

APPENDIX 3 - THERMOCALC MIXING MODELS

% NCMnKFMASH datafile

%

chl 5 % order-disorder model

x(chl) 0.40 % bulk Fe/(Fe+Mg)
 y(chl) 0.56 % $y = 1/2 = \text{clinochlore-amesite}$
 Q(chl) 0.43 % order parameter
 M(chl) 0.003

%

p(afchl) 1 1 1 2-1 y-1 Q

p(clin) 2 1 0 1 2 Q
 2 0 2-2/5 x-2/5 M 3 1-1 y

p(daph) 1 2 0 1 2/5 x 3 1-1 y

p(ames) 1 1 0 2 1 y-1 Q

p(mnchl) 1 2 0 1 2/5 M 3 1-1 y

%

sf

W(afch,clin) 18 0 0
 W(afchl,daph) 14.5 0 0
 W(afchl,ames) 20 0 0
 W(afchl,mnchl) 0 0 0
 W(clin,daph) 2.5 0 0
 W(clin,ames) 18 0 0
 W(clin,mnchl) 0 0 0
 W(daph,ames) 13.5 0 0
 W(daph,mnchl) 0 0 0
 W(ames,mnchl) 0 0 0

%

13

x(Fe,M23) 1 1 0 1 1 x
 x(Mg,M23) 1 1 1 2-1 x-1 M
 x(Mn,M23) 1 1 0 1 1 M

x(Al,M1) 1 1 0 2 1 y-1 Q
 x(Fe,M1) 1 2 0 1 1 x 1 2-1 y 1 Q
 x(Mg,M1) 1 2 1 2-1 x-1 M 1 2-1 y 1 Q
 x(Mn,M1) 1 2 0 1 1 M 1 2-1 y 1 Q

x(Al,M4) 1 1 0 2 1 y 1 Q
 x(Fe,M4) 1 2 0 1 1 x 1 2-1 y-1 Q
 x(Mg,M4) 1 2 1 2-1 x-1 M 1 2-1 y-1 Q
 x(Mn,M4) 1 2 0 1 1 M 1 2-1 y-1 Q

x(Al,T2) 1 1 0 1 1 y
 x(Si,T2) 1 1 1 1-1 y

%

afchl 1 4 x(Mg,M23) 4 x(Mg,M1) 1 x(Mg,M4) 1 x(Si,T2) 2
 check 0 0 0 0

clin 4 5 x(Mg,M23) 4 x(Mg,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 0 1/2 1/2 0

daph 4 5 x(Fe,M23) 4 x(Fe,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 1 1/2 1/2 0

ames 1 4 x(Mg,M23) 4 x(Al,M1) 1 x(Al,M4) 1 x(Al,T2) 2
 check 0 1 0 0

mnchl 4 5 x(Mn,M23) 4 x(Mn,M1) 1 x(Al,M4) 1 x(Al,T2) 1 x(Si,T2) 1
 check 0 1/2 1/2 1

%

bi 5 % order-disorder model

x(bi) 0.45 % bulk Fe/(Fe + Mg + Mn)
 y(bi) 0.27 % x(Al,M1)
 Q(bi) 0.39 % $3(x - x(\text{Fe},\text{M2}))$
 M(bi) 0.003

%

p(phl) 2 2 1 2-1 x-1 M 1 1-1 y
 1 0 1-2/3 Q

p(ann) 1 1 0 2 1 x -1/3 Q

p(east) 1 1 0 1 1 y

p(obi) 2 2 0 1-1 x 0 1 1 y
 1 0 1 1 Q

p(mnbi) 1 1 0 1 1 M

%

sf

W(phl,ann) 9 0 0
 W(phl,east) 10 0 0
 W(phl,obi) 3 0 0
 W(phl,mnbi) 0 0 0
 W(ann,east) -1 0 0
 W(ann,obi) 6 0 0
 W(ann,mnbi) 0 0 0
 W(east,obi) 10 0 0
 W(east,mnbi) 0 0 0
 W(obi,mnbi) 0 0 0

%

9 % no of site fractions

x(Al,M1) 1 1 0 1 1 y

x(Fe,M1) 2 2 0 1 1 x 1 1-1 y
 1 0 1 2/3 Q

x(Mg,M1) 2 2 1 2-1 x-1 M 1 1-1 y
 1 0 1-2/3 Q

x(Mn,M1) 1 1 0 1 1 M

x(Fe,M2) 1 1 0 2 1 x-1/3 Q

x(Mg,M2) 1 1 1 3-1 x 1/3 Q-1 M

x(Mn,M2) 1 1 0 1 1 M

x(Al,T1) 1 1 1/2 1 1/2 y

x(Si,T1) 1 1 1/2 1-1/2 y

%

phl 4 4 x(Mg,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 0 0 0 0

ann 4 4 x(Fe,M1) 1 x(Fe,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 1 0 0 0

east 1 3 x(Al,M1) 1 x(Mg,M2) 2 x(Al,T1) 2
 check 0 1 0 0

obi 4 4 x(Fe,M1) 1 x(Mg,M2) 2 x(Al,T1) 1 x(Si,T1) 1

make 2 phl 2/3 ann 1/3
 DQF -10.73 0 0
 check 1/3 0 1 0

mnbi 4 4 x(Mn,M1) 1 x(Mn,M2) 2 x(Al,T1) 1 x(Si,T1) 1
 check 0 0 0 1

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% _____
st 3
  x(st) 0.85
  M(st) 0.002

p(mst) 1 1 1 2 -1 x -1 M
p(fst) 1 1 0 1 1 x
p(mnst) 1 1 0 1 1 M

sf
w(mst,fst) -8 0 0
w(mst,mnst) 0 0 0
w(fst,mnst) 0 0 0

3 x(Mg) 1 1 1 2 -1 x -1 M
  x(Fe) 1 1 0 1 1 x
  x(Mn) 1 1 0 1 1 M
mst 1 1 x(Mg) 4
fst 1 1 x(Fe) 4
mnst 1 1 x(Mn) 4

% _____
ctd 3
  x(ctd) 0.86
  M(ctd) 0.014

p(mctd) 1 1 1 2 -1 x -1 M
p(fctd) 1 1 0 1 1 x
p(mnctd) 1 1 0 1 1 M

sf
w(mctd,fctd) 1 0 0
w(mctd,mnctd) 0 0 0
w(fctd,mnctd) 0 0 0

3 x(Mg) 1 1 1 2 -1 x -1 M
  x(Fe) 1 1 0 1 1 x
  x(Mn) 1 1 0 1 1 M
mctd 1 1 x(Mg) 1
fctd 1 1 x(Fe) 1
mnctd 1 1 x(Mn) 1

