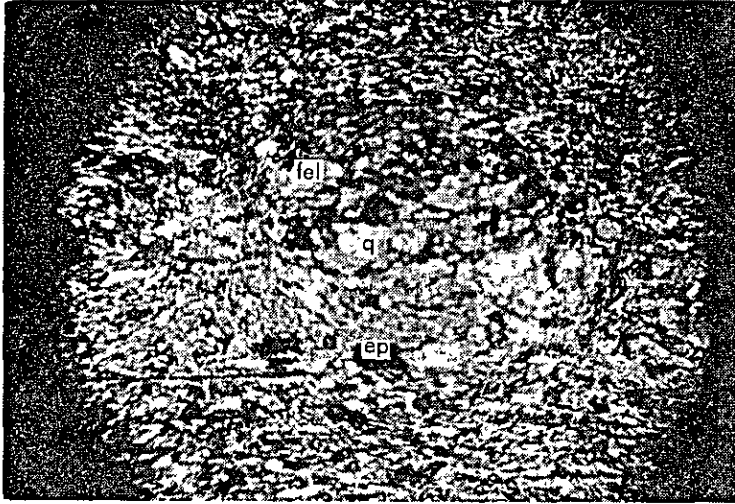


Microscopic observation of thin section

1. Sample No. : A-114
2. Laboratory No. : AR - 10089
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.4
6. Coordinates : 19.73 N, 00.63 E
7. Location : Kemsakel Sr., Erbaş, Çayırılı, Erzincan
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : dolomite
10. Occurrence : lenticular body between harzburgite (foot wall side) and terrace deposit (hanging wall side)
11. Description of specimen : This specimen is pure white colored, fine grained and compact.
12. Microscopy : The specimen is oval-shaped, equidimensional, fine grained. It is composed of very fine (less than 0.02 mm) dolomite aggregates. This dolomite will be the secondary mineral. The specimen includes small amount of clay minerals partly.
13. Remarks : refer Appendix 6-5.

Microscopic observation of thin section



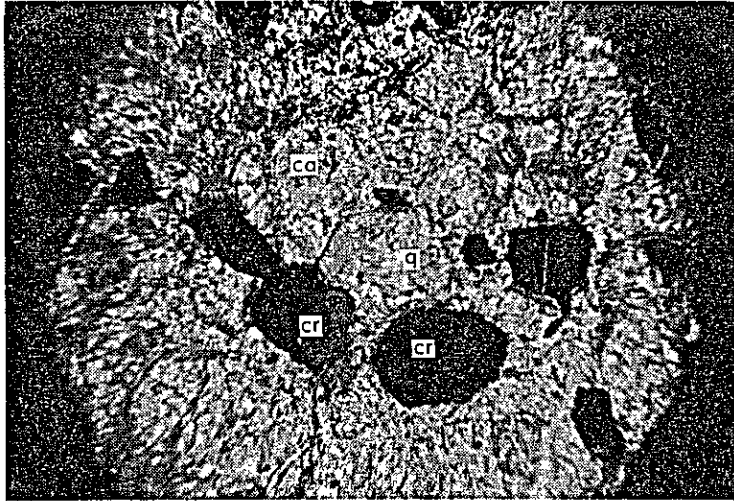
ak : actinolite
q : quartz
fel : feldspar
ep : epidote

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : B-14
2. Laboratory No. : AR - 10103
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 25.35 N, 06.05 E
7. Location : Yayladere, Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : schist
9. Rock name : epidote-actinolite schist
10. Occurrence : float
11. Description of specimen : This specimen is dark yellowish green colored, fine grained and schistose. Epidote and amphibole are observable.
12. Microscopy : The specimen shows schistose texture. It is composed of epidote, actinolite and chlorite accompanied with small amount of albite and leucoxene. Epidote is abundant and shows granular shape of 0.1 - 0.5 mm size. Actinolite is bluish green colored, fibrous-long prismatic (0.3 mm long) and oriented in parallel. Chlorite is commonly found and has yellowish green color, very low refractive index. It occurs as veinlets and fine aggregates. Albite makes fine aggregates at interstices of the other minerals.

Microscopic observation of thin section



cr : chromite
q : quartz
ca : carbonate

Crossed nicols $\times 4$

0 0.75 1.5 mm
└──────────┘

1. Sample No. : B-36
2. Laboratory No. : AR - 10019
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.3
6. Coordinates : 17.99 N, 05.30 E
7. Location : Karataşdere, Kâğışna, Tercan, Erzincan
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is pale brown colored and very fine grained. It is rich in aggregates of serpentine and aggregates or bands of chromite.
12. Microscopy :

Due to the alteration, no primary mineral is present (except chromite).

It is composed of carbonate mineral, quartz and chromite.

Large amount of carbonate mineral (dolomite?) shows fine (0.01 - 0.02 mm) granular and anhedral shape.

Chromite is abundant, and has euhedral - subhedral shape with 0.5 - 1 mm size. Quartz occurs both in the matrix and as veinlet.

The specimen is affected by carbonatization at first and then by silicification.

The original rock is estimated to be dunite because of the abundance of chromite.

Microscopic observation of thin section



Volcanic fragment (v) and fossils (f) are shown.

Crossed nicols $\times 10$

0 0.25 0.5 mm

1. Sample No. : B-42
2. Laboratory No. : AR - 10104
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, a2, No.2
6. Coordinates : 25.40 N, 03.70 E
7. Location : Güllüdağ, Aravans, Çayırılı, Erzincan
8. Lithostratigraphic unit : Kopdağ limestone
9. Rock name : tuffaceous calcareous sandstone
10. Occurrence : bedded, covering gabbro
11. Description of specimen : This specimen is dark gray colored, fine-grained and well-bedded.
12. Microscopy :

The specimen is ill-sorted sandstone.

Grains are composed of;

angular plagioclase monocrystal of 0.1 - 0.3 mm size,

angular quartz of 0.1 - 0.3 mm size

round grains of limestone,

chromite grains which is magnetized partly,

sandstone grains mainly composed of quartz,

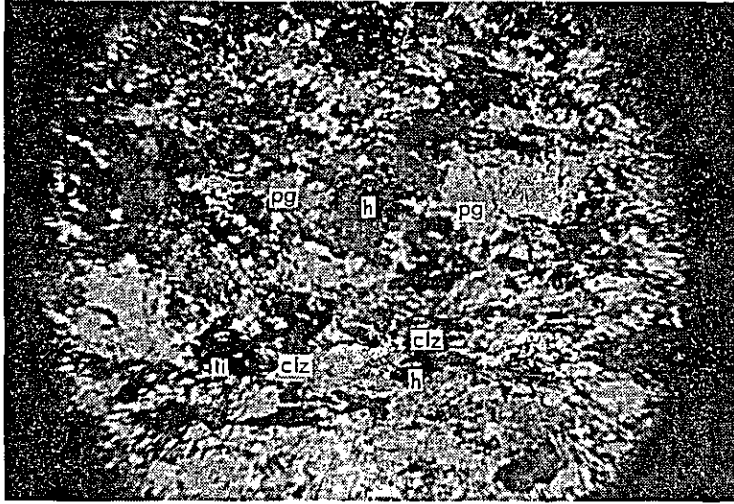
round grains of volcanic rock,

fossil of foraminifera, chlorite and apatite.

Matrix are composed of carbonate mineral (calcite).

Because of the abundance of the carbonate mineral, the specimen is judged to be calcareous sandstone and to belong to a member of Kopdağ limestone.

