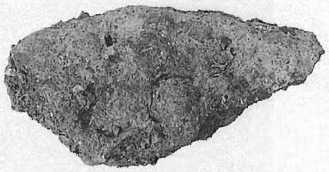
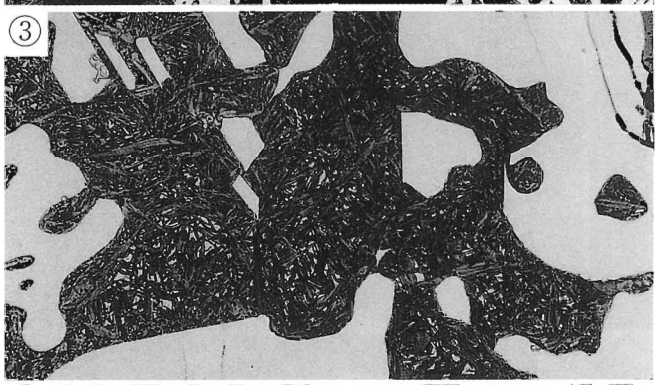
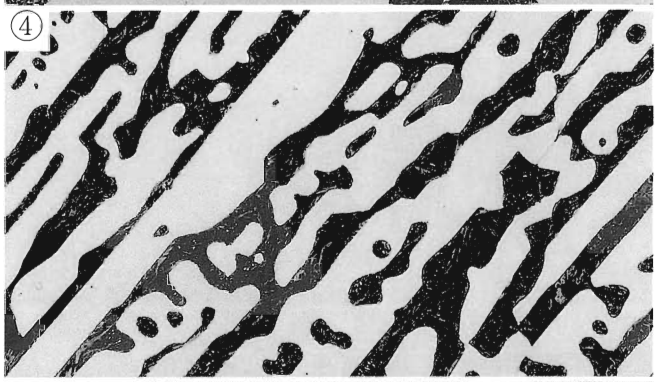
DAN-23(2)

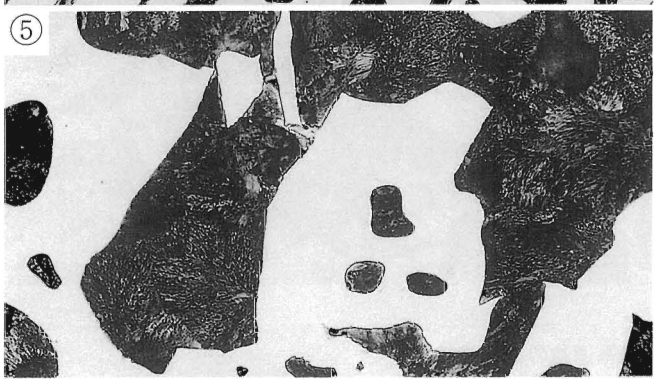
鉄塊系遺物

①～⑤　ナイタルetch
①×50　白鋳鉄組織
②～⑤　①の拡大
②×100 ③×400 表層部：
基地マルテンサイト・
微細パーライト混在
④×100 高炭素部：
基地マルテンサイト
パーライト混在
⑤×400 内部：基地パーライト









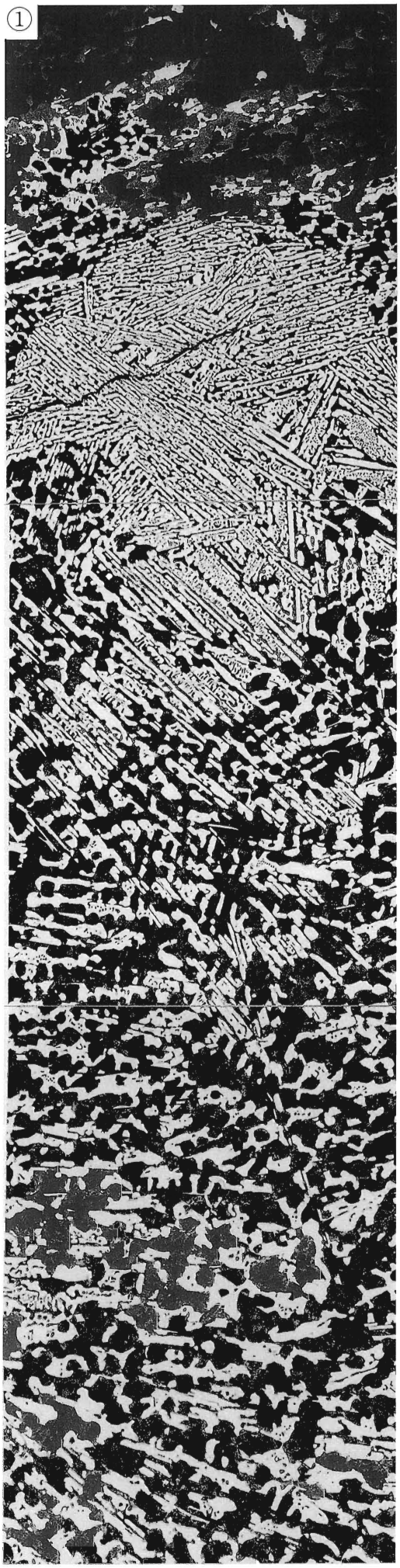
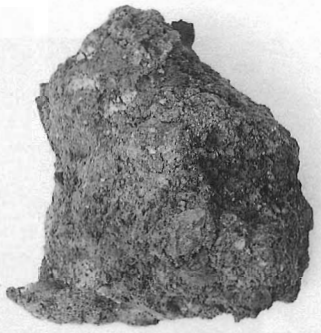


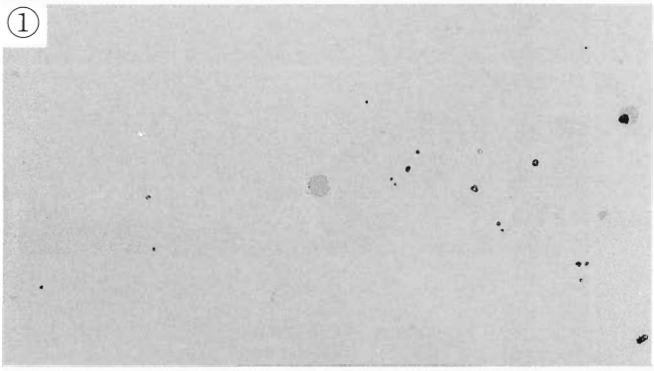
Photo.20 鉄塊系遺物の顕微鏡組織

(24) DAN-24
再結合滓（含鉄部）

①×400 鉄中非金属介在物
②～⑤　ナイタルetch
②×100 表層脱炭：過共析組織
内側：白鋳鉄
③×400 ②の表層部拡大
④⑤×200 硬度圧痕：④220Hv
⑤682Hv