% _____
% ternary plag: SF: symmetric
pl 3
  ca(pl) 0.21
  k(pl) 0.012

% -----
p(ab) 1 1 1 2 -1 k -1 ca
p(an) 1 1 0 1 1 ca
p(san) 1 1 0 1 1 k

% -----
sf
w(aban) 0 0 0
w(sanab) 15.3 0 0.225
w(sanan) 45 0 0

% -----
3
x(K) 1 1 0 1 1 k
x(Na) 1 1 1 2 -1 k -1 ca
x(Ca) 1 1 0 1 1 ca

% -----
abh 1 1 x(Na) 1
an 1 1 x(Ca) 1
DQF 6.01 -0.0035 0 % C1 plag
san 1 1 x(K) 1

% _____ Garnet _____
g 4
  F(g) 0.76 % Fe/Fe+Mg+Ca+Mn
  C(g) 0.09 % Ca/Fe+Mg+Ca+Mn
  M(g) 0.08 % Mn/Fe+Mg+Ca+Mn

% -----
p(gr) 1 1 0 1 1 C
p(alm) 1 1 0 1 1 F
p(spss) 1 1 0 1 1 M
p(py) 1 1 1 3 -1 C -1 F -1 M

% -----
sf
W(gr,alm) 0 0 0
W(gr,py) 33 0 0
W(gr,spss) 0 0 0
W(alm,py) 2.5 0 0
W(alm,spss) 0.24 0 0
W(py,spss) 4.5 0 0

% -----
4
x(Fe,M1) 1 1 0 1 1 F
x(Ca,M1) 1 1 0 1 1 C
x(Mn,M1) 1 1 0 1 1 M
x(Mg,M1) 1 1 1 3 -1 C -1 F -1 M

% -----
gr 1 1 x(Ca,M1) 3
check 0 1 0
alm 1 1 x(Fe,M1) 3
check 1 0 0
spss 1 1 x(Mn,M1) 3
check 0 0 1
py 1 1 x(Mg,M1) 3
check 0 0 0

% -----
% _____muscovite with (Fe)celadonite, DQF paragonite mixing
mu 4
  x(mu) 0.56 %Fe/Fe+Mg
  y(mu) 0.87 %Al,T1
  N(mu) 0.12 %Na/K+Na

% -----
p(mu) 1 1 0 2 1 y -1 N
p(CEL) 1 2 1 1 -1 x 1 1 -1 y
p(fcel) 1 2 0 1 1 x 1 1 -1 y
p(pa) 1 1 0 1 1 N

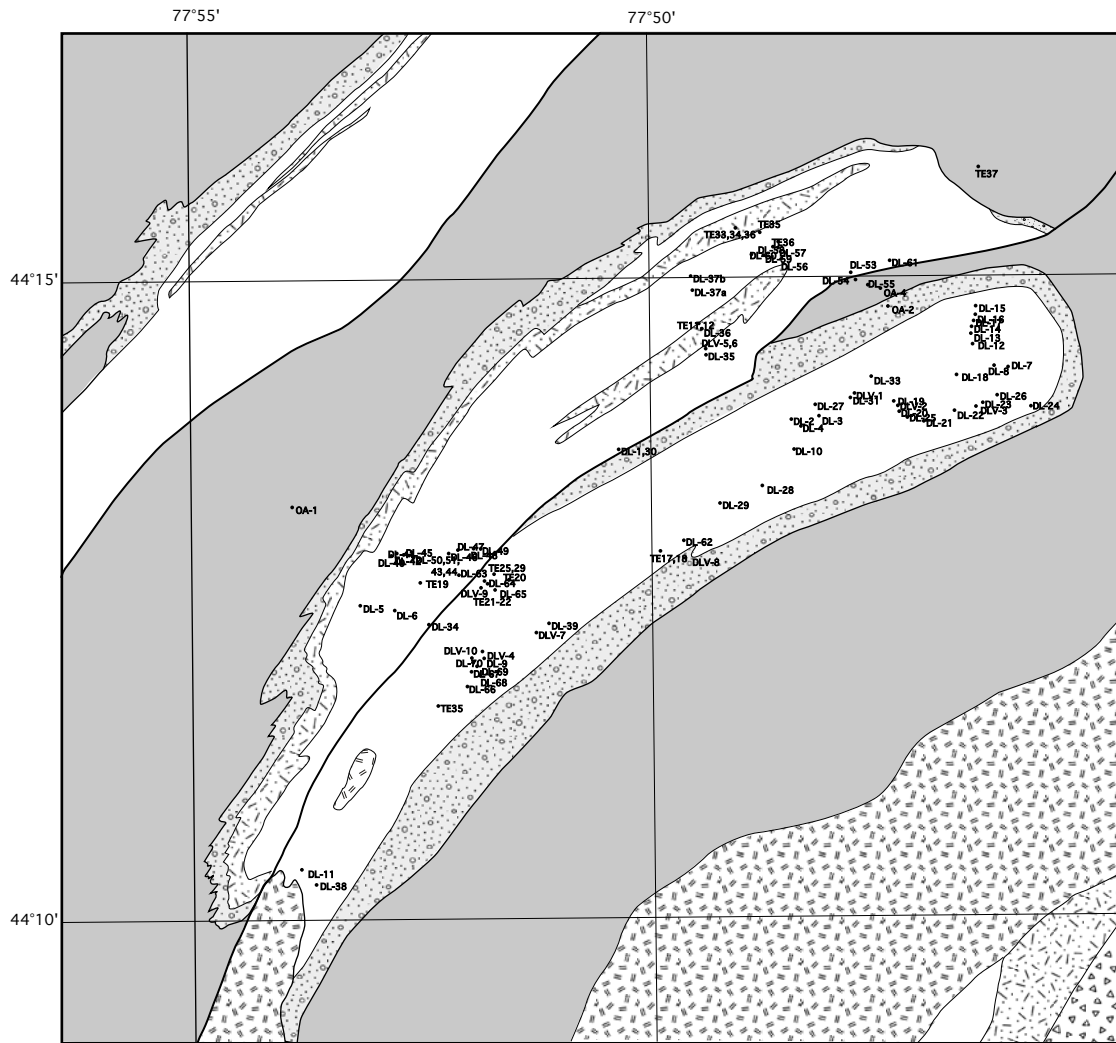
% -----
sf
W(mu,cel) 0 0 0
W(mu,fcel) 0 0 0
W(mu,pa) 12 0 0.4
W(CEL,fcel) 0 0 0
W(CEL,pa) 14 0 0.2
W(fcel,pa) 14 0 0.2

