 10024
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzican, i-44, a2, No.1
6. Coordinates : 23.58 N, 97.48 E
7. Location : Karataşdere, Mirzaoğlu, Çayırılı, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : altered andesite - dacite
10. Occurrence : dyke
11. Description of specimen : This specimen has pale greenish white color and fine grain. Phenocrystic mafic minerals (hornblende) are found in abundance with long prismatic shape.
12. Microscopy : This shows porphyritic - hypocrystalline texture. Phenocrysts of hornblende and plagioclase occur. Hornblende shows long prismatic shape and mostly altered to chlorite. A large amount of plagioclase has euhedral - subhedral shape with 0.1 - 1 mm size and mostly altered to chlorite, carbonate and saussurite. Apatite and sphene are found as accessory mineral. Groundmass is composed of alkali feldspar, silica mineral (quartz) and glass.

Microscopic observation of thin section

1. Sample No. : A-48
2. Laboratory No. : AR - 10083
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzican, i-44, a2, No.2
6. Coordinates : 21.60 N, 05.48 E
7. Location : Taşocağı Tepe, Cancıkkomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : carbonate rock
10. Occurrence : lenticular
11. Description of specimen : This specimen shows pure white colored, very fine grained, homogeneous, compact nature. Chromite disseminates occasionally.
12. Microscopy : This specimen is judged as magnesite in field observation, but under microscope, it is not determined whether magnesite or dolomite. It has very fine grained and equidimensional granular texture. It is composed of aggregates of very fine (less than 0.05 mm) carbonate mineral. Small amount of opaque minerals (chromite and magnetite) are found in and around carbonate minerals.
13. Remarks : refer Appendix 7-37 (TA-35).
Plate 7-6

Microscopic observation of thin section



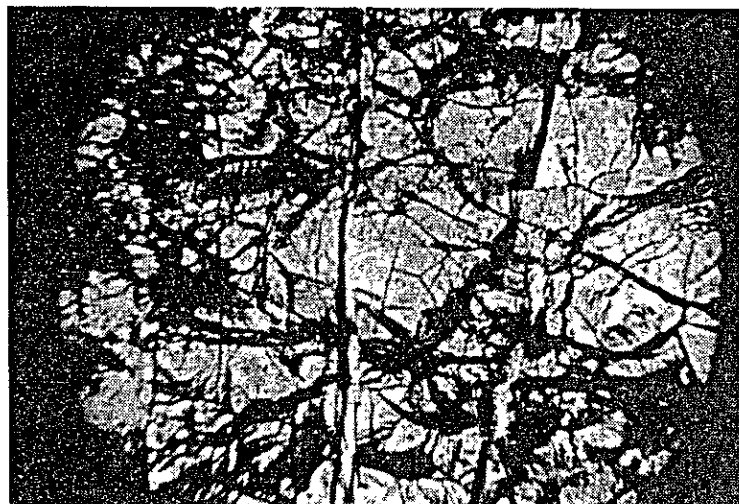
Enstatite (left, dark color) and olivine (light color) has completely changed to serpentine.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-49
2. Laboratory No. : AR - 10084
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 21.63N, 05.36E
7. Location : Taşocağı Tepe, Cancıkkomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : lateritic serpentinite
10. Occurrence : massive, weathered
11. Description of specimen : This specimen shows brownish red colored, ferruginous nature. Original part remains as dark green - yellowish green serpentinite.
12. Microscopy : The original rock is judged to be harzburgite. The specimen is serpentinitized and lateritized due to the weathering. Olivine and enstatite are completely altered to serpentine and carbonate mineral, but their pseudomorph is observable. Magnetite occurs as fine aggregates of isometric, euhedral shape. Goethite is found commonly due to the lateritization.
13. Remarks : This specimen is the host rock of chromite deposit and taken from trench (TA-34) at Cancıkkomu mine.
refer Appendix 6-3, Appendix 7-36
Plate 7-6