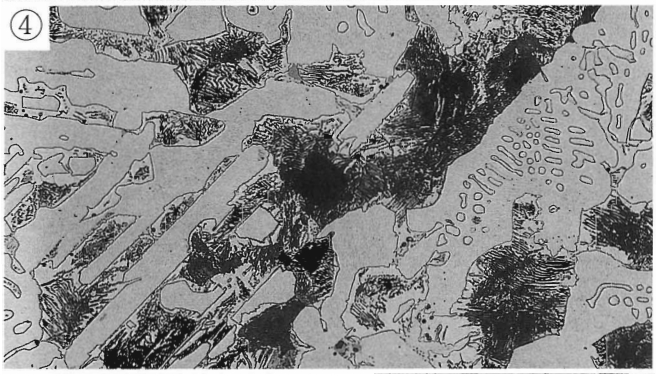


①



③

④



⑤

②

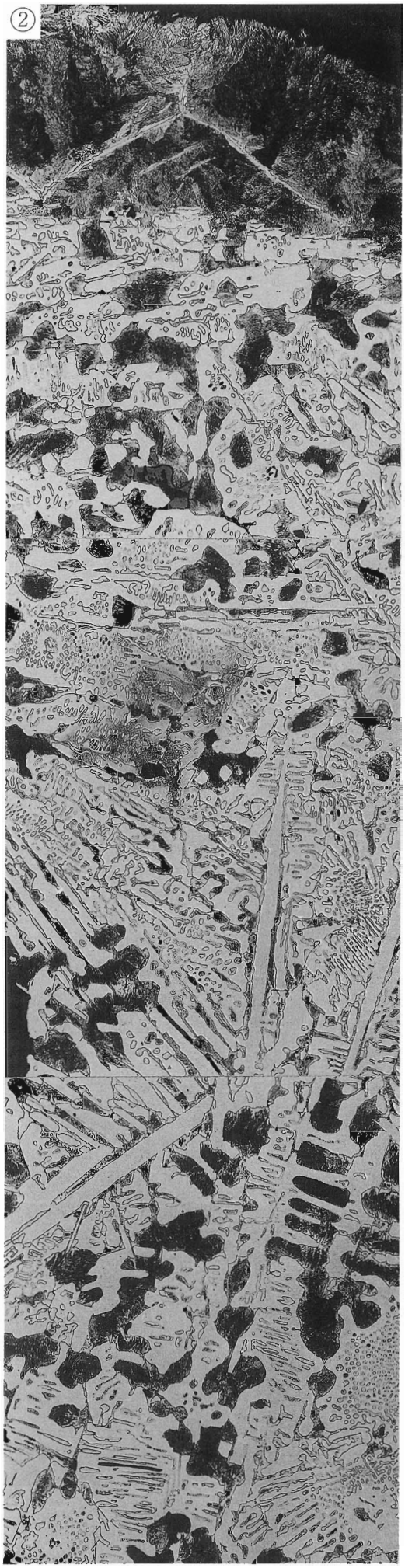
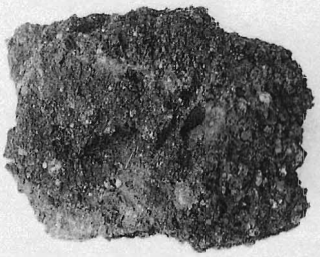
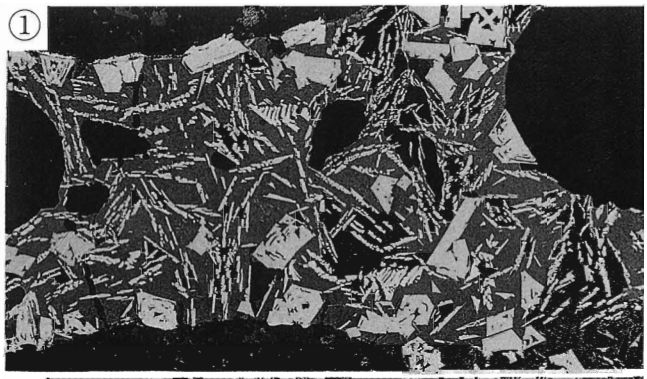


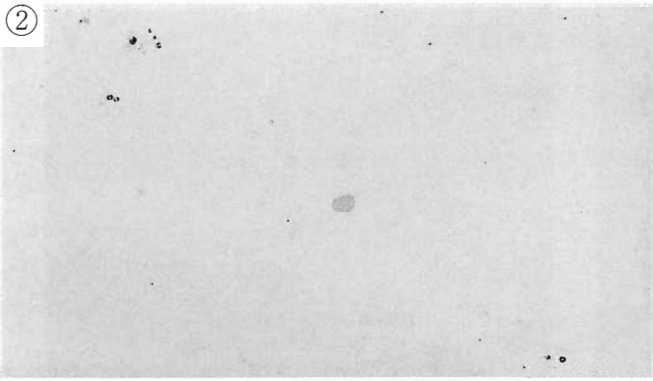
Photo.21 再結合滓（含鉄部）の顕微鏡組織

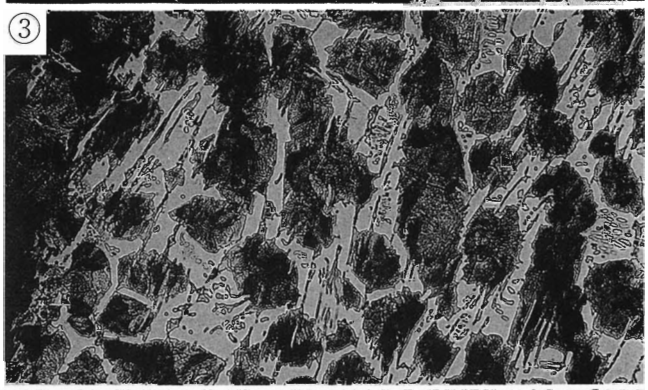
(25) DAN-25
再結合滓

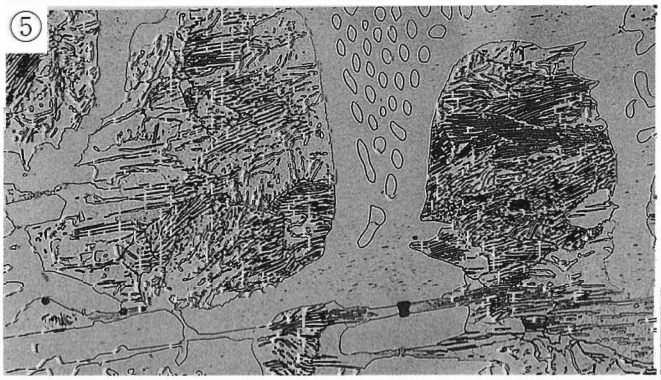
①×100 滓部：ウルボスピネル・
イルミナイト・
ファイヤライト
②×400 鉄中非金属介在物
③～⑨ ナイタルetch
③×100 亜共析組成白鋳鉄
④×100 ⑤⑥×400 同上
⑦⑧×200 硬度圧痕：⑦236Hv
⑧636Hv

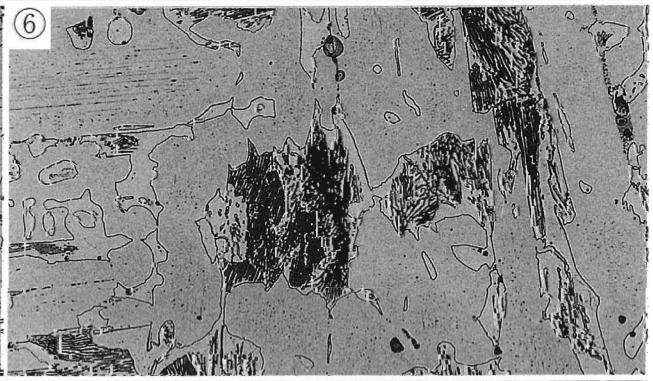


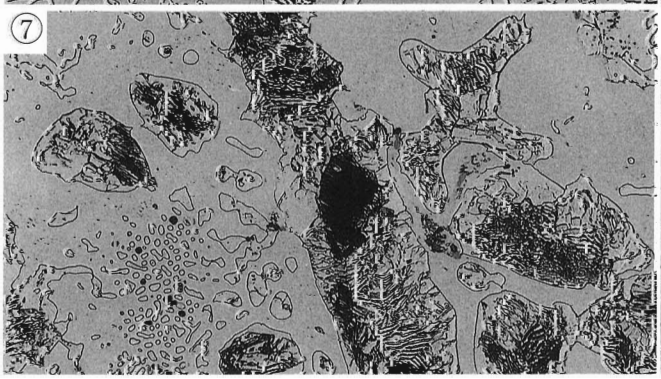












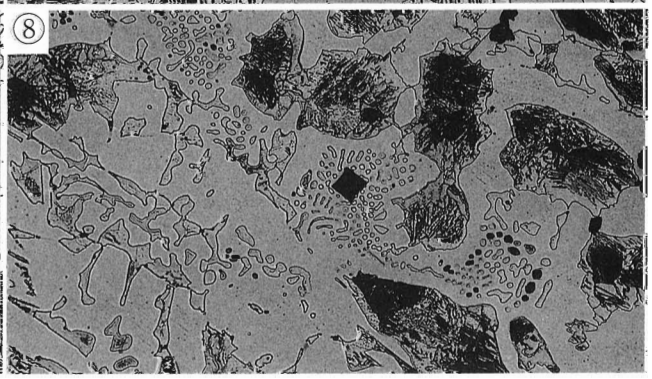
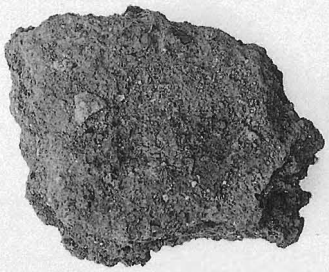
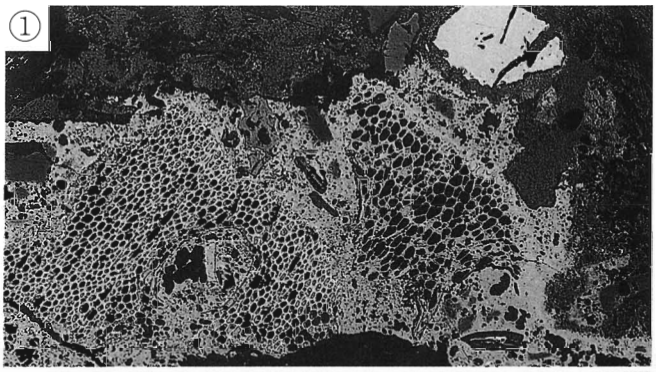