% -----
7
x(Na,A) 1 1 0 1 1 N
x(K,A) 1 1 1 1 -1 N
x(Al,M2A) 1 1 0 1 1 y
x(Mg,M2A) 1 2 1 1 -1 x 1 1 -1 y
x(Fe,M2A) 1 2 0 1 1 x 1 1 -1 y
x(Al,T1) 1 1 0 1 1/2 y
x(Si,T1) 1 1 1 1 -1/2 y

% -----
mu 4 4 x(K,A) 1 x(Al,M2A) 1 x(Al,T1) 1 x(Si,T1) 1
check 0 1 0
cel 1 3 x(K,A) 1 x(Mg,M2A) 1 x(Si,T1) 2
check 0 0 0
fcel 1 3 x(K,A) 1 x(Fe,M2A) 1 x(Si,T1) 2
check 1 0 0
pa 4 4 x(Na,A) 1 x(Al,M2A) 1 x(Al,T1) 1 x(Si,T1) 1
DQF 1.42 0 0.4
check 0 1 1

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APPENDIX 6 - SAMPLE LOCATIONS



APPENDIX 7 - THIN SECTION CATALOGUE

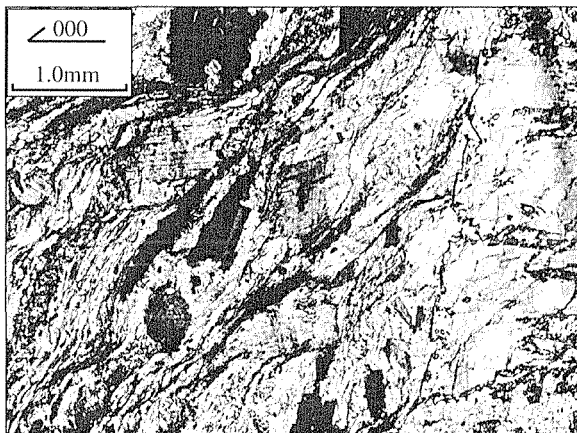
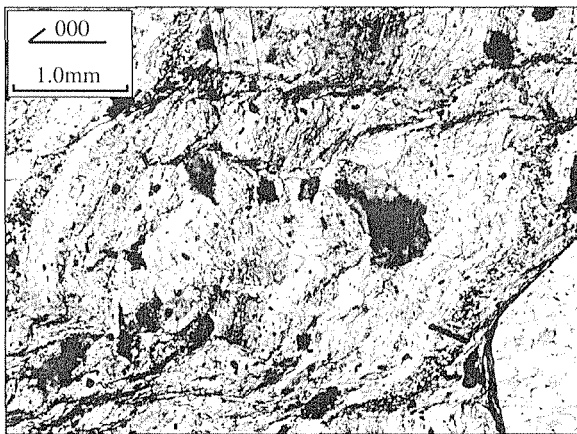
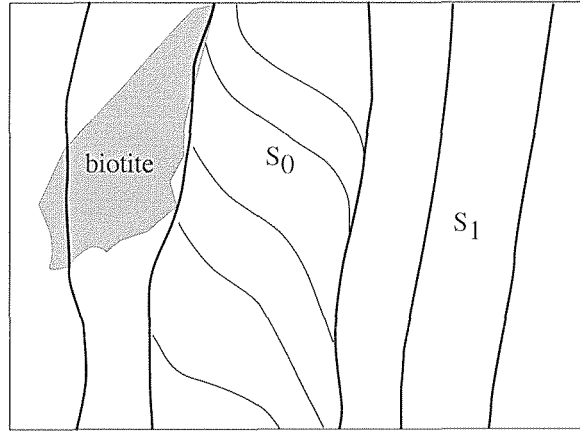
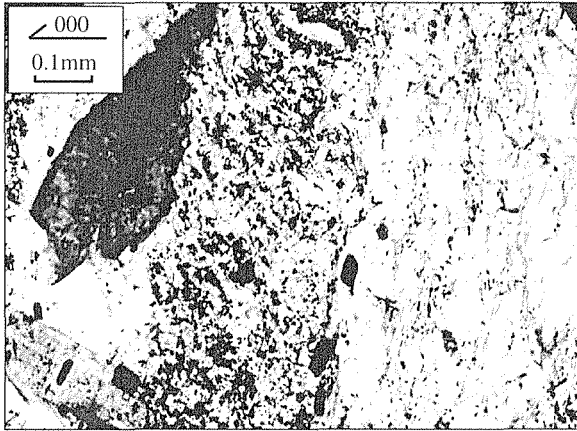
sample	orientation cut
DL-2	0
	60
	120
DL-3	0
	60
	120
DL-4	0
	30
	60
	90
	120
	150
DL-7	0
	30
	60
	90
	120
	150
DL-10	0
	60
	120
DL-16	0
	30
	40
	50
	60
	80
	90
	120
	150
DL-25	0
	30
	40
	50
	60
	70
	80
	90
	120
	150
DL-30	0
	10
	20
	30
	40
	50
	60
	80
	90
	100
	120
DL-34	0

DL-34	10
	20
	40
	70
	90
	120
	160
	170
DL-36	HZ
	0
	10
	20
	30
	40
	50
	60
	70
	80
	90
100	
110	
120	
130	
140	
150	
160	
170	
DL-38	0
	30
	60
	80
	90
	100
120	
130	
150	
DL-40	0
	90
DL-41	60
	90
	100
	110
120	
DL-43	0
	30
	60
	90
	120
150	
DL-44	0
	30
	10
	20