Microscopic observation of thin section



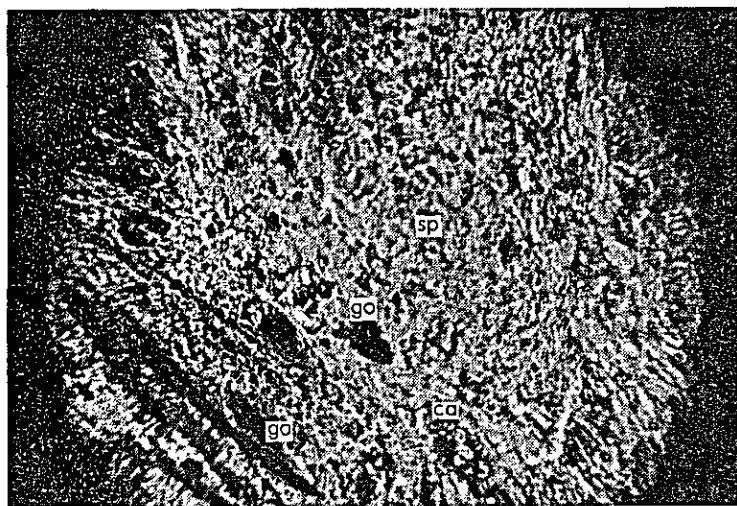
h : hornblende
clz : clinozoisite
pg : plagioclase
ti : sphene

Crossed nicols × 4

0 0.75 1.5 mm

1. Sample No. : B-50
2. Laboratory No. : AR - 10105
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Tortum, H-45, d4, No.4
6. Coordinates : 32.70 N, 29.95 E
7. Location : Kızıleşme Tepe, Dencik, Aşkale, Erzurum
8. Lithostratigraphic unit : schist
9. Rock name : amphibolite
10. Occurrence : xenolith in gabbro, near the contact to Kopdağ limestone
11. Description of specimen : This specimen is dark greenish colored and very coarse grained. It is abundant in mafic minerals.
12. Microscopy : The specimen slightly shows schistosity. It is composed of much amount of hornblende and plagioclase with small amount of sphene and clinozoisite. Brownish green hornblende is long prismatic - tabular (1 mm long) and oriented in parallel. Plagioclase (oligoclase - andesine) occurs commonly having anhedral and granular shape. Both clinozoisite and sphene are fine grained.

Microscopic observation of thin section



go : goethite
ca : carbonate
sp : serpentine

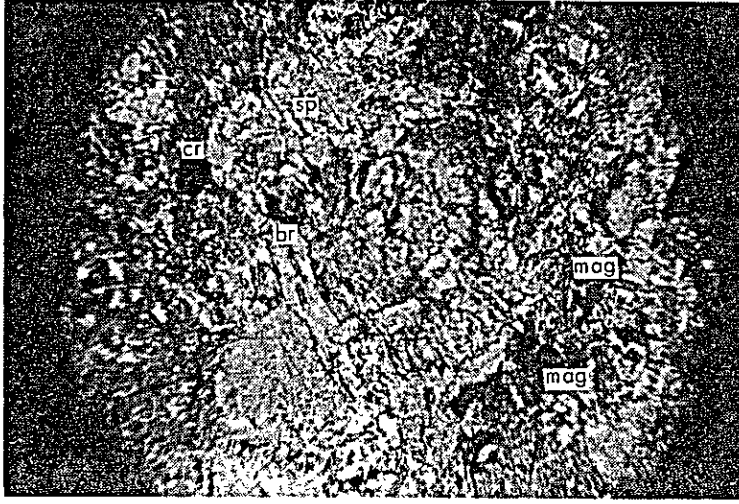
Crossed nicols × 4

0 0.75 1.5 mm

1. Sample No. : B-60
2. Laboratory No. : AR - 10102
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.3
6. Coordinates : 15.15 N, 36.40 E
7. Location : Uzunçayır Sr., Persor Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : carbonatized serpentinite
10. Occurrence : massive
11. Description of specimen : This specimen is dark olive gray colored and coarse grained. Coarse, olive colored olivine is abundantly observed. Serpentine of irregular-fibrous shape is commonly present.
12. Microscopy :

The specimen is fine and granular.
The primary minerals are completely altered to serpentine and carbonate mineral. So the original rock name cannot be determined. It is composed of much amount of goethite and carbonate mineral with serpentine and chromite.
Goethite is dark greenish brown colored and acicular shape.
Serpentine coexists with goethite.
Carbonate mineral (magnesite) is fine grained and makes aggregates.
Chromite is fine grained and granular.
13. Remarks : refer Appendix 6-8

Microscopic observation of thin section



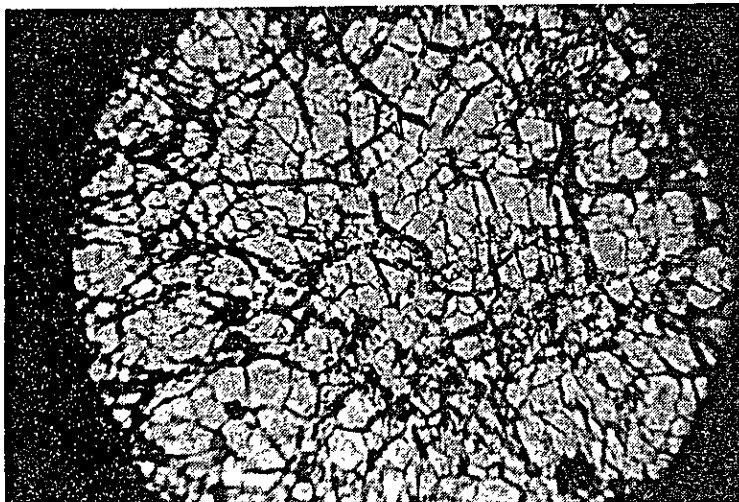
cr : chromite
br : brucite
sp : serpentine
mag : magnesite

Crossed nicols \times 4

0 0.75 1.5 mm

1. Sample No. : C-4
2. Laboratory No. : AR - 10074
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 27.20 N, 07.37 E
7. Location : Büyükgüllünün Sr., Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is dark gray colored. Serpentine develops and makes mesh structure. White carbonate aggregates are abundant. This is the typical host rock of ore in northern chromite zone.
12. Microscopy : The specimen is equidimensional granular. Olivine is completely altered to serpentine and brucite. Very fine grains of carbonate mineral (magnesite) make aggregates and found commonly. Fine grain of magnetite is rich around olivine crystals. Chromite occurs abundantly with subround granular shape and 0.5 mm size. Few amount of talc is present.

Microscopic observation of thin section



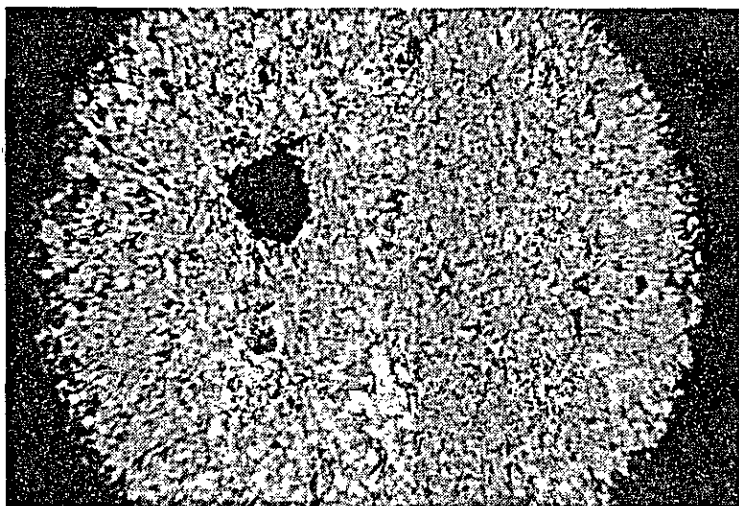
Olivine has completely changed to serpentine. Black dots are chromite crystals. Meshes are filled with carbonate, serpentine and magnetite

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-7
2. Laboratory No. : AR - 10075
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 26.73 N, 08.18 E
7. Location : Keşişsuyudere, Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is yellowish olive colored and very fine grained. Networks of very fine serpentine develop. Dissemination of fine, granular chromite is found commonly.
12. Microscopy : The specimen is fine, equidimensional granular. Olivine is completely altered to serpentine. Carbonate mineral (magnesite) develops as veinlets and filling up cracks in olivine crystals. Magnetite occurs around and in olivine crystals. Chromite has subround, granular shape and 0.3 mm size. It occurs commonly.