Microscopic observation of thin section



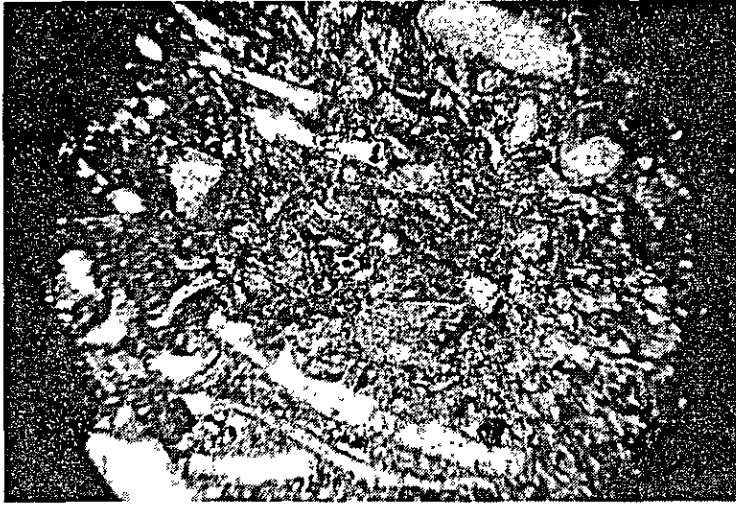
Chalcedony (white part) and veinlet of carbonate with clay minerals are shown

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-52
2. Laboratory No. : AR - 10029
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.3
6. Coordinates : 21.07 N, 05.85 E
7. Location : Değirmendere, Cancıkkomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : lateritic serpentinite
10. Occurrence : dyke-like, weathered
11. Description of specimen : This specimen is reddish brown colored, fine grained, ferruginous and porous. Carbonate mineral disseminates and makes very fine veinlets commonly.
12. Microscopy : Original texture and minerals are wholly disappeared by alterations. A large amount of serpentine is found. Asbestos veinlet and carbonate veinlet (width 0.3 - 0.5 mm) are commonly found. Carbonate veinlet cut chalcedony. Fine aggregates of chalcedony occur in abundance. Acicular goethite is present commonly along the cracks of other minerals. Opaque minerals (chromite and magnetite) show anhedral shape and 0.2 - 0.5 mm size. Alterations in this specimen occur according to the following order; serpentinization followed by lateritization, then silicification and lastly carbonatization.

Microscopic observation of thin section



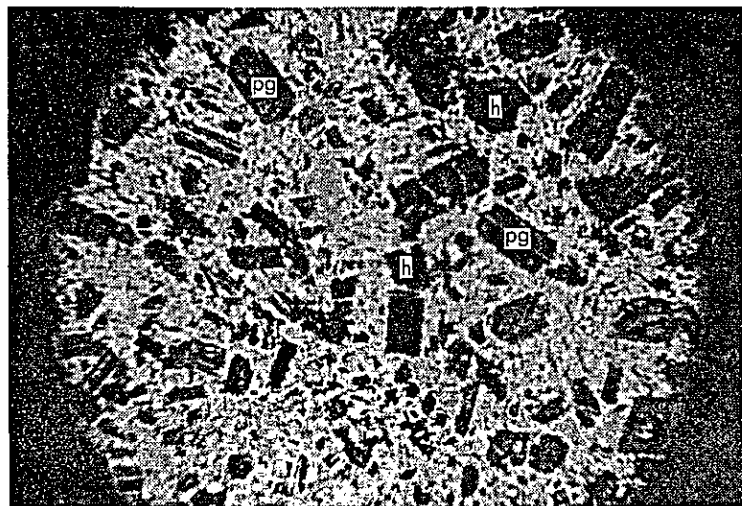
Porous feature is shown.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-54
2. Laboratory No. : AR - 10085
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 22.08 N, 05.34 E
7. Location : Taşocağı Tepe, Cancıkkomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : carbonate rock
10. Occurrence : lenticular
11. Description of specimen : This specimen shows creamy white color, porous, very fine grained, hard nature. Imperfect shell fossil has remained.
12. Microscopy : The specimen is fine, equidimensional, granular, porous in texture.
It is composed of aggregates of very fine grained (< 0.05 mm) carbonate mineral (dolomite and/or magnesite)
In and around the druses, carbonate minerals develop into large size.
Small amount of feldspar fragments (0.1 mm size) are found.