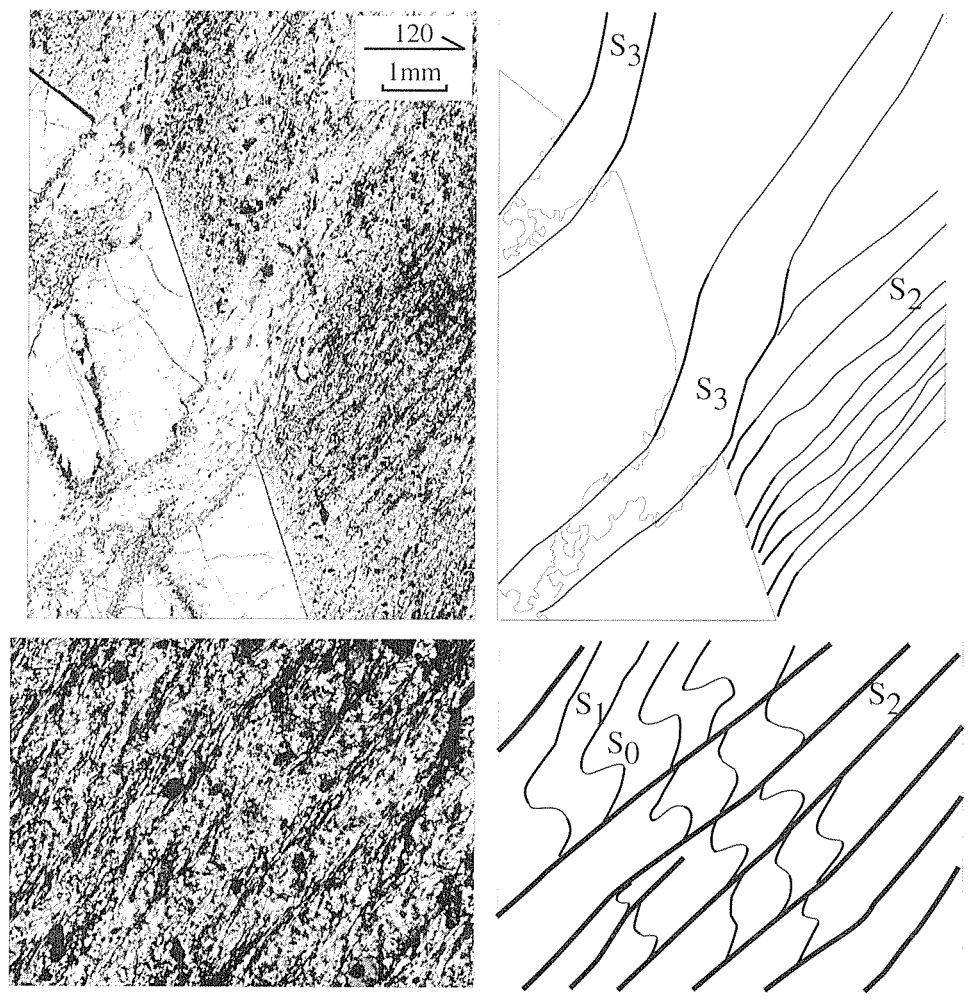
sample	orientation cut
DL-44	60
	90
	120
	150
DL-58	0
	60
	120
DL-60	0
	60
	120
DL-62	0
	30
	50
	60
	90
	100
	110
	130
	140
	150
DL-64	HZ
	0
	10
	30
	40
	60
	80
	90
	100
	110
	120
	150
DL-65	0
	30
	40
	50
	60
	70
	80
	90
	120
	150
DL-68	0
	30
	40
	60
	90
	150
TE19	0
	30

	60
	90
	120
	150
TE21	HZ
	0
	30
	40
	50
	60
	70
	80
	90
	120
TE23	0
	30
	60
	90
	120
	150
TE33	HZ
	0
	20
	30
	40
	60
	90
	120
	150
TE36	0
	30
	60
	90
	150

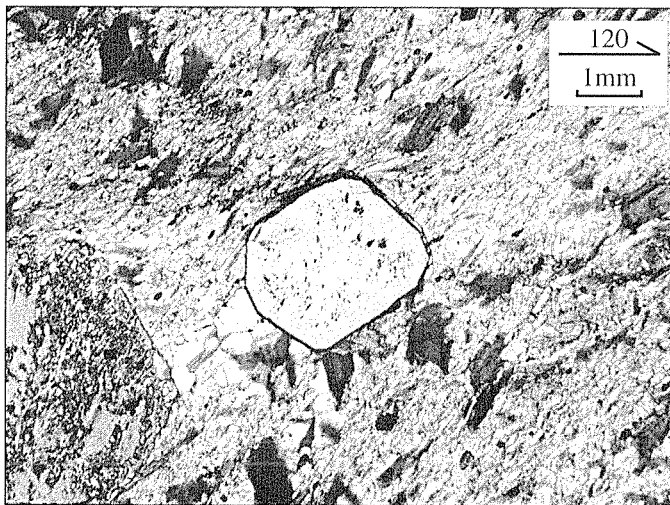
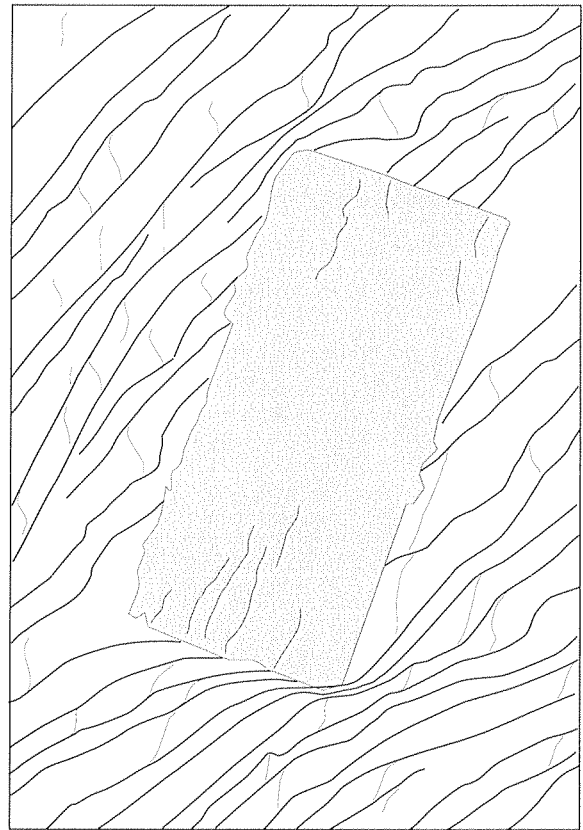
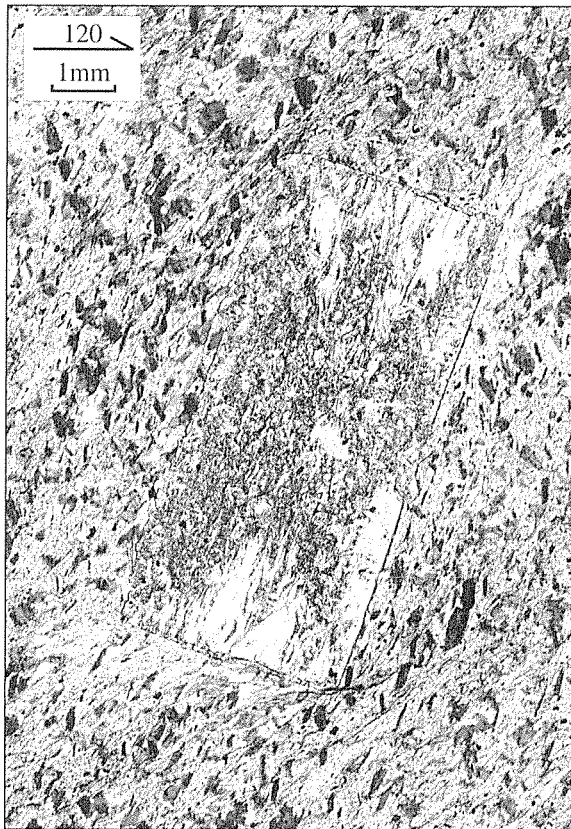
APPENDIX 7 - PETROGRAPHY OF KEY SAMPLES