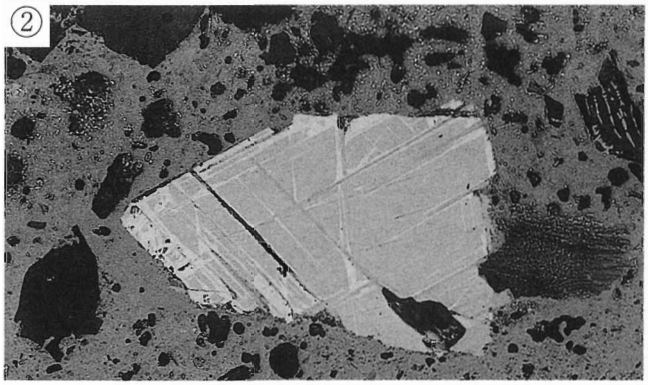
Photo.22 再結合滓の顕微鏡組織

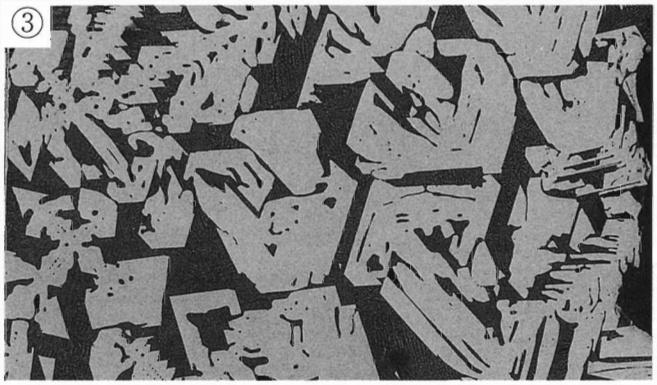
(26) DAN-26
再結合滓

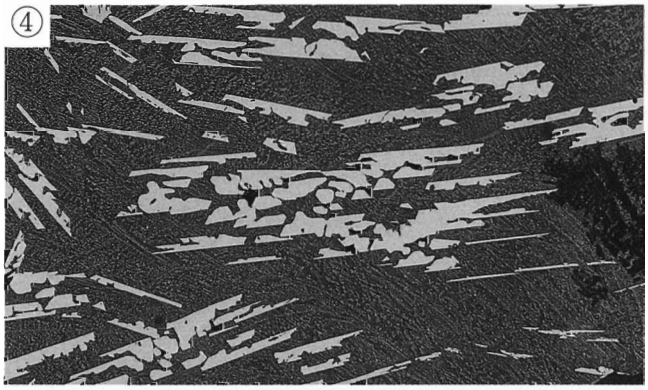
①×100 木炭及び砂鉄（磁鉄鉱）
②×100 砂鉄粒子（チタン鉄鉱）
③×100 ウルボスピネル・ファイヤライト
④×100 イルミナイト・ファイヤライト
⑤×100 シュードブルーカイト・イルミナイト
⑥×100 ウルボスピネル・イルミナイト
⑦×400 付着鍛造剥片
⑧×100 ⑨×400 同上

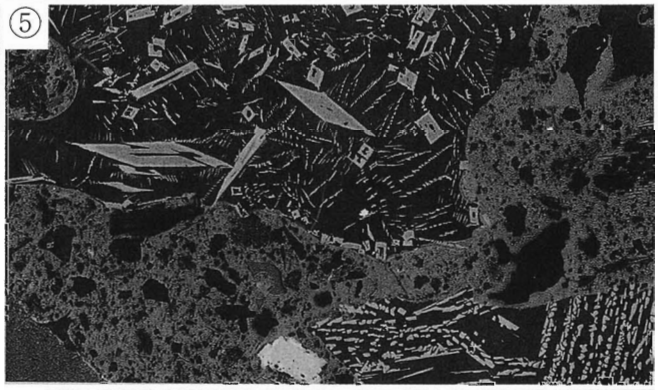


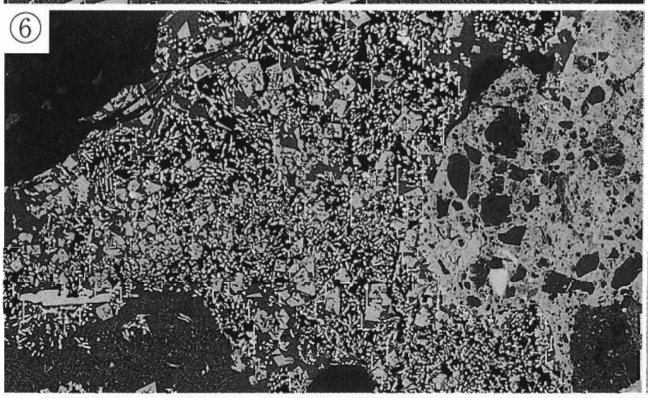


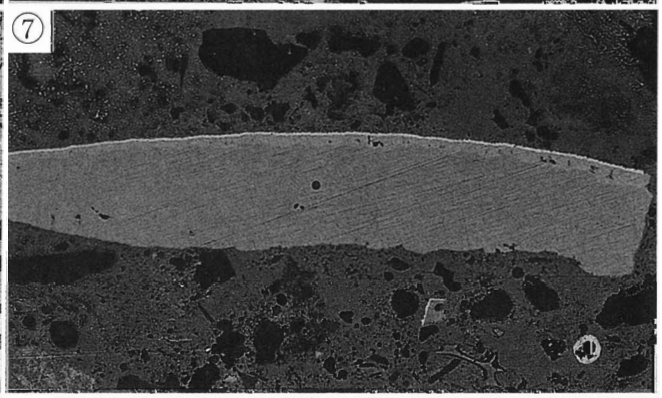


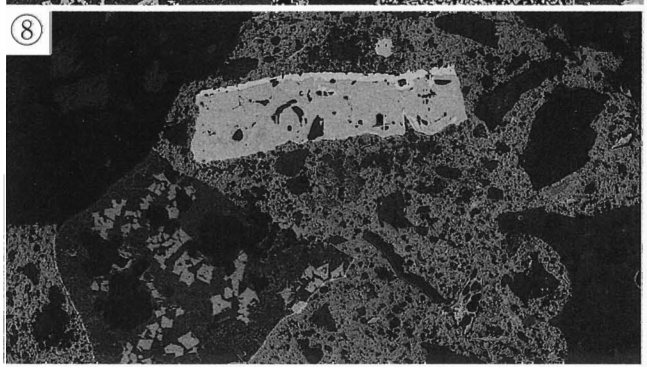












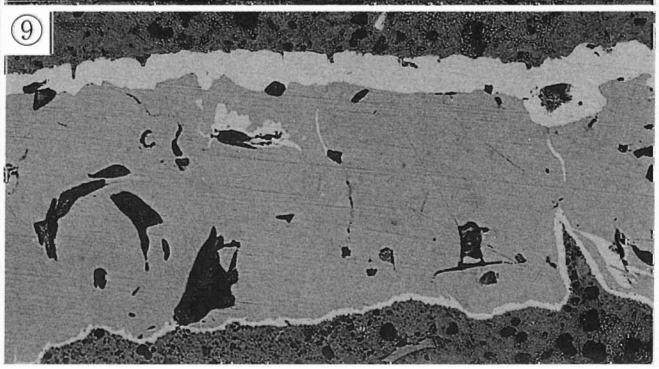
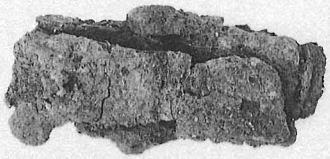
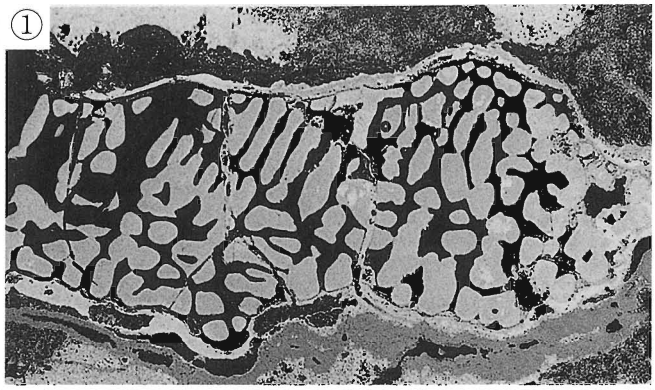