Microscopic observation of thin section



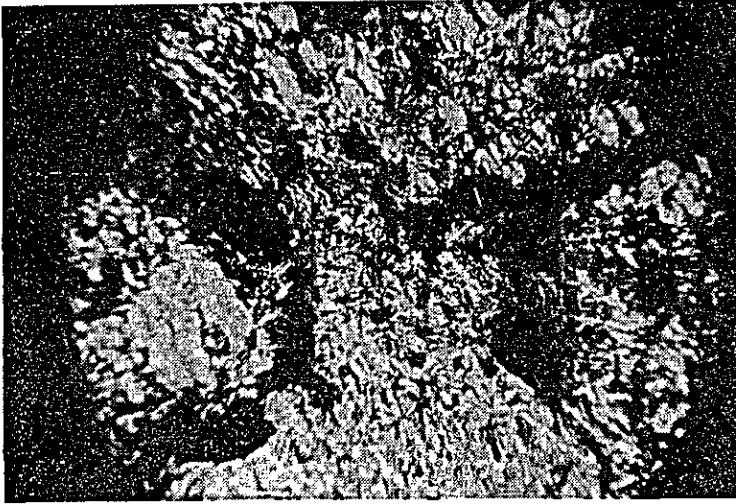
Plagioclase (pg) and
hornblende ? (h) phenocrysts
are shown.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-58
2. Laboratory No. : AR - 10030
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.3
6. Coordinates : 16.13 N, 03.37 E
7. Location : Karayatak Tepe, Kârhanekomu, Tercan, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : diorite porphyrite
10. Occurrence : dyke
11. Description of specimen : This specimen shows white - pale green colored and porphyritic texture. Granular, medium grained plagioclase and acicular hornblende are found in abundance as phenocryst.
12. Microscopy : The specimen has porphyritic texture. Plagioclase phenocrysts are abundant; they have euhedral prismatic shape of 1 - 1.5 mm size and altered to kaoline? mineral. Phenocrystic mafic minerals (hornblende?) occur commonly as euhedral long prismatic crystal of 0.8 mm size. They are completely altered to Fe-chlorite and epidote. A small amount of euhedral quartz is found as microphenocryst. Groundmass is composed of albite, potash feldspar and quartz.

Microscopic observation of thin section



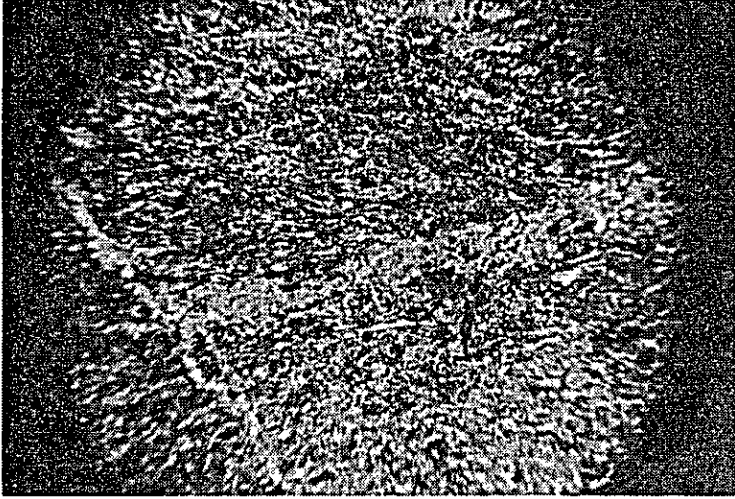
Chromite (dark colored grain) and serpentine (rest) are shown.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-63
2. Laboratory No. : AR - 10032
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.3
6. Coordinates : 17.60 N, 06.33 E
7. Location : Çatdere, Kâğışna, Tercan, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite
10. Occurrence : massive
11. Description of specimen : This specimen is yellowish green colored, and fine grained. Fine grained chromite is found commonly, which is disseminated and banded.
12. Microscopy : Due to the complete serpentization, original rock name is difficult to define. The specimen is composed of serpentine (mostly chrysotile). Chromite aggregates are found abundantly. Magnetite and veinlet of carbonate mineral are accompanied.