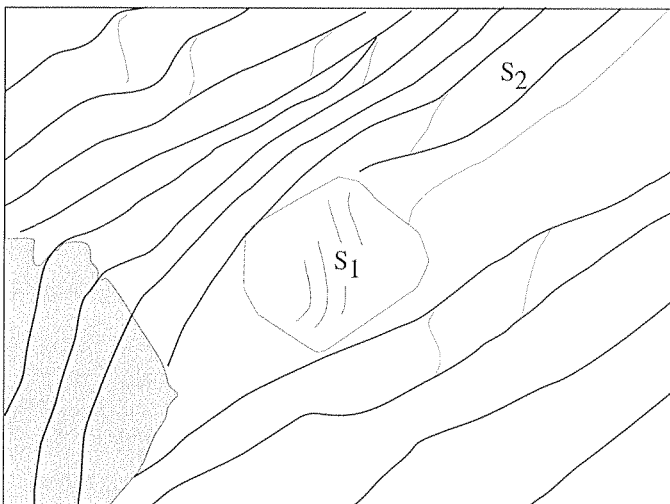
DL-16

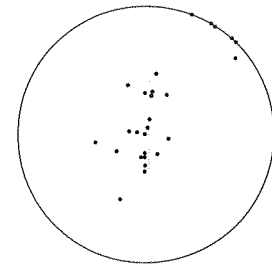
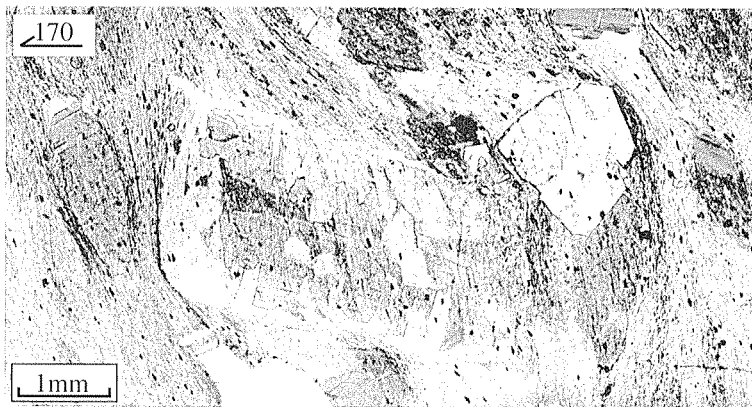


DL-25

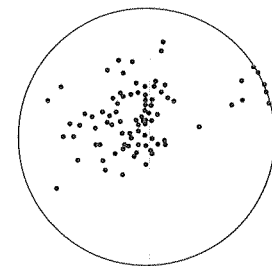
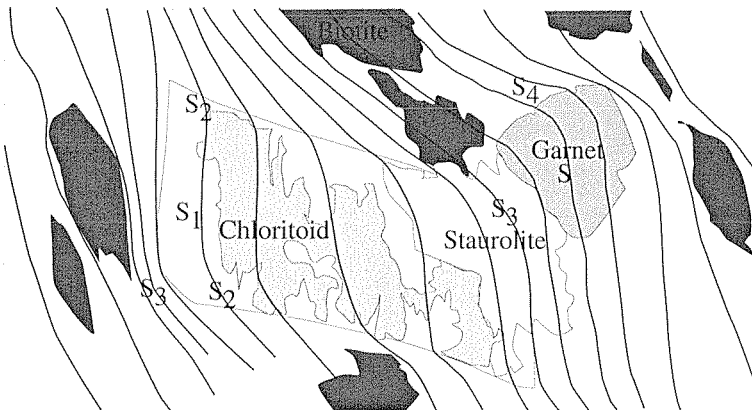


DL-30





S₁ within chloritoid

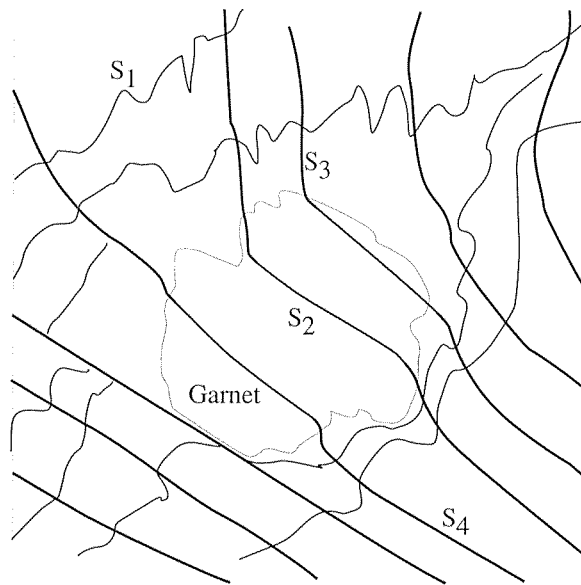
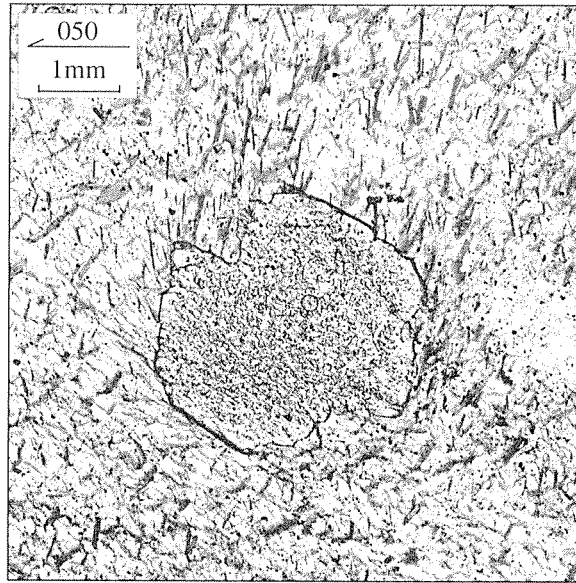