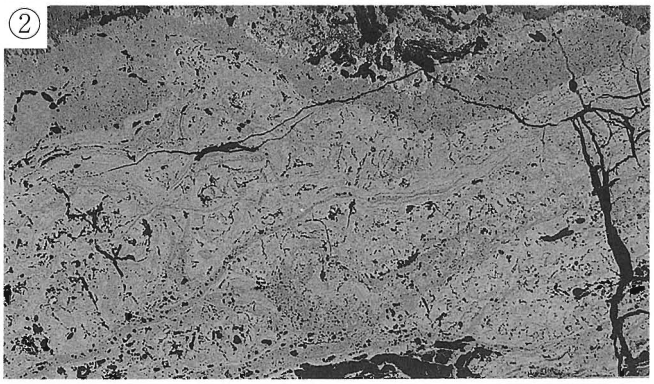
Photo.23 再結合滓の顕微鏡組織

（27）DAN-27
鉄器（クサビ状）

①×400 ヴスタイト
②×100 ③×400
銹化鉄・フェライト・
少量パーライト
亜共析組織痕跡

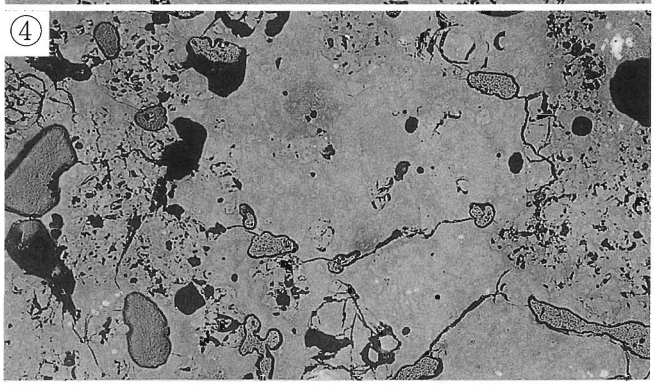


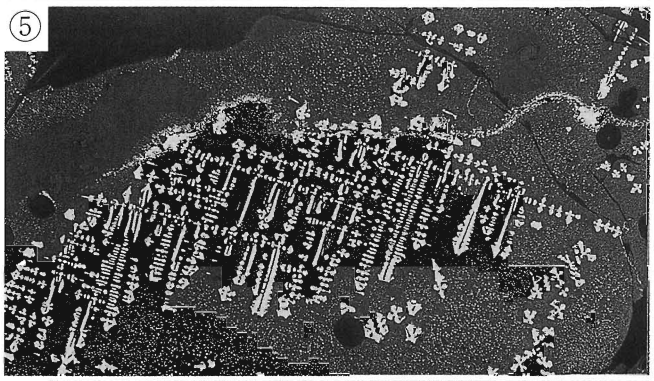


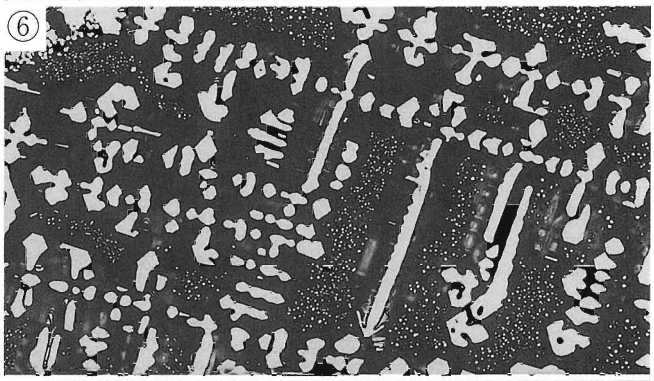


（28）DAN-30
炉壁

④×100 被熱胎土：粘土
鉱物非晶質化
⑤×100 ⑥×400
暗黒色ガラス質滓中の
ウルボスピネル
⑦×400 胎土中の混入砂鉄
⑧×400 暗黒色ガラス質滓中の
微細なマグネタイトか







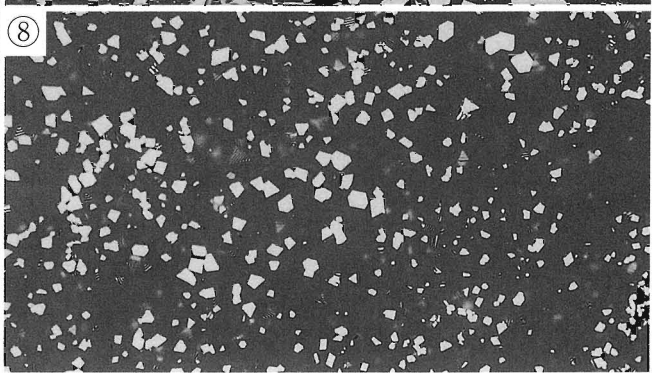
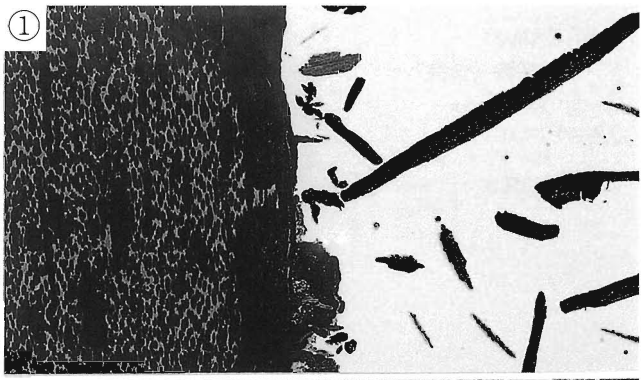
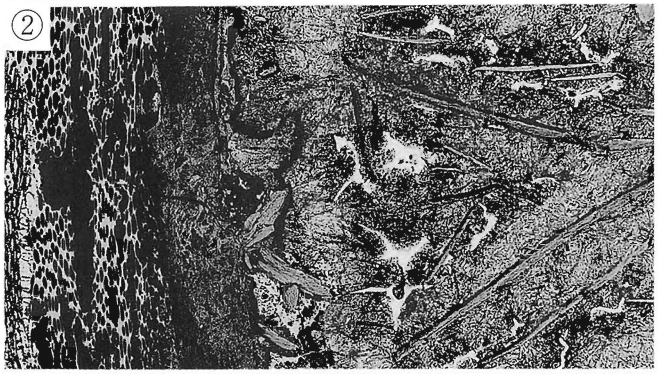


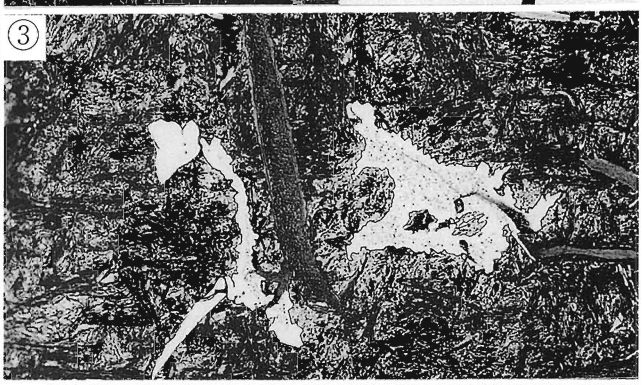
Photo.24　鉄器・炉壁の顕微鏡組織

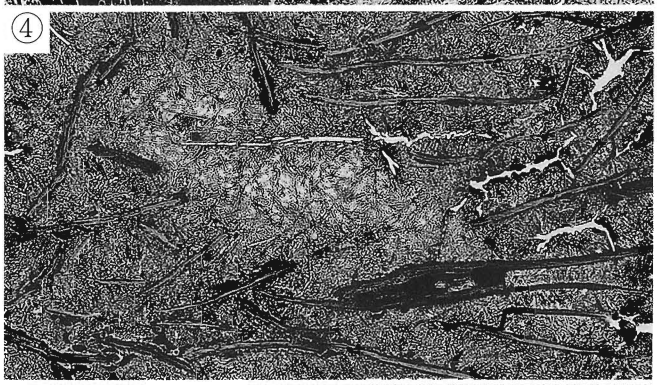
(29) DAN-28
黒鉛化木炭

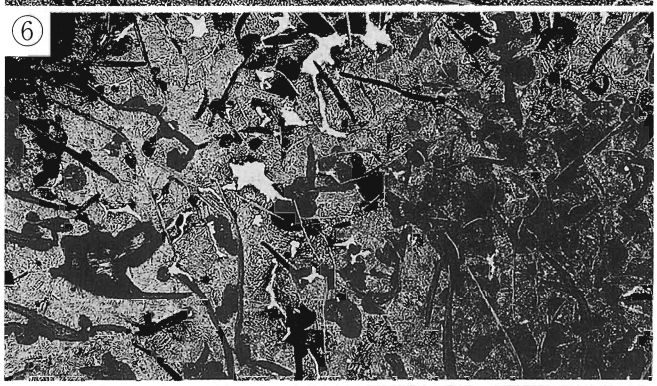
①×100 木炭繊維. 鉄部：黒鉛析出
②～⑨　ナイタルetch
②×100 ③×400 鉄部：ねずみ鋳鉄
基地急冷組織：
マルテンサイト
④×100 ⑤×400 同上
⑥×100 ⑦×400 ねずみ鋳鉄：
基地マルテンサイト・パーライト混在
⑧⑨×200 硬度：⑧544Hv ⑨727Hv