Microscopic observation of thin section



A carbonate vein is found in the center.

Dark colored minerals are identified mainly as actinolite.

Parallel nicol \times 4

0 0.75 1.5 mm

1. Sample No. : A-67
2. Laboratory No. : AR - 10023
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 26.39 N, 03.88 E
7. Location : Ömerdere, Aravans, Çayırılı, Erzincan
8. Lithostratigraphic unit : schist
9. Rock name : epidote-actinolite schist
10. Occurrence : xenolith in gabbro
11. Description of specimen : This specimen is dark green colored, fine grained and schistose. Veinlets of carbonate? minerals are commonly found.
12. Microscopy : The specimen shows schistose texture. It is composed of actinolite, epidote-clinzoisite and feldspar accompanied by leucoxene and apatite. Actinolite is bluish green colored, long prismatic of 0.5 mm size and oriented in parallel. Feldspar is albite altered from plagioclase. Leucoxene is altered from ilmenite. Apatite occurs in a small amount. Carbonate veins are present.

Microscopic observation of thin section



pg : plagioclase
q : quartz

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-69
2. Laboratory No. : AR - 10026
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 25.61 N, 04.01 E
7. Location : Güllüdağ, Aravans, Çayırılı, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : quartz diorite
10. Occurrence : dyke
11. Description of specimen : This specimen shows white colored, coarse grained, holocrystalline nature. It is composed of feldspar, quartz and mafic mineral (hornblende). It is called as granitic rock in the field.
12. Microscopy :

The specimen shows coarse-grained, subhedra texture. Very large amount of plagioclase (oligoclase) is present. It is euhedral, prismatic (1.5 - 2 mm size), twinned and weakly zoned. The rim of its crystal is of ablite component and center is altered to kaoline mineral. It is partly replaced by epidote. Anhedral coarse quartz is commonly present filling the interstices of plagioclase crystals. Small amount of potash feldspar makes thin layers around plagioclase crystals and interstices of other minerals. Coarse epidote occurs commonly and its central part is occasionally altered to allanite. Few amount of sphene is present. As potash feldspar is small in amount, the specimen cannot be judged to be granitic.

Microscopic observation of thin section



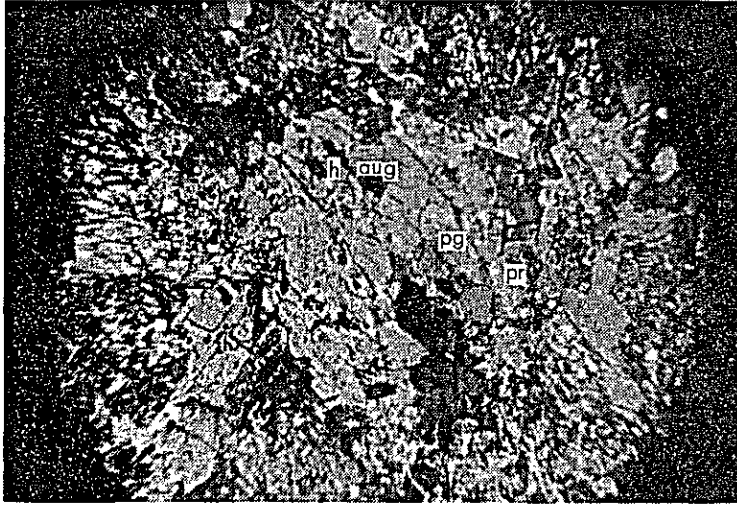
Chromite (black colored)
is shown.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : Acr-79
2. Laboratory No. : AR - 10022
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Tortum, H-45, d4, No.4
6. Coordinates : 32.90 N, 31.91 E
7. Location : Orta Tepe, Dencik, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from chromite-bearing dunite
10. Occurrence : disseminated and banded chromite ore
11. Description of specimen : The specimen is dark greenish gray colored and fine grained. Serpentine is commonly found as dots and veinlets of mesh structure. Fine granular chromite aggregates occur.
12. Microscopy : The specimen shows equidimensional and granular texture.
Olivine has 0.1 mm size and it is mostly serpentinized.
Veinlet of asbestos is found in abundance.
Chromite is of round and anhedral shape with 2 mm size and occurs abundantly.
13. Remarks : The specimen is the host rock of chromite deposit and taken from trench (TA-42) in Orta Tepe area.
refer Appendix 7-44, Appendix 4-6
Plate 7-7