S₃₋₄ within staurolite and garnet

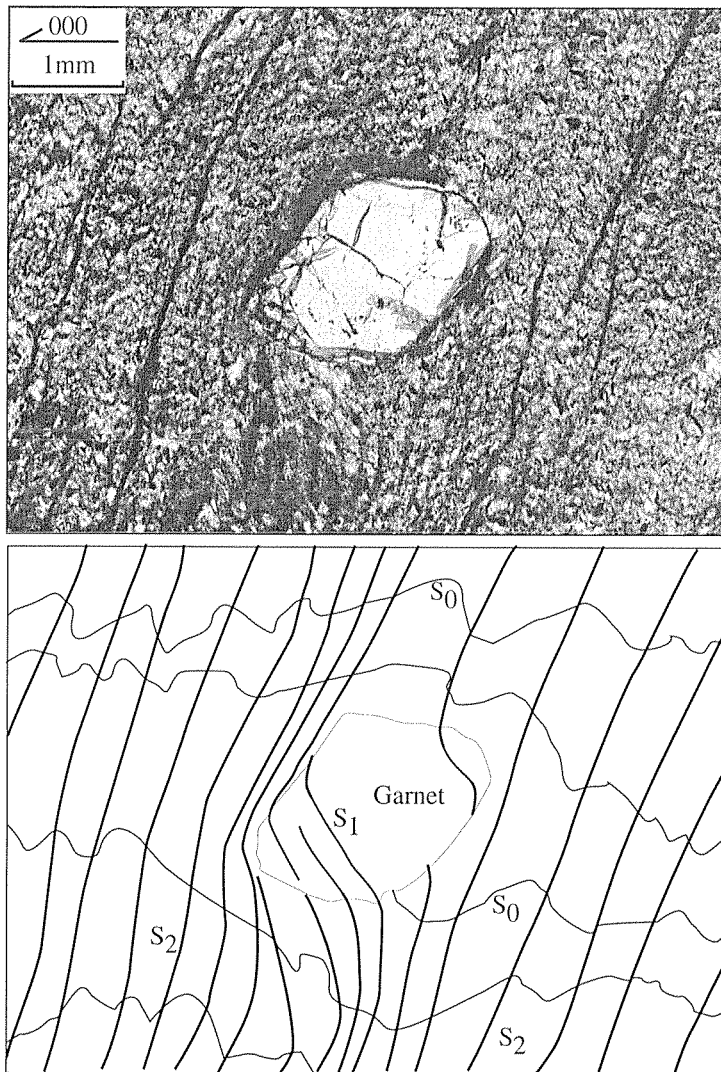
DL-36

Schistosity Development History

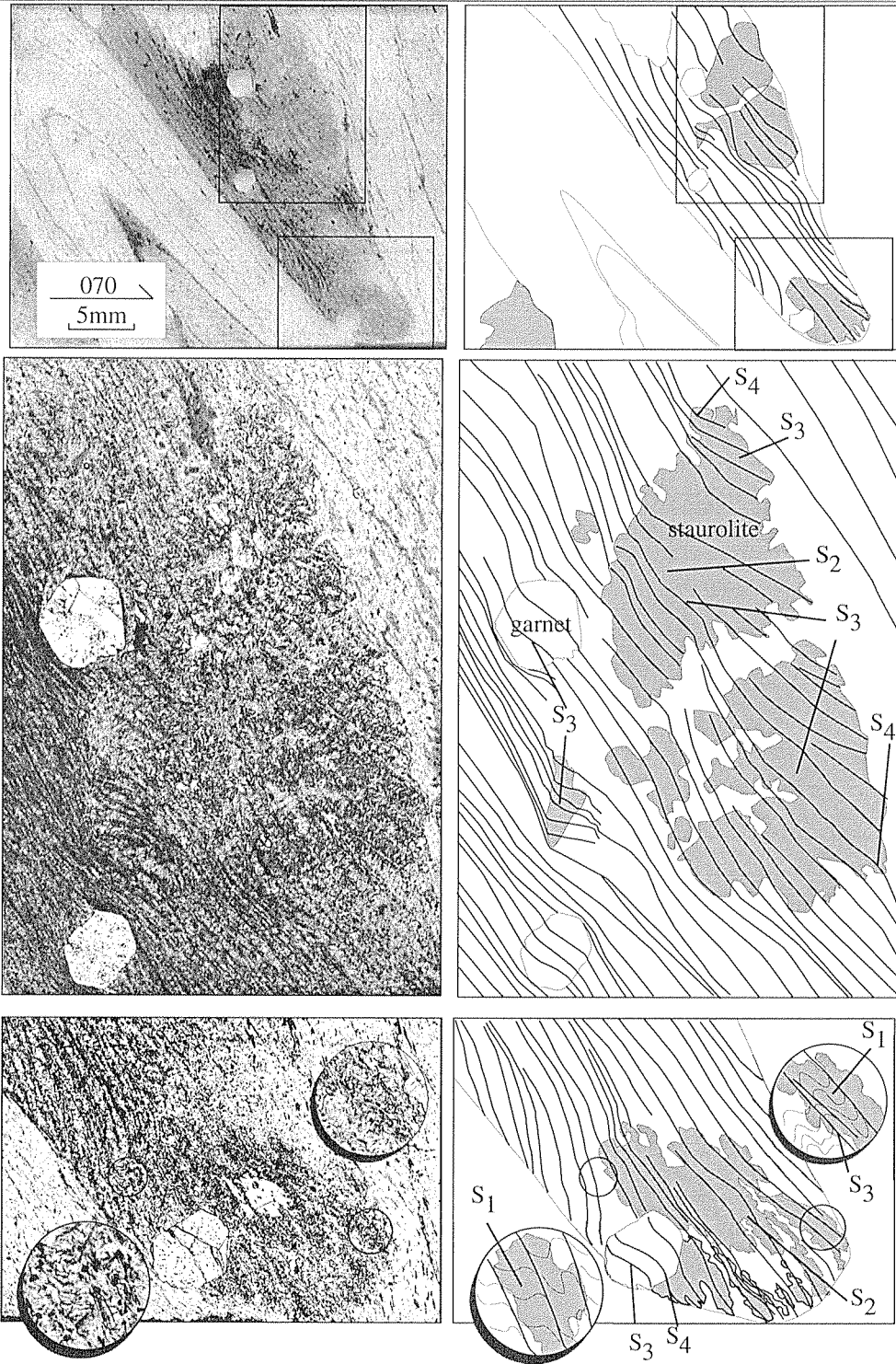
1. Subvertically oriented S₁ is formed striking ~020.
2. Subhorizontally oriented S₂ formed with a top to the E shear-sense during chloritoid growth.
3. Subvertically oriented S₃ forms striking ~060 with a SE up shear-sense. Some garnet growth occurs.
4. Subhorizontally oriented, weakly developed S₄ forms with a top to the SE shear-sense during the bulk of garnet and staurolite growth.