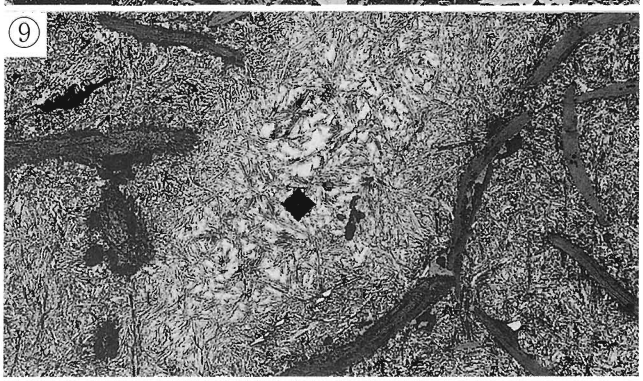
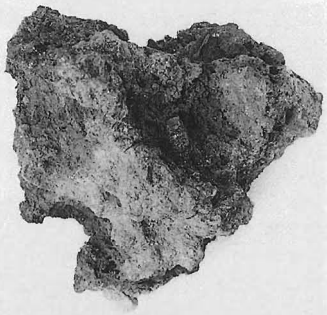
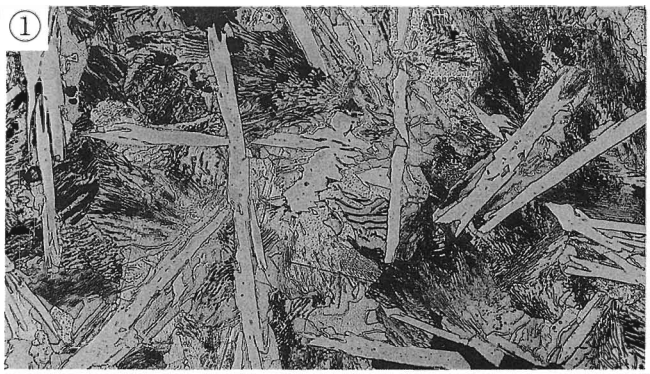


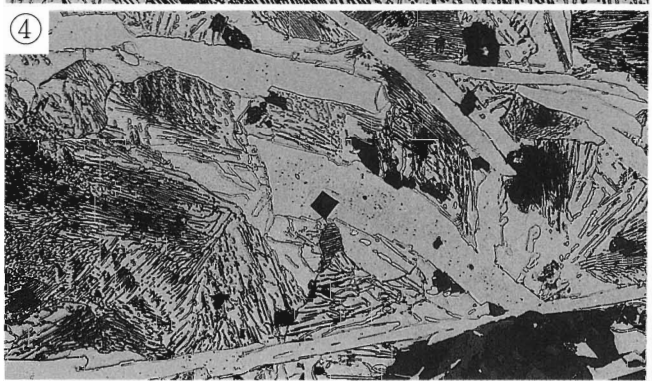
Photo.25 黒鉛化木炭の顕微鏡組織

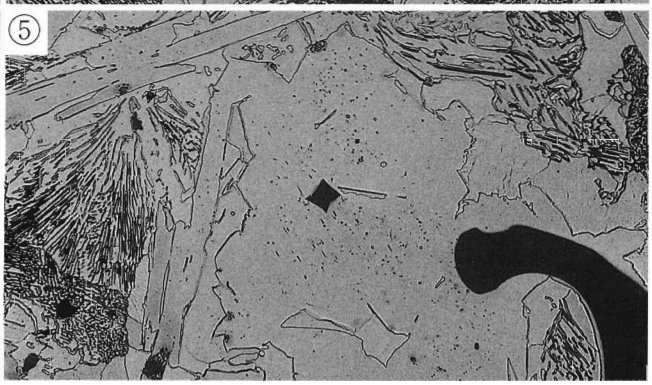
(30) DAN-31
炉底塊（含鉄）

①～⑤　ナイタルetch
①×100 ②×400 セメントタイト・パーライト
③～⑤　硬度圧痕：③190Hv
④105Hv
⑤631Hv



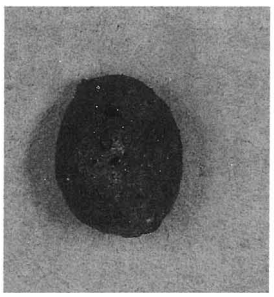


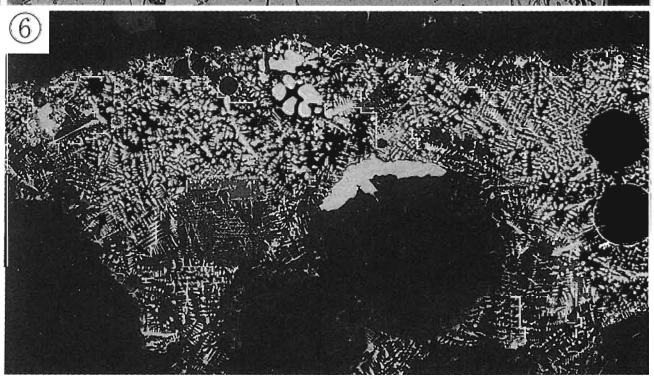


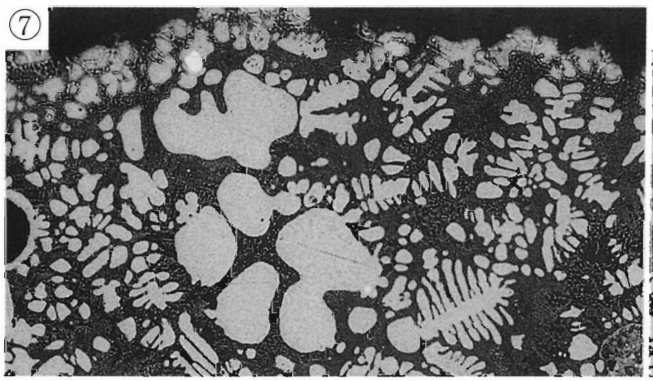


(31) DAN-32-1a
粒状滓

⑥×100 ⑦⑧×400
ヴスタイト・ファイヤライト
ヴスタイト粒内微小析出物







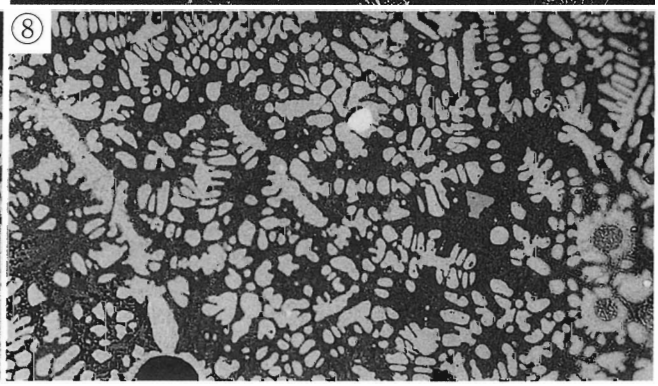
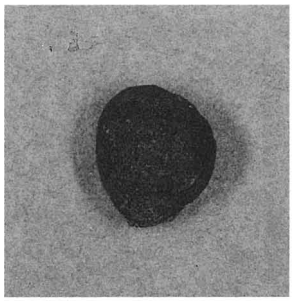
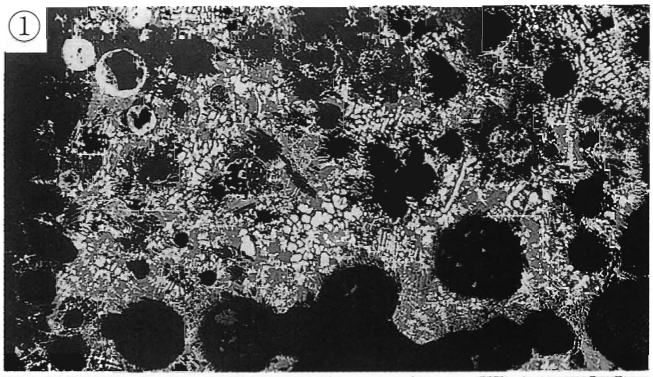