Microscopic observation of thin section



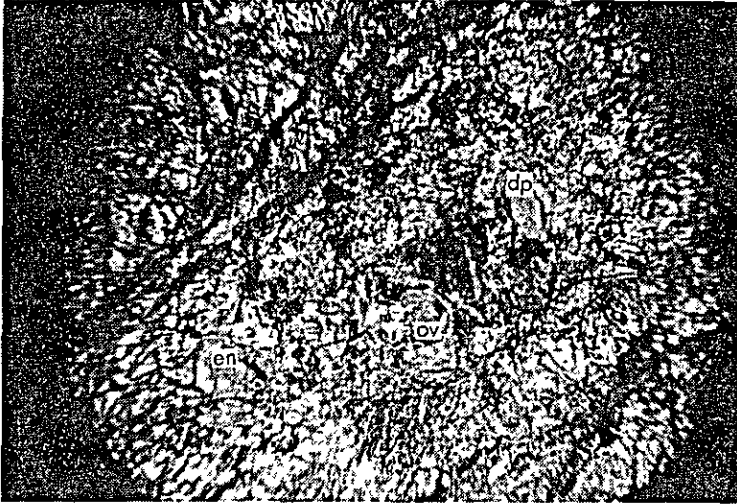
Chromite (black dot) and serpentine are shown.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-11
2. Laboratory No. : AR - 10017
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 27.60 N, 10.26 E
7. Location : Gökyokuşun Sr, Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : brucite bearing serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is dark grey colored and very fine grained. Small amount of chromite disseminates with fine, granular shape. This is host rock of chromite deposit and called as fine dunite in the field.
12. Microscopy : The specimen is equidimensional, fine and granular. Olivine is mostly altered to serpentine and partly to brucite. Ferruginous minerals are commonly observed. Very fine magnetite aggregates occur in abundance. Round grains of chromite are present commonly.

Microscopic observation of thin section



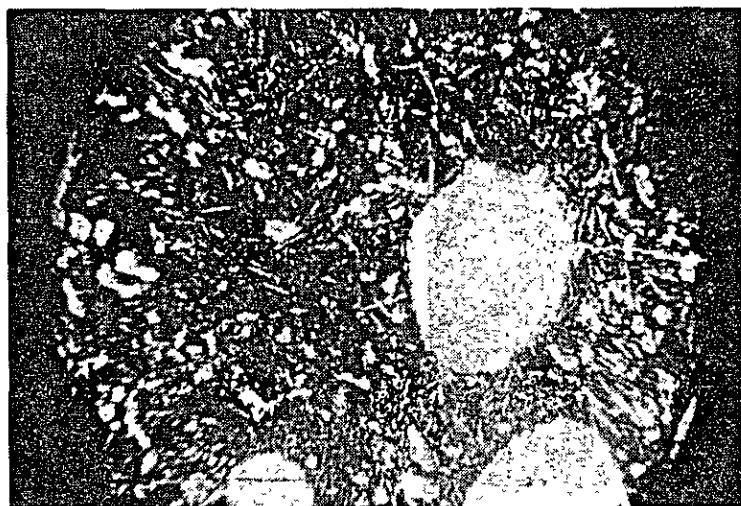
en : enstatite
dp : diopside
ov : olivine

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-15
2. Laboratory No. : AR - 10071
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 28.17N, 11.25 E
7. Location : Gökyokuşun Sr., Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : harzburgite or lherzolite
10. Occurrence : massive
11. Description of specimen : This specimen is dark gray colored and fine grained. Aggregates of serpentine are dotted. This is called as typical harzburgite (fine-grained) in the field.
12. Microscopy : The specimen is equidimensional and granular. Olivine and enstatite are mostly altered to serpentine (antigorite). Pseudomorph of them has still remained. Clinopyroxene (diopside) has anhedral shape and fills the interstices of olivine and enstatite. Small amount of primary chromite and secondary magnetite is found everywhere. As the amount of clinopyroxene is comparatively large, this specimen may be named as lherzolite.

Microscopic observation of thin section



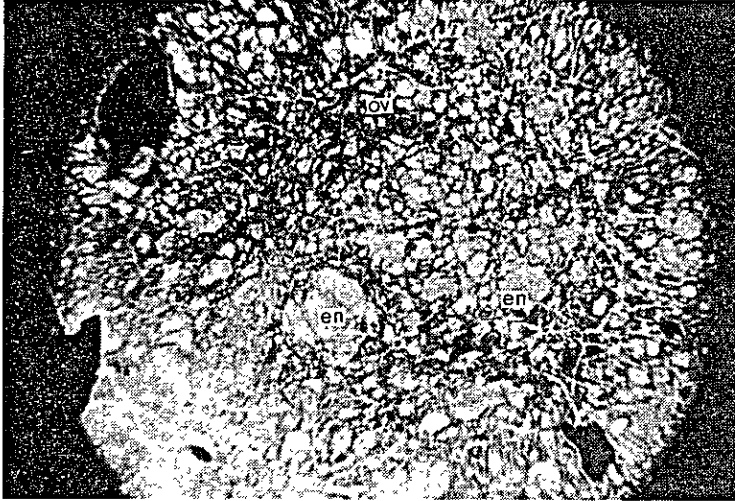
Druses (bright round part)
and plagioclase lath are
shown.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-17
2. Laboratory No. : AR - 10072
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Trabzon, H-44, c4, No.4
6. Coordinates : 29.02 N, 11.60 E
7. Location L : Kanlıçayır Mvk., Coşankomu, Çayırılı, Erzincan
8. Lithostratigraphic unit : volcanic rocks
9. Rock name : altered volcanic rock (basalt?)
10. Occurrence : lava at the boundary between Kopdağ limestone and ultrabasic rocks
11. Description of specimen : This specimen is dark gray colored, vine fine-grained, ferruginous and abundant in fine druses.
12. Microscopy : The specimen has pilotaxitic texture. Phenocrysts are composed of mafic minerals and epidote. Plagioclase is completely carbonatized. Groundmass is composed of fine lath of feldspar, sphene, opaque minerals (magnetite) and much amount of fine secondary epidote. Irregular-shaped druses are abundant and filled up with carbonate minerals.