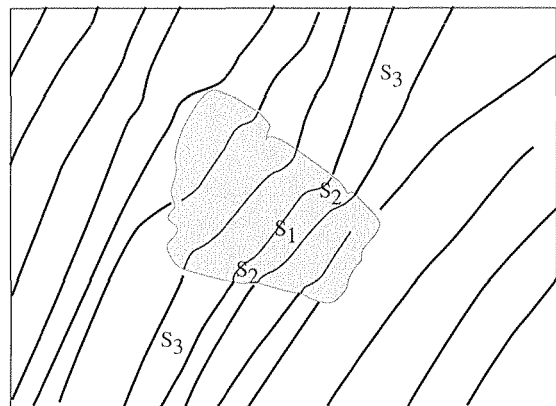
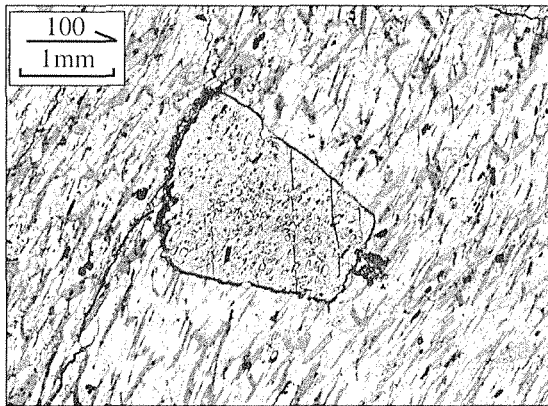
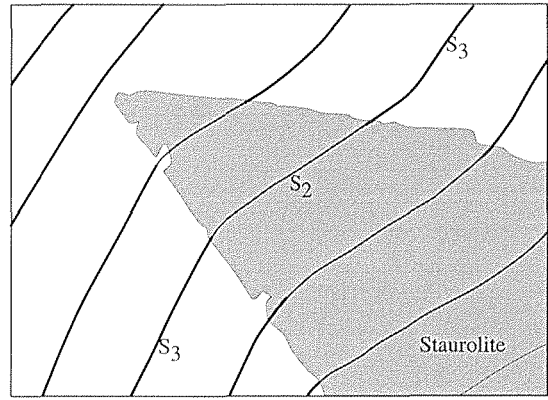
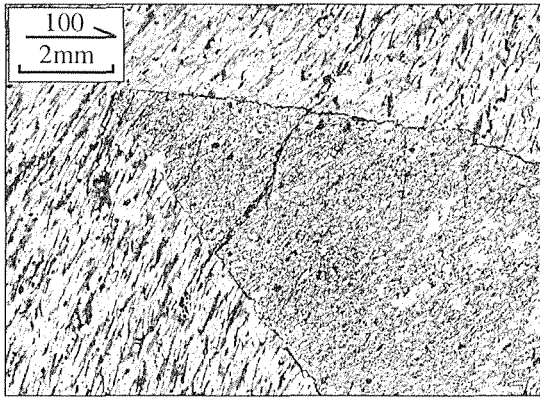
DL-38



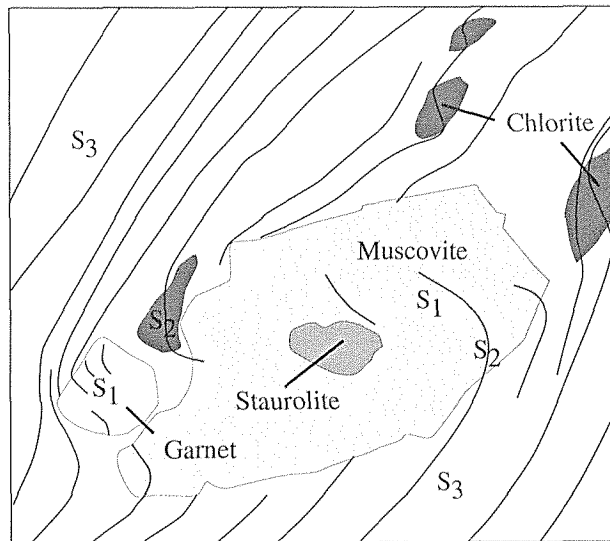
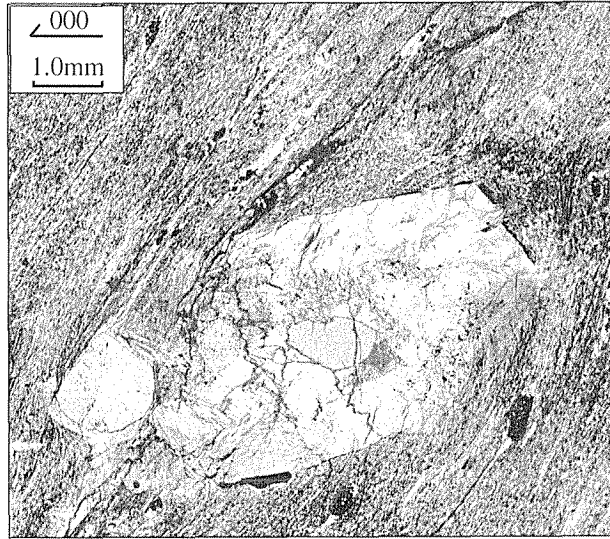
DL-44