Microscopic observation of thin section



h : hornblende
aug : augite
pg : plagioclase
pr : prehnite

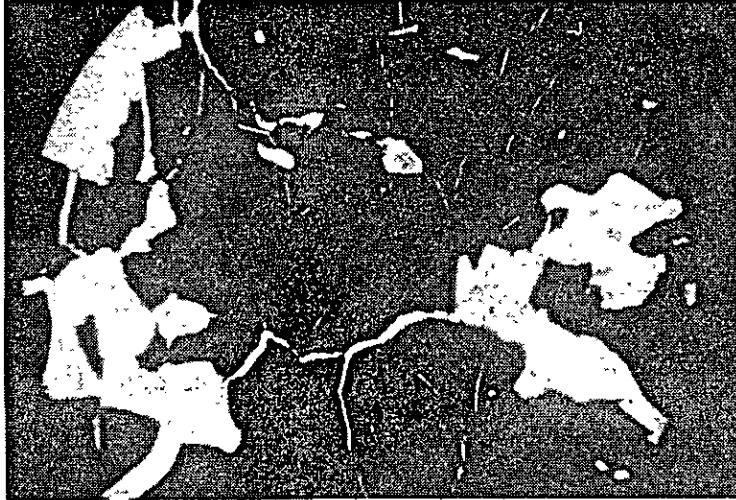
Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-82
2. Laboratory No. : AR - 10086
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Tortum, H-45, d4, No.4
6. Coordinates : 33.92 N, 31.71 E
7. Location : Hasdığindere, Dencik, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : clinopyroxene-bearing hornblende diorite
10. Occurrence : dyke
11. Description of specimen : This specimen is white colored with green dots and medium grained. Granular hornblende and fine aggregative feldspar are observed.
12. Microscopy :

The specimen has coarse grained, subhedral texture. Small amount of augite is found. It is euhedral, short prismatic with 0.8 mm size, situated at the central part of hornblende and replaced by hornblende. Large amount of hornblende shows greenish brown color, anhedral shape, 0.5 - 1.5 mm size and fills the interstices of plagioclase. It includes round pseudomorph of the mafic mineral. Plagioclase (andesine) is euhedral - subhedral, prismatic with 0.5 - 2 mm long and shows oscillatory zoning. Its rim changed to oligoclase. It is partly replaced by prehnite. As alteration products, prehnite replaces plagioclase or occurs as veinlet. A small amount of clinozoisite is present. The specimen is judged to be clinopyroxene-bearing hornblende diorite or hornblende gabbro.