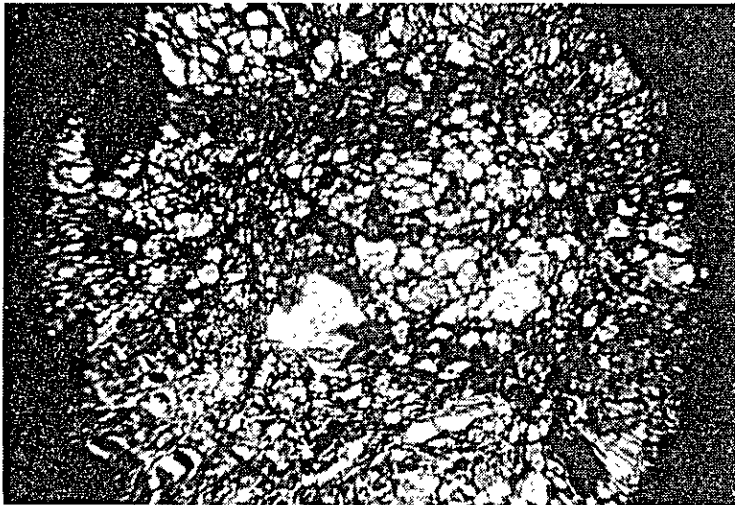
Microscopic observation of thin section



ov : olivine
en : enstatite

Parallel nicol $\times 4$

0 0.75 1.5 mm

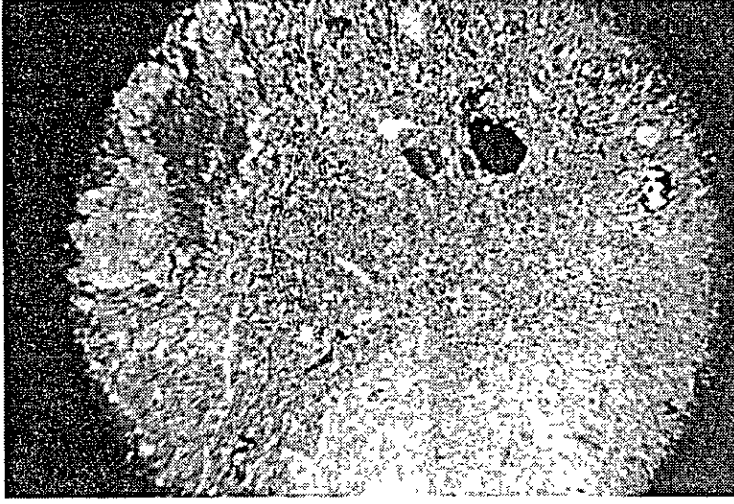


Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-44
2. Laboratory No. : AR-10070
3. Project No. : 78/26
4. Area : Kopdag
5. Map No. : Trabzon, H-44, C3, No.3
6. Coordinates : 33.14N, 22.52E
7. Location : Göksulakyolu Sr., Kop, Bayburt, Gümüşhane
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : harzburgite
10. Occurrence : massive
11. Description of specimen : This specimen is black colored and fine grained. Pyroxene crystals are observed. This is called as wehrlite in the field.
12. Microscopy : The specimen is coarse grained, anhedral and granular. Olivine has anhedral shape, 2 mm size and weak wavy extinction. It is serpentinized along its cracks. Enstatite has 1 mm size and irregular shape filling the interstices of olivine crystals. It includes round olivine crystals occasionally. It is partly altered to bustite. Chromite is irregular and 0.5 mm large. It is magnetized along its rim and crack.

Microscopic observation of thin section



Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : C-46
2. Laboratory No. : AR - 10018
3. Project No. : 78/26
4. Area : Kopdag
5. Map No. : Erzincan, i-44, b2, No.1
6. Coordinates : 23.78 N, 22.10 E
7. Location : Kale Tepe, Altıntaş, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : carbonate rock
10. Occurrence : intercalated in terrace deposit between ultrabasic rocks and Meyramdağ limestone.
11. Description of specimen : This specimen is pale brown colored, having large amount of breccia and fine cementing material. It is coarse, drusy in part. Breccia is white-pale green colored, angular and reaches to 1 cm size.
12. Microscopy : This is granular with several size. It is composed of fine-medium grained granular aggregates of carbonate minerals. (magnesite) Coarse patches of carbonate mineral are estimated to be dolomite. Small amount of epidote and opaque mineral is present. By X-ray diffractive analysis, carbonate minerals are determined as magnesite and dolomite.
13. Remarks : refer Appendix 6-8

Microscopic observation of thin section



Hornblende (dark part) includes plagioclase (light part, commonly twinned).

Crossed nicols $\times 4$

0 0.75 1.5 mm

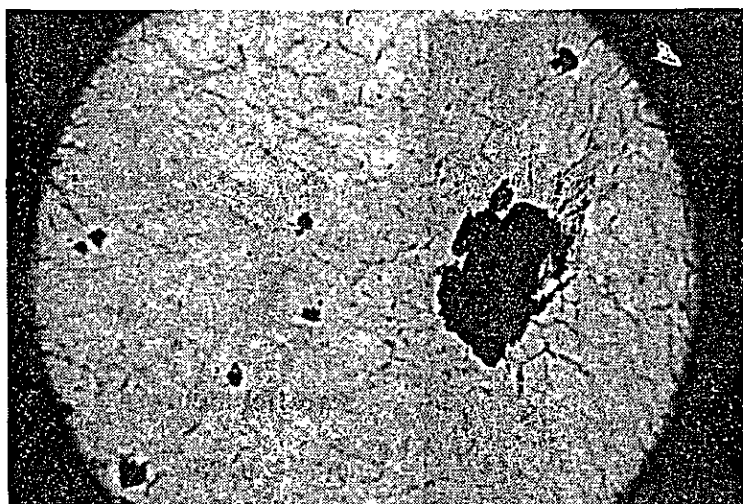
1. Sample No. : C-58
2. Laboratory No. : AR - 10073
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.4
6. Coordinates : 15.91 N, 28.67 E
7. Location : Kavluk Tepe, Taşlıçayır köyü, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : hornblende quartz gabbro
10. Occurrence : stock
11. Description of specimen : This specimen is darkgreen colored and coarse grained. Mafic minerals and feldspar are main constituents. This is called as typical gabbro in the field.
12. Microscopy :

The specimen is coarse grained, subhedral, poikilitic in texture. Small amount of euhedral, short prismatic (0.1 mm size) augite are included in hornblende.

Hornblende is very rich in the specimen. It is greenish brown colored, (bluish green colored at the margin) anhedral, 2-4 mm size. It includes tabular plagioclase (0.5 mm size) poikilitically.

Plagioclase (andesine-labradorite) is found abundantly. It is prismatic, euhedral - subhedral, 0.5 - 1 mm size and remarkably albite-twinned. Small amount of quartz is anhedral and 0.1 mm large. It makes aggregates filling the interstices of plagioclase. Subhedral-anhedral opaque minerals are included in hornblende.

Microscopic observation of thin section



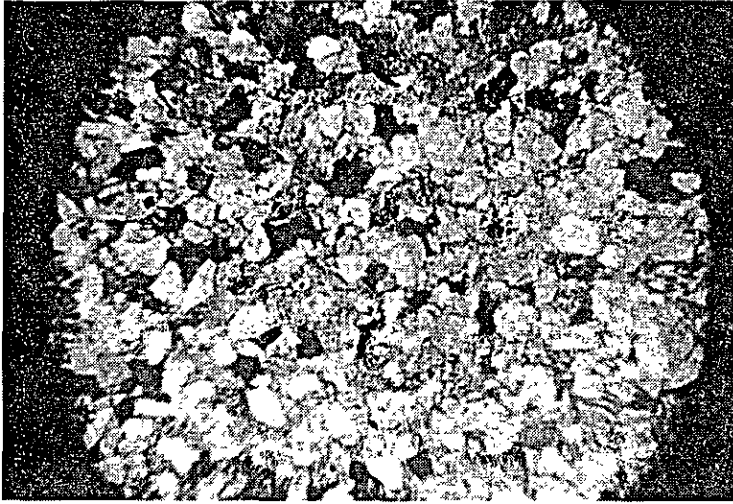
Chromite (black fragment, right), brucite (gray, with chromite) and serpentine are shown.

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : D-9
2. Laboratory No. : AR - 10076
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Trabzon, H-44, c4, No.3
6. Coordinates : 28.78 N, 15.57 E
7. Location : Kayın Tepe, Akdağın Sr., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : brucite-bearing serpentinite from dunite
10. Occurrence : dyke in harzburgite
11. Description of specimen : This specimen is light blue colored and very fine grained. Chromite disseminates commonly, which is surrounded by serpentine. It is anticipated as wehrlite or fine-grained harzburgite in the field.
12. Microscopy : The specimen is equidimensional, granular. Olivine is completely altered to serpentine and brucite. Brucite which is made by the reaction of olivine and chromite is commonly found and it makes large subhedral crystals. Chromite has octahedron or hexahedron shape and 0.5 - 0.8 mm size.