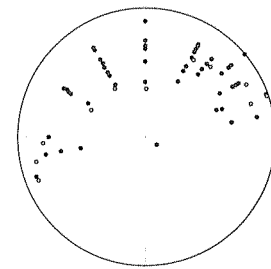
DL-65



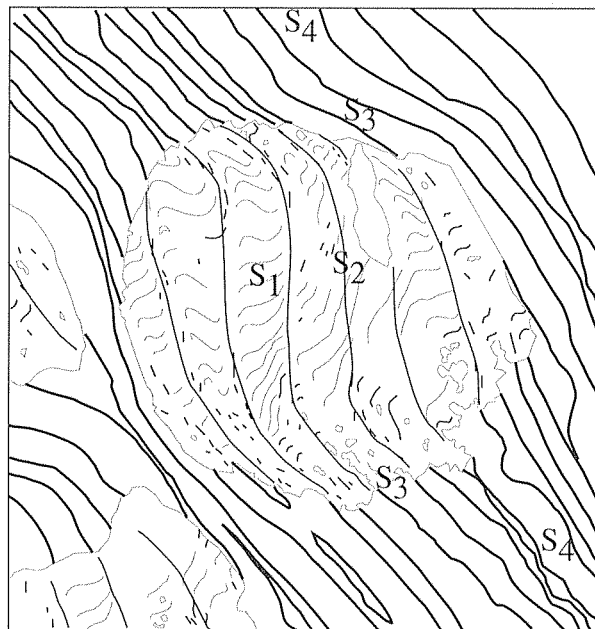
DL-68



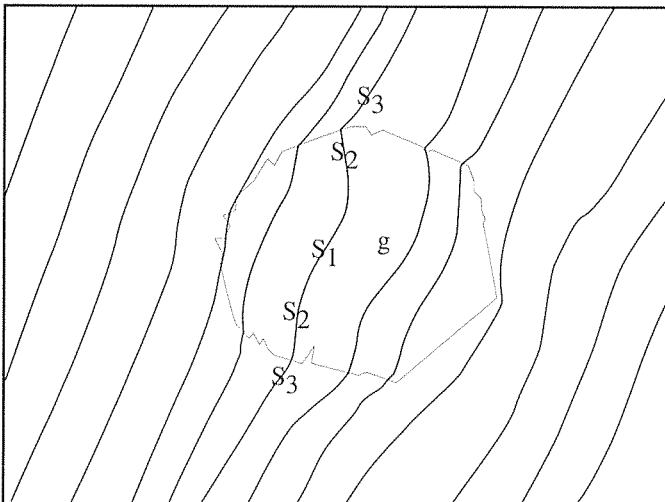
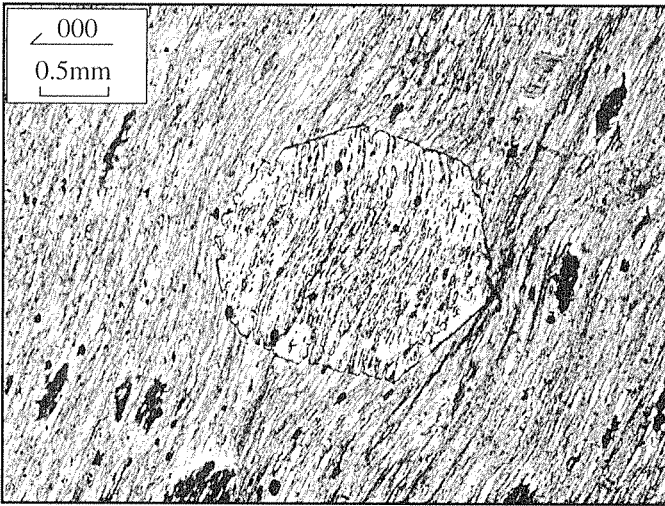
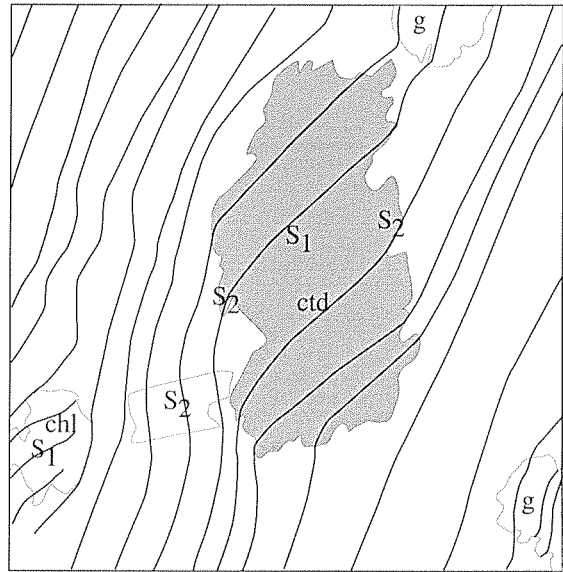
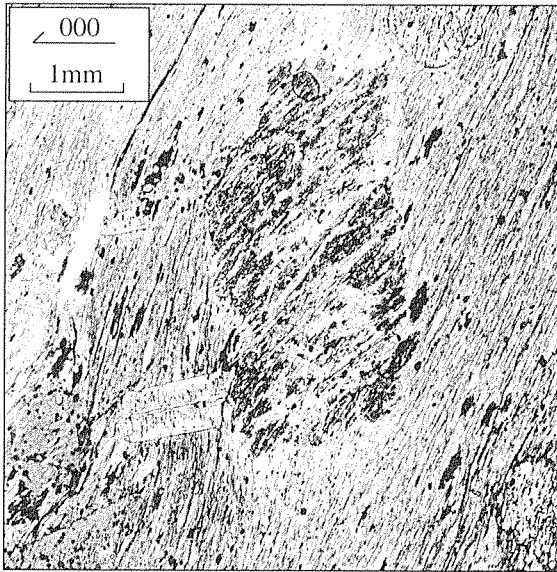
TE19



- cleavage pitch within garnet
- cleavage pitch within matrix



TE21



TE36