Microscopic observation of thin section

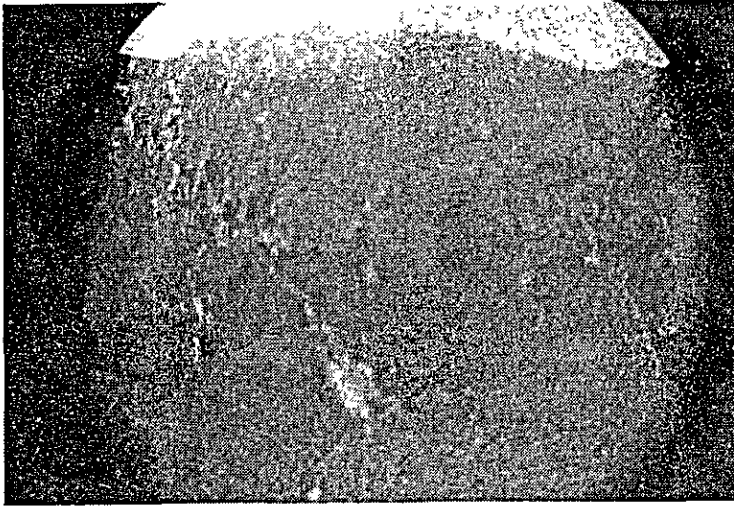


Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : Acr-85
2. Laboratory No. : AR - 10028
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.1
6. Coordinates : 27.88N, 33.50 E
7. Location : Kuru dere, Pırnakapan, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : chromitite
10. Occurrence : lenticular - layered body in dunite
11. Description of specimen : Large amount of coarse chromite aggregates is found and its grade is estimated 40% Cr_2O_3 in specimen. Yellowish green-creamy green colored, coarse grained serpentine aggregates fill intersertally chromite grains.
12. Microscopy : Chromite makes subround, coarse granular aggregates and occurs abundantly. Olivine is common and perfectly serpentinized. Fine aggregates of magnetite are common around olivine crystals. Carbonate mineral is found as veinlet and fine aggregates.
13. Remarks : The specimen is taken from stokpile of ore in trench (TA-47) at Pırnakapan area. refer Appendix 7-49, Appendix 4-7
Plate 7-8

Microscopic observation of thin section

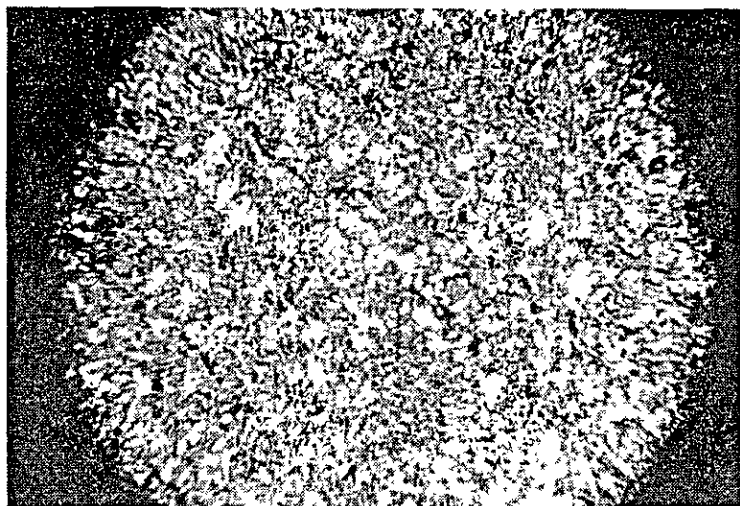


Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-91
2. Laboratory No. : AR - 10021
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.1
6. Coordinates : 27.83 N, 30.20 E
7. Location : Henegesuyu, Hasbeykomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : carbonate rock
10. Occurrence : lenticular body in dunite
11. Description of specimen : This specimen is pure white colored, fine and compact. It is judged as magnesite in the field.
12. Microscopy : The specimen is very fine grained and granular. It is composed of very fine (less than 0.05 mm), granular aggregate of carbonate mineral. Kind of carbonate cannot be determined to be dolomite, magnesite or both of them. It makes coarser part around the other minerals and in veinlet. Chlorite aggregates and feldspar grains are present.
13. Remarks : The specimen is taken from the trench (TA-1) at Hasbey komu area.
refer Appendix 7-1
Plate 7-6