Microscopic observation of thin section

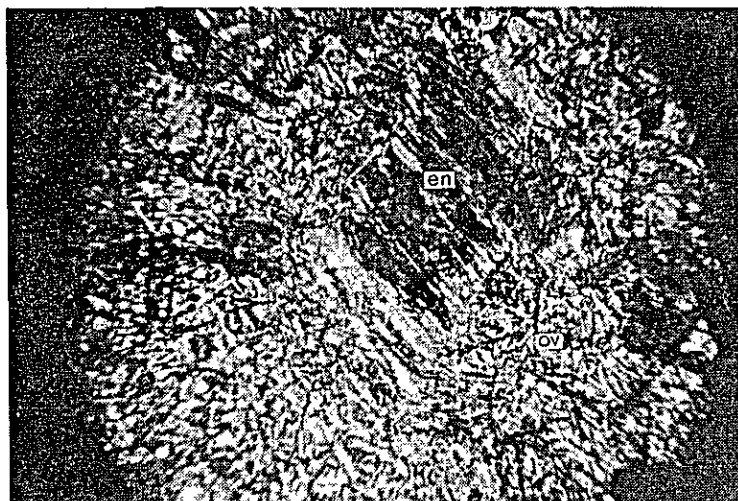


Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : D-17
2. Laboratory No. : AR - 10077
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Trabzon, H-44, c3, No.4
6. Coordinates : 32.70 N, 18.68 E
7. Location : Karapınar Sr., Bayramhoca Tepe, Bayburt, Gümüshane
8. Lithostratigraphic unit : Kopdağ limestone
9. Rock name : carbonaceous sandstone
10. Occurrence : bedded, intercalated in limestone
11. Description of specimen : This specimen is light brown - light gray colored, equigranular and coarse grained sandstone.
12. Microscopy : The specimen is coarse, granular. Grains are composed of large amount of angular quartz and plagioclase crystals and very fine fragments of silica rock (chert). Small amount of chlorite fragments, apatite grains, goethite and opaque minerals is found. Matrix is composed of carbonate mineral.

Microscopic observation of thin section



ov : serpentine from olivine.
en : bustite from enstatite

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : D-36
2. Laboratory No. : AR - 10079
3. Project No. : 78/26
4. Area : Kodağ
5. Map No. : Trabzon, H-44, c3, No.4
6. Coordinates : 29.46 N, 20.40 E
7. Location : Arapçayırı Tepe, Kop, Bayburt, Gümüşhane
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from harzburgite
10. Occurrence : massive
11. Description of specimen : This specimen is creamy yellow colored and fine grained. Pyroxene crystals are observable. Chromite is disseminated irregularly or thin-layered (less than 0.2 mm). This is judged as pyroxenite in the field.
12. Microscopy : The specimen is granular and completely altered. Olivine is common in amount and completely serpentinized. Pseudomorph of enstatite is rich in amount and it has anhedral shape and 0.5 - 4 mm size. It is completely altered to serpentine. Chromite has hexahedron or octahedron shape and 0.5 - 1.5 mm size. It includes partly the pseudomorph of round, small crystals of olivine.

Microscopic observation of thin section



Chromite (black part, left), serpentine-talc vein (dark part, right) and serpentine (rest) are given.

Parallel nicol $\times 4$

0 0.75 1.5 mm

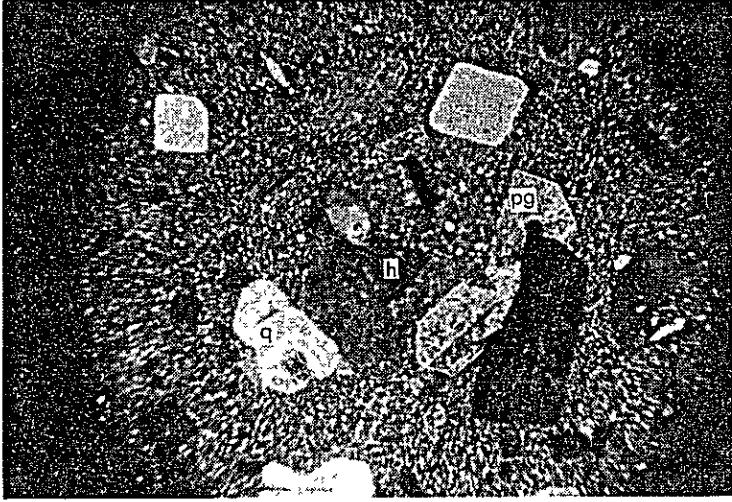


Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : D-38
2. Laboratory No. : AR-10080
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 27.27N, 12.78E
7. Location : Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : brucite-bearing serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is dark gray colored and fine grained. Veinlet of serpentine is found commonly. Fine chromite dissemination is observed. This is called as fine dunite in the field.
12. Microscopy : The specimen is equidimensional granular and completely altered. Olivine is perfectly altered to serpentine (chrysotile and antigorite). Chromite is commonly found having round granular shape. Veins of brucite, serpentine and talc are present. Very fine grains of magnetite surround olivine crystals.
13. Remarks : This specimen is taken from footwall-side of orebody in trench (TD-7) at Sıçankale mine. refer Appendix 7-126, 6-11 Plate 7-2

Microscopic observation of thin section



q : quartz
h : hornblende
pg : plagioclase

Crossed nicols \times 4

0 0.75 1.5 mm

1. Sample No. : D-40
2. Laboratory No. : AR - 10078
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.4
6. Coordinates : 17.20 N, 32.35 E
7. Location : Köy Tepe, Çırmıt köyü, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : quartz porphyry
10. Occurrence : dyke in harzburgite
11. Description of specimen : This specimen is pale gray colored and porphyritic. Phenocrysts are composed of acicular hornblende and plagioclase.
12. Microscopy :

The specimen is porphyritic in texture.

Phenocrysts are composed of large amount of hornblende and plagioclase accompanied by quartz.

Hornblende is greenish brown colored, euhedral, long prismatic (1 mm long) and frequently twinned.

Plagioclase is euhedral, prismatic, (0.5 - 2 mm long) twinned and zoned. It is albitized, kaolinized and epidotized.

Quartz has euhedral shape, 0.5 - 1 mm size and corroded form in part.

Microphenocrysts of euhedral apatite are present.

Groundmass is composed of aggregates of very fine grained anhedral quartz, plagioclase and potash feldspar?

Microscopic observation of thin section



left half : hornblende
right half : plagioclase

Crossed nicols $\times 4$

0 0.75 1.5 mm

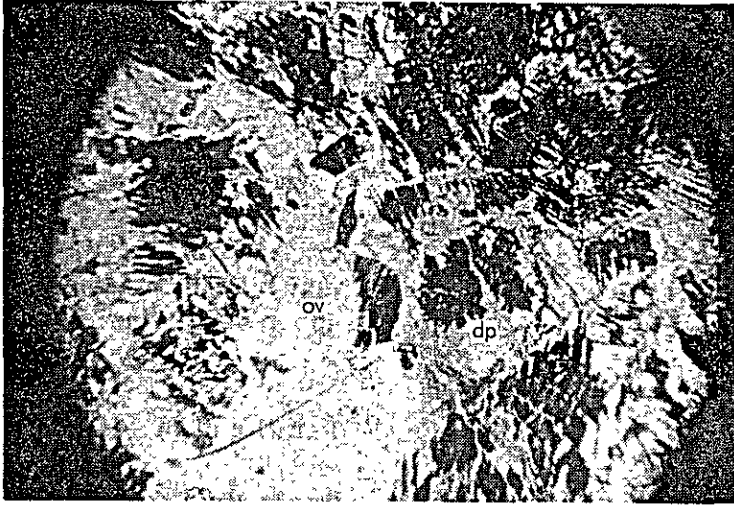
1. Sample No. : D-45
2. Laboratory No. : AR - 10081
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a4, No.1
6. Coordinates : 14.85 N, 31.17 E
7. Location : Çırmıt Tepe, Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : pyroxene hornblende quartz gabbro
10. Occurrence : stock
11. Description of specimen : This specimen is dark green colored and composed of granular pyroxene, tabular hornblende and irregular shaped feldspar.
12. Microscopy :

The specimen is coarse grained and subhedral in texture. Pyroxene (augite) has short prismatic, corroded shape and occurs at the core of hornblende.

Hornblende has brownish color and anhedral shape. It includes small prismatic crystals of plagioclase poikilitically. It alters to chlorite. Plagioclase has euhedral-subhedral prismatic shape. It is remarkably twinned.