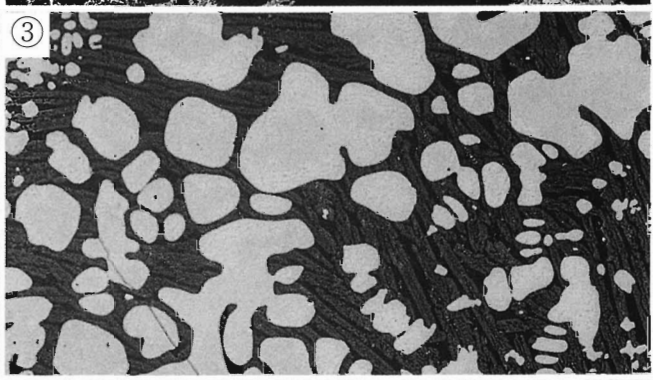
Photo.26 炉底塊・粒状滓の顕微鏡組織

（32）DAN-32-1b
粒状滓

①×50 ②×100 ③×400
ヴスタイト・ファイヤライト
微小銹化鉄粒
ヴスタイト粒内微小析出物

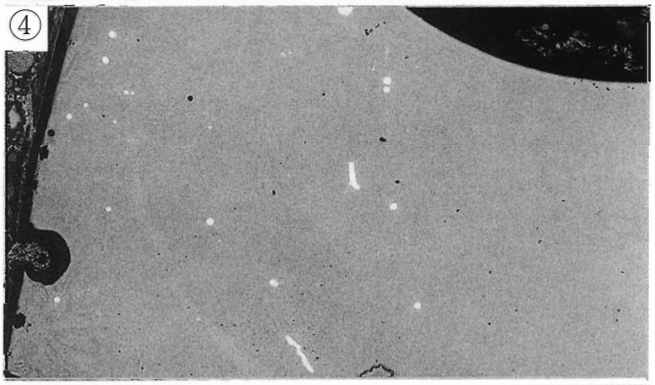


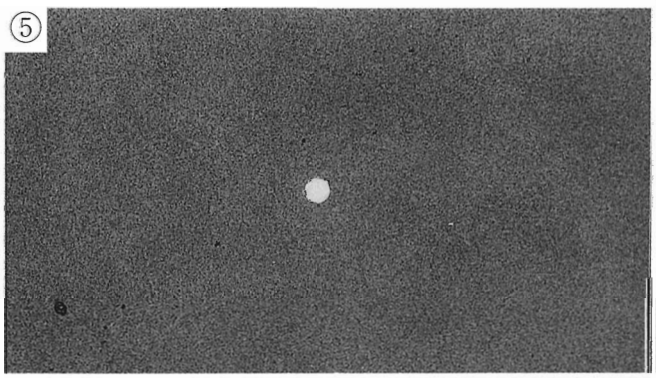


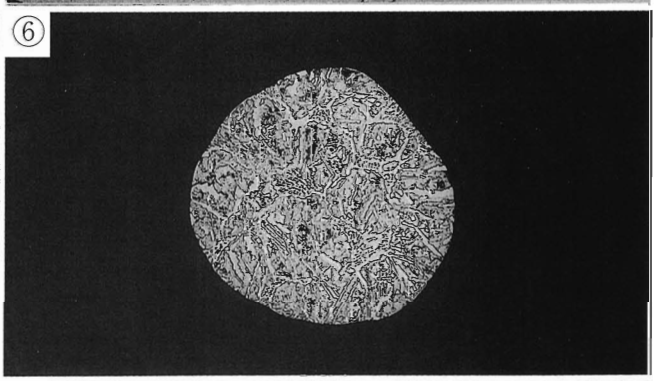


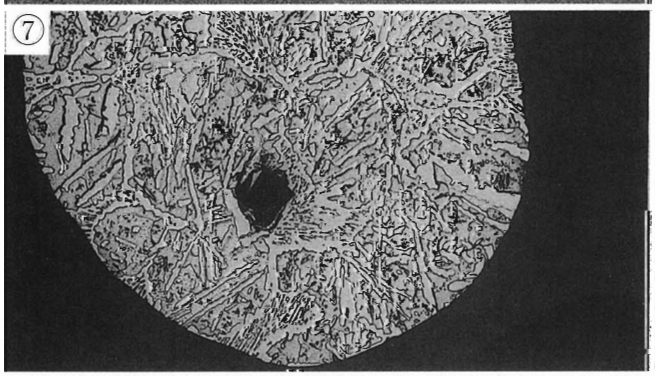
（33）DAN-32-1c
粒状滓

④×100 ⑤×400
ガラス質滓中に
微小金属鉄粒散在
⑥×100 ⑦×200 ⑧×400
ナイタルetch
フェライト基地に
セメントタイト・
レデブライト析出









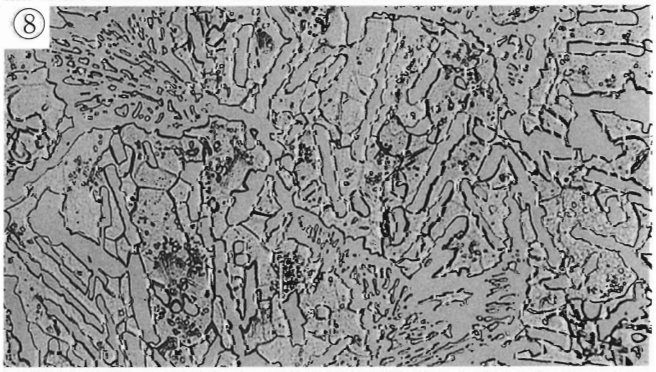
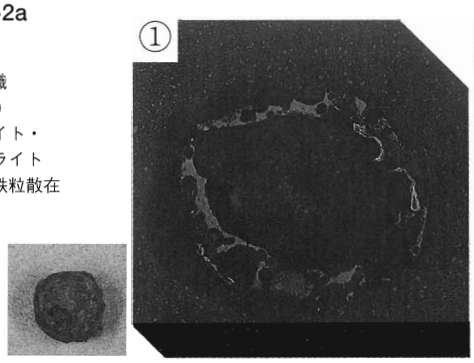
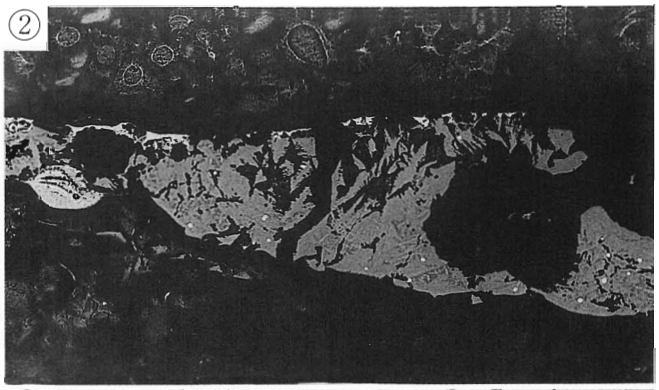


Photo.27 粒状滓の顕微鏡組織

（34）DAN-32-2a
粒状滓

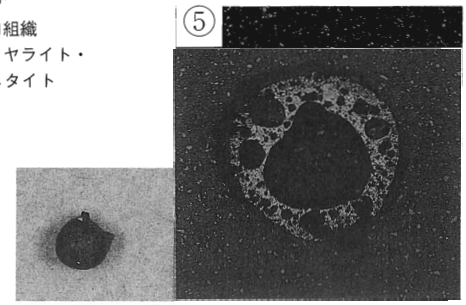
①×10　マクロ組織
②×100 ③④×400
マグネタイト・
ファイヤライト
微小金属鉄粒散在