Microscopic observation of thin section

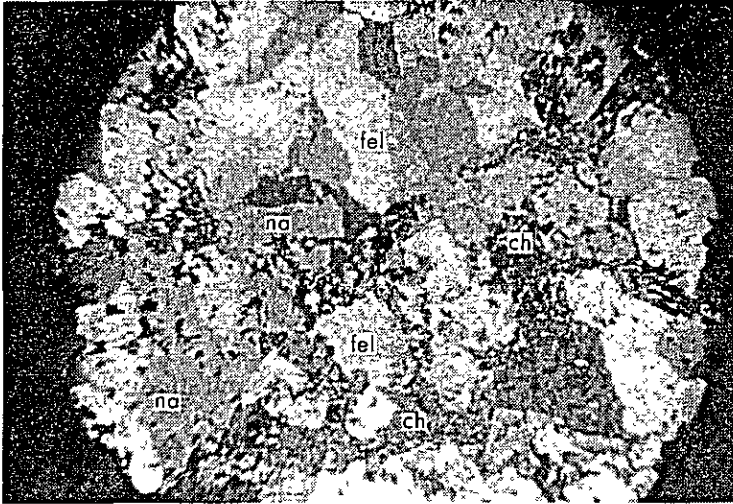


Crossed nicols $\times 4$

0 0.75 1.5mm

1. Sample No. : A-92
2. Laboratory No. : AR - 10025
3. Project No. : 78-26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.1
6. Coordinates : 27.06 N, 30.25 E
7. Location : Henegesuyu, Hasbeykomu, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : natrolite rock
10. Occurrence : dyke
11. Description of specimen : This specimen is creamy brown colored, fine grained. Small amount of fine, fibrous mafic minerals and aggregates of feldspar? is present.
12. Microscopy : The specimen is fine, granular and intersertal? in texture. It is composed of mainly natrolite and feldspar. Natrolite is fine and subhedral. Feldspar (albite) is anhedral and fine grained (0.1 - 0.2 mm size). Fe-chlorite is commonly present accompanied with small amount of carbonate mineral and epidote.
13. Remarks : refer Appendix 6-4

Microscopic observation of thin section



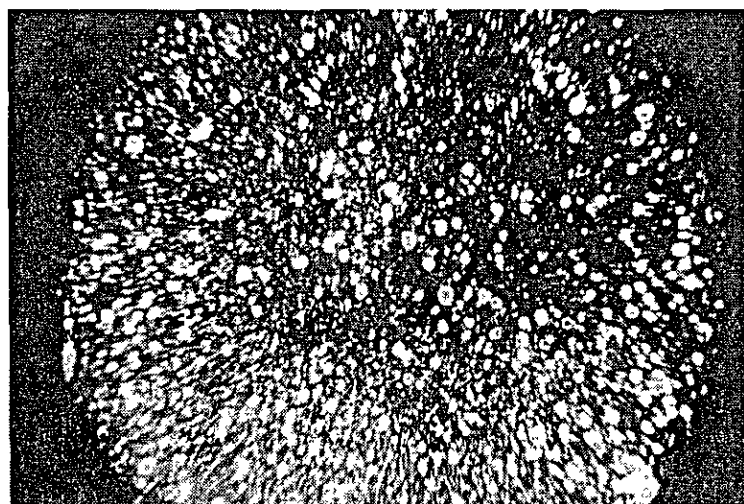
na : natrolite
fel : feldspar
ch : chlorite

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-93
2. Laboratory No. : AR - 10020
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.1
6. Coordinates : 21.28 N, 30.92 E
7. Location : Henegesuyu, Saptıran, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : natrolite rock
10. Occurrence : dyke
11. Description of specimen : This specimen is pale green colored and medium grained. It is composed of feldspar? and fine mafic minerals.
12. Microscopy : The specimen is coarse grained, subhedral in texture. Natrolite is coarse grained (1 mm size), subhedral and found commonly.
Feldspar (plagioclase) is very coarse grained (more than 2 mm), anhedral and found in abundance. Accessory minerals are chlorite, Fe-chlorite and leucoxene.
13. Remarks : refer Appendix 6-4.

Microscopic observation of thin section



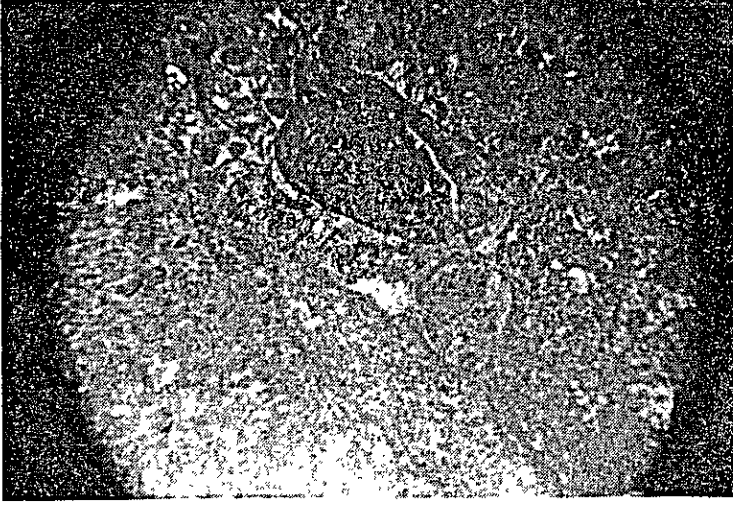
Oolitic texture is shown.
Dark part is hematite and
bright part is silica mineral.