Quartz is present filling up the plagioclase crystals. Veins of chlorite and carbonate mineral are found.

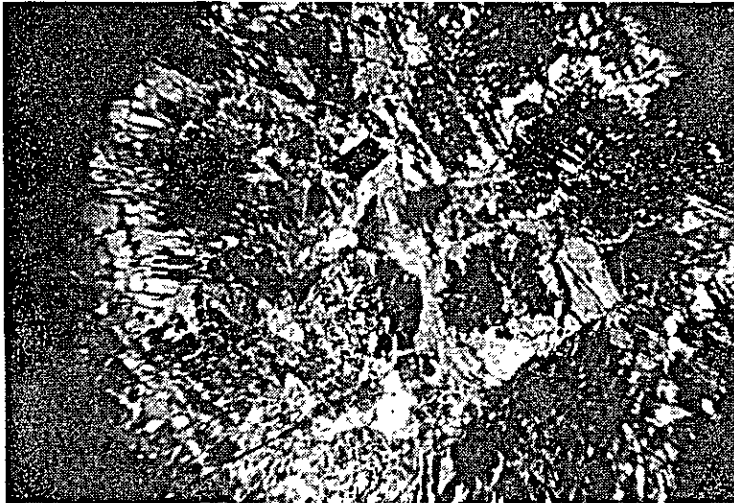
Microscopic observation of thin section



ov : serpentine from olivine
dp : diopside
(black part is contaminated
by Fe-mineral)

Parallel nicol × 4

0 0.75 1.5 mm

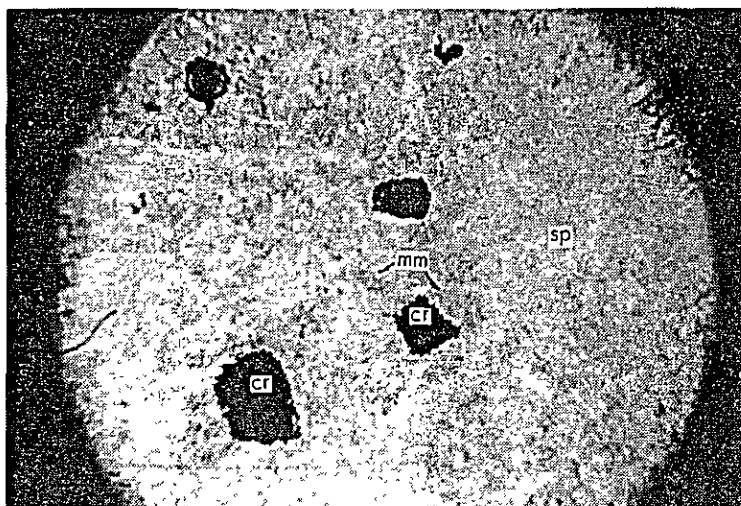


Crossed nicols × 4

0 0.75 1.5 mm

1. Sample No. : D-57
2. Laboratory No. : AR-10106
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Trabzon, H-44, c3, No.4
6. Coordinates : 29.90N, 18.64E
7. Location : Coşan ocak, İskanlığindere, Kop, Bayburt, Gümüşhane
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : wehrlite
10. Occurrence : dyke in dunite
11. Description of specimen : This specimen is black colored.
Serpentine is found commonly.
12. Microscopy : The specimen is coarse grained.
It is composed of clinopyroxene followed by olivine.
Olivine is mostly altered to serpentine.
Brucite fills the pseudomorph of olivine crystals.
Clinopyroxene (diopside) is coarse grained, short prismatic and contaminated
by Fe-mineral. It is partly replaced by serpentine.
Carbonate vein is found.

Microscopic observation of thin section



cr : chromite
mm : Fe-montmorillonite
sp : serpentine

Parallel nicol $\times 4$

0 0.75 1.5 mm

1. Sample No. : D-58
2. Laboratory No. : AR - 10107
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 28.12 N, 16.82 E
7. Location : Batı Coşan, Bendindere, Sıçankale Y.,
Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is black colored (partly brownish due to the weathering). Fine grained granular chromite disseminates occasionally.
12. Microscopy : The specimen is granular and coarse grained. Olivine is completely altered to serpentine and brucite. Chromite is commonly found with round shape and 1 mm size. Very fine magnetite occurs around olivine crystals. Small amount of saponite and Fe-montmorillonite? is present.
13. Remarks : refer Appendix 6-11

Microscopic observation of thin section



ov : olivine pseudomorph.
dp : diopside
cr : chromite

Crossed nicols × 4

0 0.75 1.5 mm
└──────────┘

1. Sample No. : X-8
2. Laboratory No. : AR - 10097
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 26.80 N, 15.75 E
7. Location : Sivrilerin Sr., Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : olivine clinopyroxenite
10. Occurrence : dyke
11. Description of specimen : This specimen is greenish grey colored and coarse grained.
12. Microscopy : The specimen is equidimensional, coarse granular. Small amount of olivine pseudomorph (0.3 mm) remains. However, olivine is mostly replaced by serpentine. Large amount of clinopyroxene (diopside) is found. It has tabular anhedral shape and 0.5 - 2.0 mm size. It is replaced by clay minerals along the cleavage. Chromite is commonly present. Pale green colored uvarovite is observed.

Microscopic observation of thin section



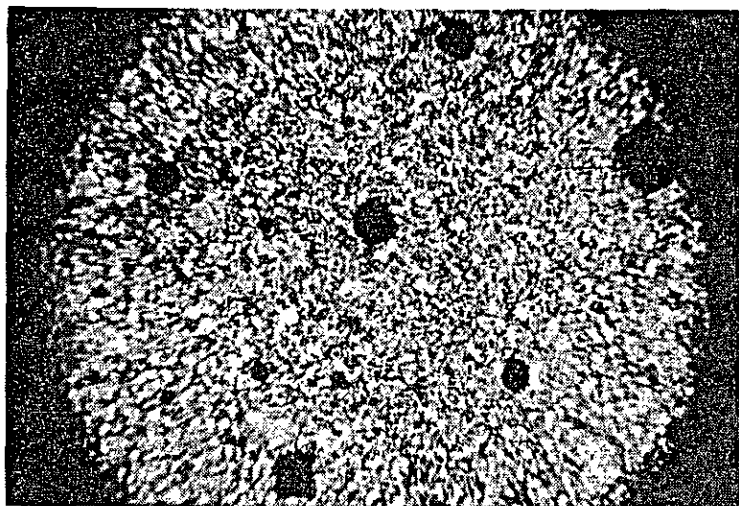
Olivine is suffered
by deformation (center)

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : X-12
2. Laboratory No. : AR - 10100
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 25.02N, 13.03 E
7. Location : Taşlı dere, Dingik, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : harzburgite
10. Occurrence : massive
11. Description of specimen : This specimen is dark greenish gray colored and medium grained. It has much amount of orthopyroxene crystals and veinlets. It is a typical specimen of harzburgite in the survey area.
12. Microscopy : The specimen is equidimensional coarse granular. Olivine is coarse, granular with 1 - 2 mm size and shows wavy extinction. Small part of it, is replaced by serpentine. Enstatite is coarse, anhedral tabular with 1 - 1.5 mm size and includes small olivine crystals. Chromite of 0.1 - 1 mm size includes olivine crystals in part. Few clinopyroxene (1 mm size) is present. Oval-shaped plagioclase is replaced by clinozoisite.
13. Remarks : refer Appendix 6-14