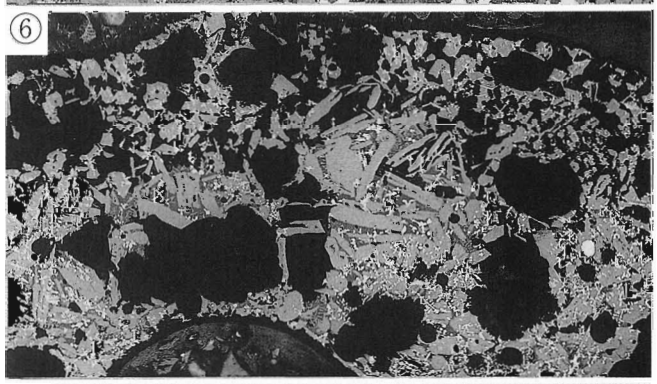




（35）DAN-32-2b
粒状滓

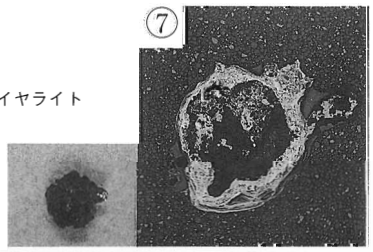
⑤×10　マクロ組織
⑥×100 ファイヤライト・
マグネタイト

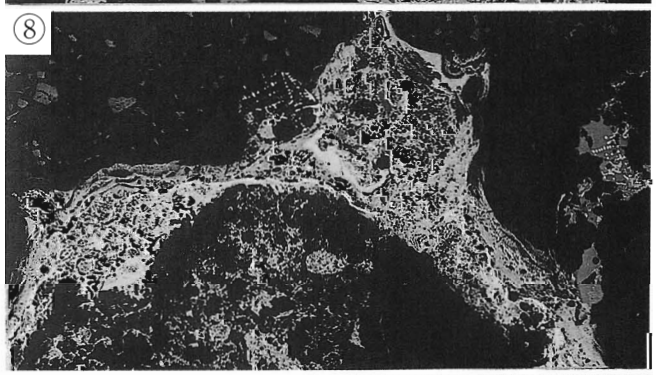


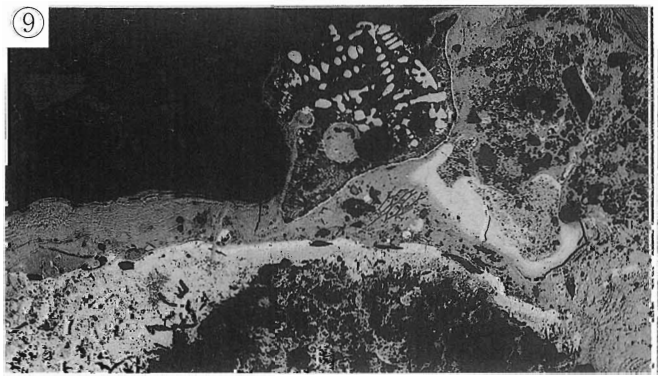


（36）DAN-32-2c
銹化鉄粒

⑦×10　マクロ組織
⑧×50　⑨×100 ⑩×400
銹化鉄
表層滓片付着：
ヴスタイト・ファイヤライト







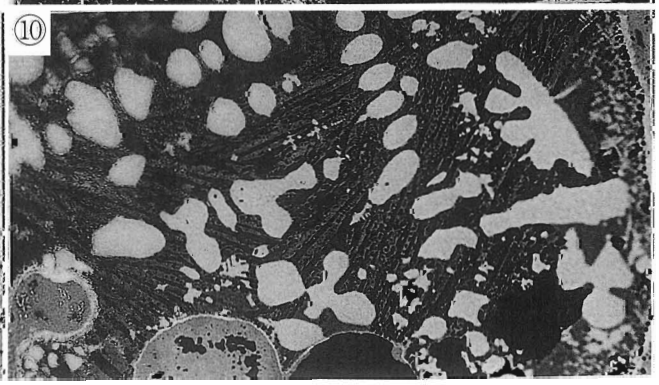
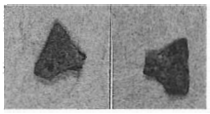
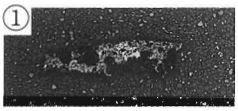


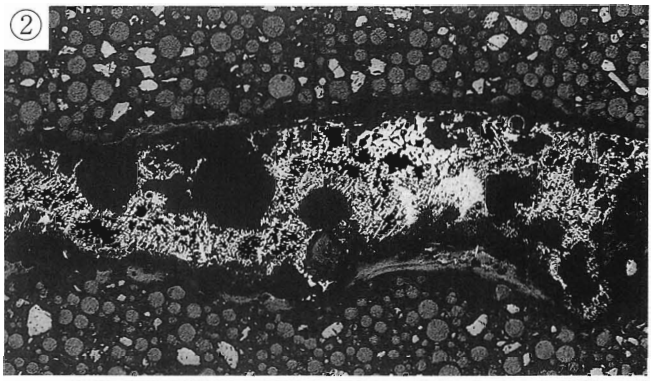
Photo.28　粒状滓の顕微鏡組織

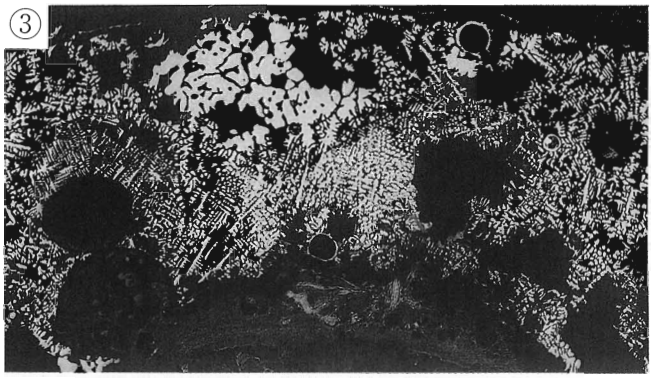
（37）DAN-33-3a①
鍛造剥片

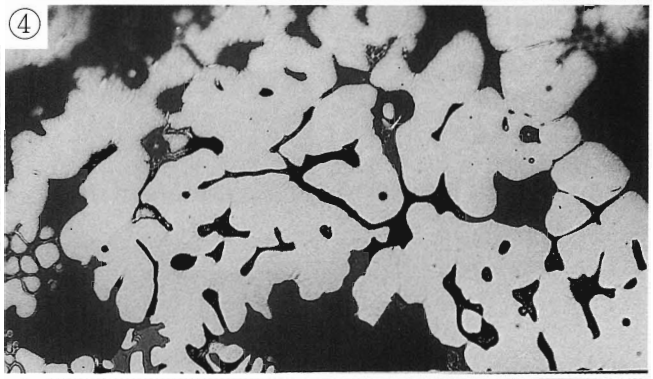
①×10　マクロ組織
②×50　③×100 ④×400
ヴスタイト（内層）
外層・中間層不明瞭
鍛打前半派生物か





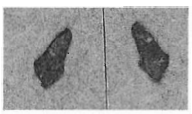


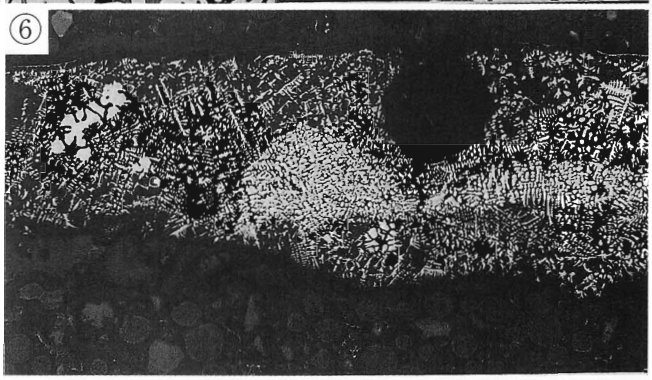




（38）DAN-33-3a②
鍛造剥片

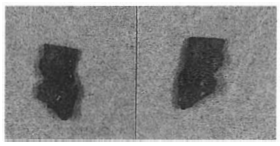
⑤×10　マクロ組織
⑥×100 ヴスタイト（内層）
外層・中間層不明瞭
鍛打前半派生物か

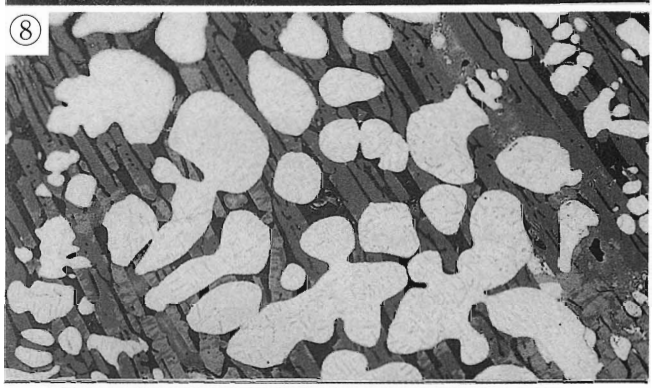




（39）DAN-33-3b
鍛造剥片？

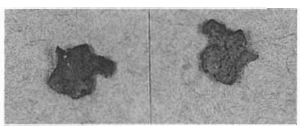
⑦×10　マクロ組織
⑧×400 ヴスタイト・
ファイヤライト
ヴスタイト粒内微小析出物
鍛冶滓の皮の可能性
（ファイヤライト結晶明瞭）