Parallel nicol \times 4

0 0.75 1.5 mm

1. Sample No. : A-103
2. Laboratory No. : AR - 10091
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b2, No.3
6. Coordinates : 15.25 N, 25.95 E
7. Location : Taş Tepe, Ortakomu, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks or Meyramdağ limestone
9. Rock name : hematite-bearing chert
10. Occurrence : dyke-like
11. Description of specimen : This specimen is black colored, very fine grained and ferruginous. It is cherty in an appearance.
12. Microscopy : The specimen is oolitic in texture. Almost all part is occupied by the aggregates of very fine (less than 0.05 mm) hematite or goethite. Interstices of it are filled with very fine silica mineral. Round - subround algal concretion of silica mineral is present commonly. It is composed of very fine (less than 0.05 mm) chalcedony which shows wavy extinction.
13. Remarks : This specimen is estimated to be made secondarily.

Microscopic observation of thin section



Oolitic texture is given.

Parallel nicol $\times 4$

0 0.75 1.5 mm



1. Sample No. : A-106
2. Laboratory No. : AR - 10090
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b2, No.3
6. Coordinates : 17.09 N, 26.11 E
7. Location : Hacımntaş Tepe, Taşlıçayırköyu, Aşkale, Erzurum
8. Lithostratigraphic unit : Meyramdağ limestone
9. Rock name : oolitic limestone
10. Occurrence : bedded
11. Description of specimen : This specimen is grayish white colored, fine and compact. It is a typical specimen of Meyramdağ limestone.
12. Microscopy : The specimen shows oolitic texture. Almost all part is composed of very fine grained calcite. Dusty argillaceous materials are sprinkled in it. Calcite is slightly coarser in part making aggregates or veinlets.

Microscopic observation of thin section



Oolitic goethite with
chalcedony is shown.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-110
2. Laboratory No. : AR - 10088
3. Project No. : 78/26
4. Area : Kopdag
5. Map No. : Erzincan, i-44, a-2, No.4
6. Coordinates : 17.16 N, 98.85 E
7. Location : Hihodağ, Doluhacıkumu, Çayırılı, Erzincan
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : siliceous rock
10. Occurrence : dyke-like
11. Description of specimen : This specimen is brown colored, fine grained, ferruginous, porous, brecciated and silicified. The largest size of breccia is approximately 1 cm.
12. Microscopy :

The specimen shows oolitic texture with lateritic crust. Primary minerals are absent in the specimen, so the original rock name cannot be determined. Large amount of goethite and gibbsite? is found. Chalcedony occurs commonly around oolitic goethite. It is fine grained (0.02 mm) aggregates and shows wavy extension. Quartz veinlets (0.1 - 0.2 mm wide) is commonly present. The specimen will be suffered by leaching due to the weathering. Then, silica mineral will reprecipitate by hydrothermal process.

Microscopic observation of thin section



h : oxyhornblende
ap : apatite
fel : feldspar
clz : clinozoisite

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : A-113
2. Laboratory No. : AR - 10087
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.4
6. Coordinates : 21.29N, 00.63E
7. Location : Karaçoban T., Hacibektaşkomu, Çayırılı, Erzincan
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : alkali gabbro pegmatite
10. Occurrence : dyke
11. Description of specimen : The specimen has dark green (mafic minerals) and white (feldspar) color and porphyritic texture. It is characterized by long prismatic coarse hornblende.
12. Microscopy :

The specimen has pegmatitic texture. Large amount of oxyhornblende-kaerstite is present. It is long tabular (more than 4 mm) and dark greenish brown colored. Aegirine augite is found at the core of and around kaerstite crystals. Feldspar, both plagioclase and potash feldspar? occurs commonly with anhedral - subhedral shape. It is replaced by clinozoisite and grossular. Apatite is commonly observed and long prismatic (0.1 - 0.3 mm long) and euhedral. Small amount of sphene makes dusty round aggregate.