Microscopic observation of thin section



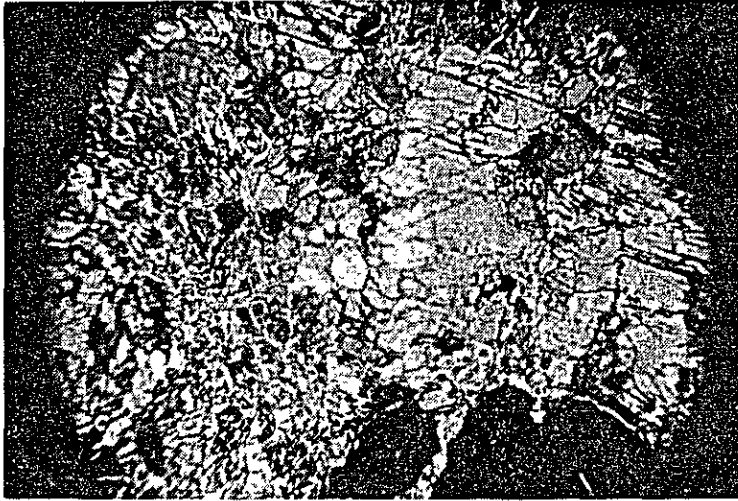
black part : chromite
other part : mainly serpentine
with brucite.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : X-14
2. Laboratory No. : AR - 10099
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 27.75 N, 17.02 E
7. Location : Batı Coşan, Bendindere, Sıçankale Y.,
Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : brucite-bearing serpentinite from dunite
10. Occurrence : massive
11. Description of specimen : This specimen is dark gray colored and fine grained. Round coarse grains of olivine? are found in abundance. Very fine granular chromite is present commonly. This is the host rock of chromite deposit and called as fine dunite in the field.
12. Microscopy : The specimen shows mesh structure of olivine pseudomorph. Olivine is completely replaced by serpentine and brucite. Chromite has octahedron or hexahedron shape, 0.2 - 0.3 mm size and occurs commonly. Magnetite fine grains are rich around olivine crystals.
13. Remarks : This specimen is taken from chromite banding zone, east of Batı Coşan mine.
refer Appendix 6-14.

Microscopic observation of thin section



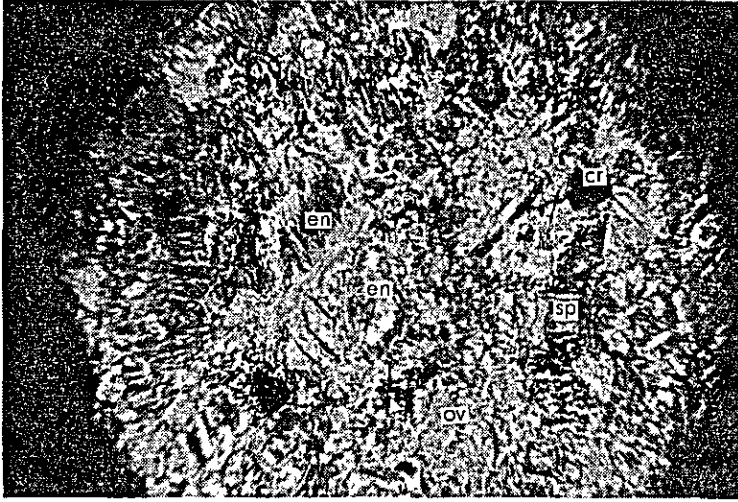
right half : clinopyroxene
left half : olivine
(serpentinized)

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : X-15
2. Laboratory No. : AR - 10098
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 27.68 N, 17.07 E
7. Location : Batı Coşan, Kücüksivri Sr., Siçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : olivine clinopyroxenite
10. Occurrence : dyke in dunite
11. Description of specimen : This specimen is pale yellowish green colored and granular with medium grain size. It is affected by serpentinization.
12. Microscopy : The specimen is coarse, equidimensional, granular. Olivine has round shape and 0.5 - 1 mm size. It is completely replaced by serpentine. Clinopyroxene (diopside) is tabular-prismatic, anhedral and 1 - 3 mm long. Its cleavage develops. It is affected partly by chloritization and carbonatization. Clay mineral is present along the cleavage.
13. Remarks : Clinopyroxene is determined as augite by X-ray diffractive analysis. refer Appendix 6-15.

Microscopic observation of thin section



ov : olivine (serpentinized)
en : enstatite
cr : chromite
sp : serpentine

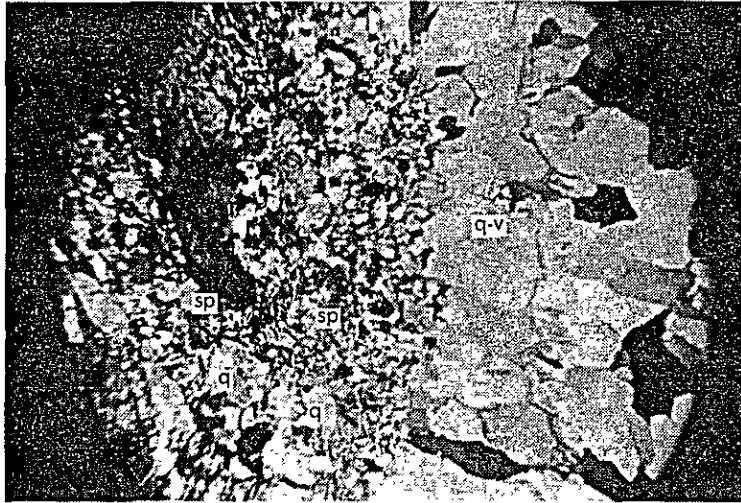
Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : X-18
2. Laboratory No. : AR - 10101
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.2
6. Coordinates : 27.01 N, 12.15 E
7. Location : Kırmızıtaş Sr., Sıçankale Y., Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from harzburgite
10. Occurrence : massive
11. Description of specimen : This specimen has dark grayish green color and very fine grains. Fine networks of serpentine including asbestos are commonly observable.
12. Microscopy :

The specimen is granular.
It is composed of olivine and enstatite.
Olivine is completely replaced by brucite, serpentine and partly saponite?
Enstatite has tabular anhedral shape and 1-2 mm size. It includes round olivine crystals partly. It is replaced completely by serpentine and saponite.
Small amount of fine magnetite around olivine and subhedral coarse chromite is present.
Brucite-magnetite-saponite? vein is observed.
13. Remarks : refer Appendix 6-15

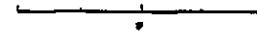
Microscopic observation of thin section



sp : serpentinite fragment
q : quartz
q-v : quartz vein

Crossed nicols $\times 4$

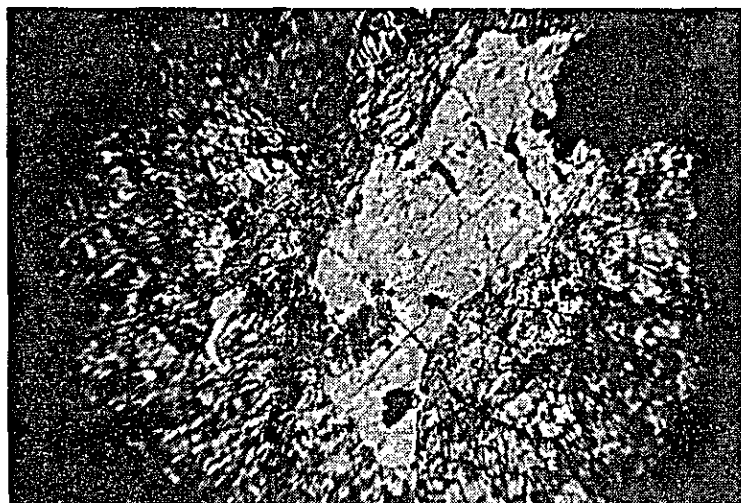
0 0.75 1.5 mm



1. Sample No. : X-21
2. Laboratory No. : AR - 10095
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a1, No.4
6. Coordinates : 16.40 N, 33.60 E
7. Location : Karaçayırdere, Çırmıt köyü, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : altered serpentinite
10. Occurrence : dyke-like appearance in harzburgite
11. Description of specimen : This specimen is affected strongly by carbonatization and silicification. It is reddish brown colored and very fine grained. Coarse, round fragments of serpentinite and veinlets of carbonate are observed.
12. Microscopy :

The specimen is coarse granular. Secondary quartz is commonly found. It shows zoning structure and partly euhedral shape in veinlet (1 - 2 mm wide). Carbonate mineral is much in amount. It makes large aggregates. By X-ray diffractive analysis, calcite, dolomite and magnesite are defined. Fine aggregates of magnetite are commonly present. Primary minerals, such as olivine and pyroxene? are completely serpentinitized, silicified and carbonatized. So the original rock name cannot be identified. This specimen is affected by serpentinitization, lateritization, carbonatization and silicification in order.
13. Remarks : refer Appendix 6-16.

Microscopic observation of thin section



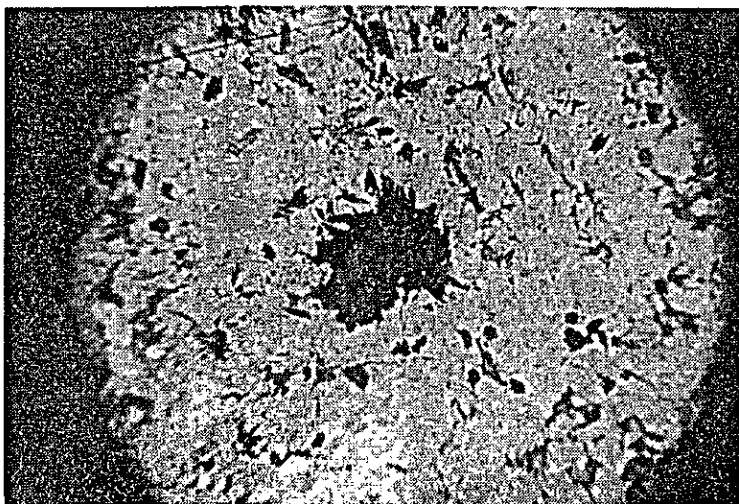
Bright part is enstatite and the rest is serpentine from olivine.

Crossed nicols $\times 4$

0 0.75 1.5mm

1. Sample No. : X-22
2. Laboratory No. : AR - 10096
3. Project No. L 78/26
4. Area : Kopdağ
5. Map No. : Erzurum, i-45, a4, No.1
6. Coordinates : 14.55 N, 33.80 E
7. Location : Kurugöldere, Penek, Aşkale, Erzurum
8. Lithostratigraphic unit : ultrabasic rocks
9. Rock name : serpentinite from harzburgite
10. Occurrence : massive
11. Description of specimen : This specimen is brownish dark gray - creamy green colored. Veinlets of pyroxene and asbestos are observed.
12. Microscopy : The specimen is equidimensional, granular. It is composed of olivine and pyroxene. Olivine is replaced perfectly by serpentine. Enstatite has anhedral shape and 0.5 - 2 mm size. It is replaced by bustite. Fine crystals of magnetite are rich around olivine crystals. Chromite has warped anhedral shape and 0.5 mm size.

Microscopic observation of thin section



Gray part (center) is aegirine and the rest is mostly natrolite.

Parallel nicol $\times 4$

0 0.75 1.5 mm

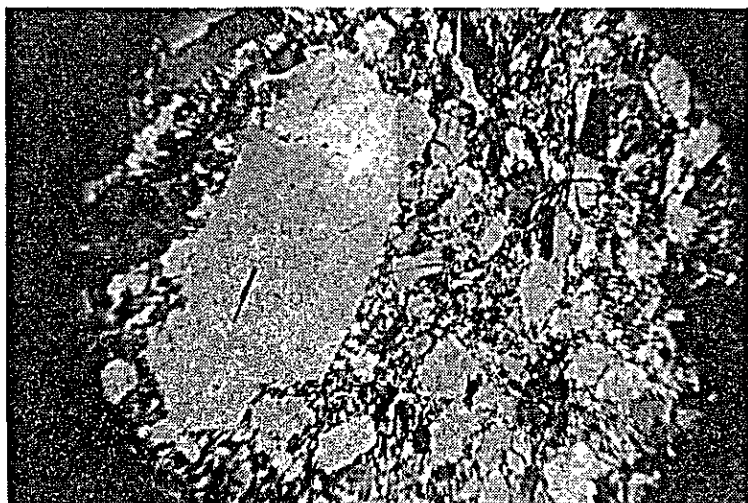


Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : Z-10
2. Laboratory No. : AR-10092
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 24.00N, 08.15E
7. Location : Atölkendere, Hınzır Mah., Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : natrolite rock
10. Occurrence : dyke in harzburgite
11. Description of specimen : This specimen is greenish white colored.
Tabular white crystals are abundantly observed.
12. Microscopy : The specimen is coarse grained, anhedral.
Large amount of natrolite shows anhedral shape of 1 - 2 mm size.
Twinned plagioclase is commonly present.
Prismatic small green crystals of aegirine are present.
Small amount of sphene, apatite is accompanied.
Carbonate and chlorite aggregates are commonly present.

Microscopic observation of thin section



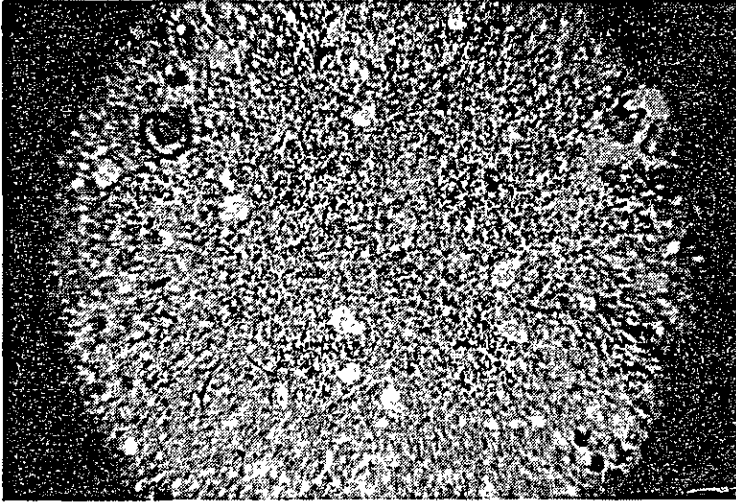
Phenocryst and micro-phenocryst of plagioclase are given.

Crossed nicols $\times 4$

0 0.75 1.5 mm

1. Sample No. : Z-12
2. Laboratory No. : AR - 10093
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 23.85 N, 08.17 E
7. Location : Topkayann Tepe, Hınzır Mah., Aşkale, Erzurum
8. Lithostratigraphic unit : intrusive rocks
9. Rock name : diorite porphyrite
10. Occurrence : dyke in harzburgite
11. Description of specimen : This specimen is greenish white colored and very fine grained. Phenocrysts are not clear.
12. Microscopy : The specimen is porphyritic. Phenocryst is composed of plagioclase. (oligoclase) It is euhedral, prismatic and twinned. Hornblende occurs as microphenocryst. It is yellowish brown colored, prismatic and surrounded by chlorite. Groundmass is composed of anhedral albite.

Microscopic observation of thin section



White parts are druses.
Other part is composed of
dolomite.

Parallel nicol $\times 4$

0 0.75 1.5 mm
└──────────┘

1. Sample No. : Z-14
2. Laboratory No. : AR - 10094
3. Project No. : 78/26
4. Area : Kopdağ
5. Map No. : Erzincan, i-44, b1, No.1
6. Coordinates : 22.14 N, 07.20 E
7. Location : Çerçiliyaş Tepe, Ağcahisar, Aşkale, Erzurum
8. Lithostratigraphic unit : terrace deposit
9. Rock name : dolomite
10. Occurrence : lenticular body intercalated in conglomerate
11. Description of specimen : This specimen is creamy white colored, very fine grained and drusy. Tabular crystals are present. (0.2 - 1 cm size)
12. Microscopy : The specimen is fine, granular.
It is composed of large amount of fine (0.05 mm size), equidimensional granular dolomite.
Very small amount of fine feldspar and fine chlorite is present.
12. Remarks : refer Appendix 6-16.