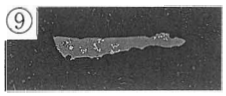




（40）DAN-33-3c
鍛造剥片

⑨×10　マクロ組織
⑩×100 ヴスタイト（内層）
外層・中間層不明瞭





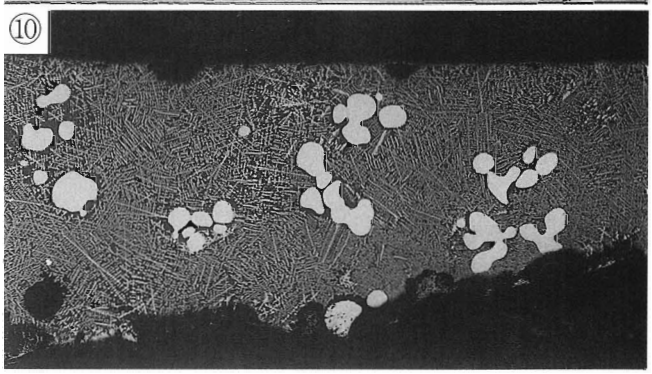
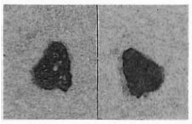
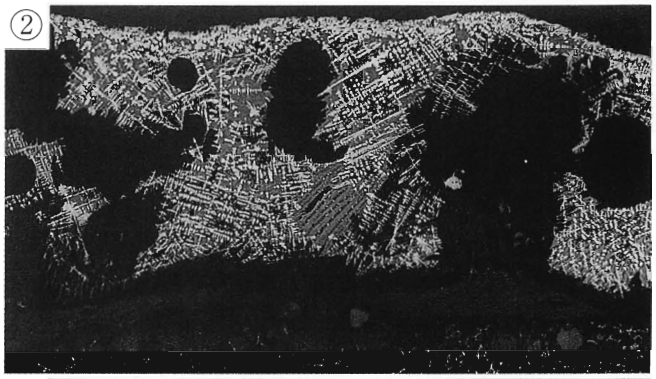


Photo.29　鍛造剥片の顕微鏡組織

（41）DAN-33-4a
鍛造剥片？

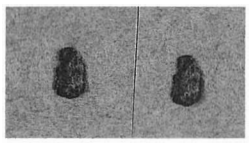
①×10　マクロ組織
②×100 ヴスタイト・
ファイヤライト
鍛冶滓の皮の可能性

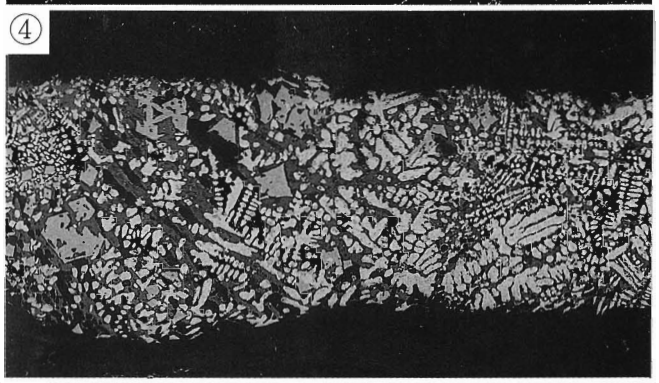


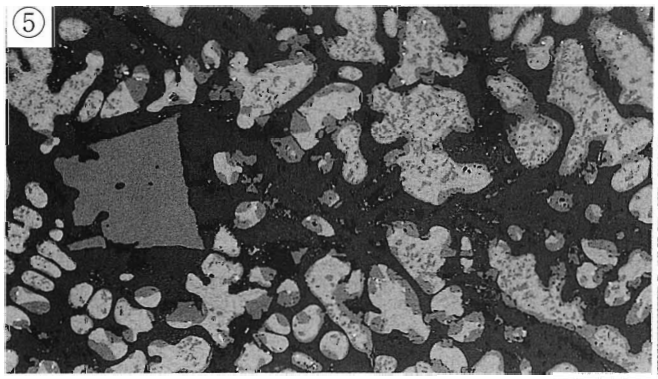


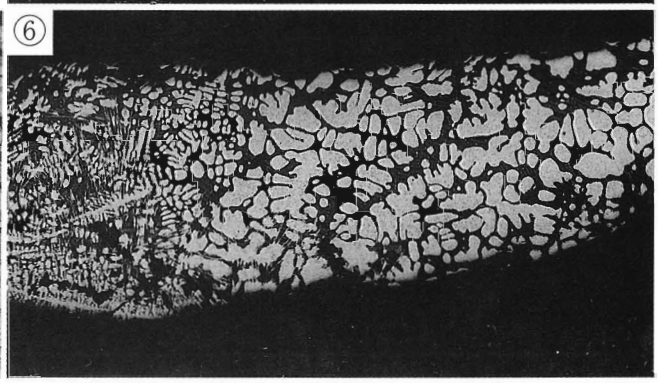
（42）DAN-33-4b
鍛造剥片？

③×10　マクロ組織
④×100 ⑤×400
ヴスタイト（粒内析出物）・
ウルボスピネル・
ファイヤライト
精錬鍛冶滓の皮か



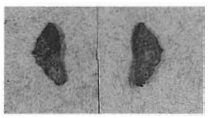


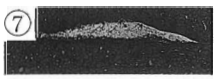


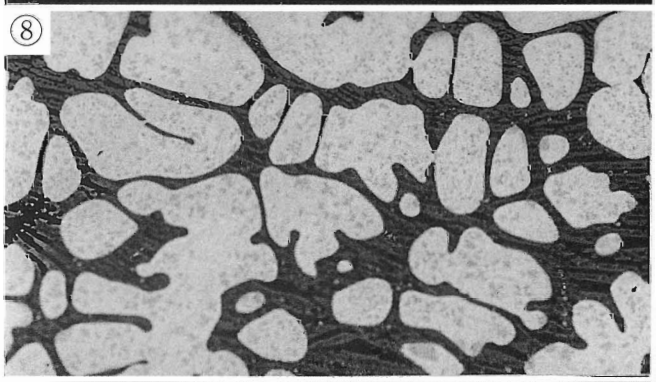


（43）DAN-33-4C
鍛造剥片？

⑦×10　マクロ組織
⑥×100 ⑧×400
ヴスタイト（粒内析出物）・
ファイヤライト
鍛冶滓の皮か







（44）DAN-33-4d
鍛造剥片

⑨×10　マクロ組織
⑩×100 内層ヴスタイト非晶質
外層・中間層不明瞭

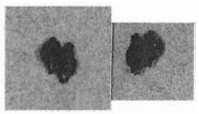
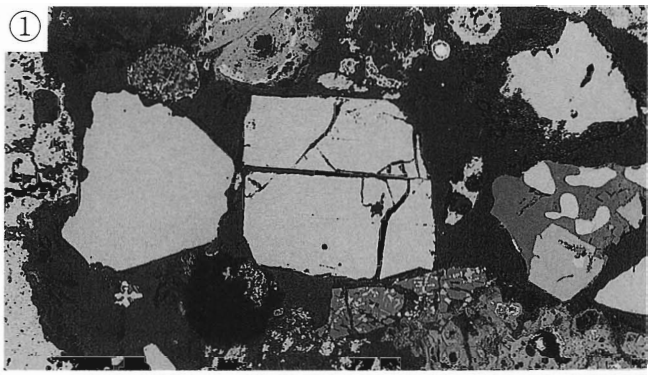
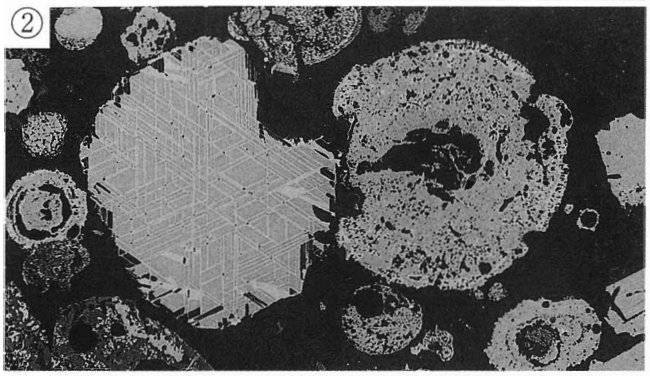


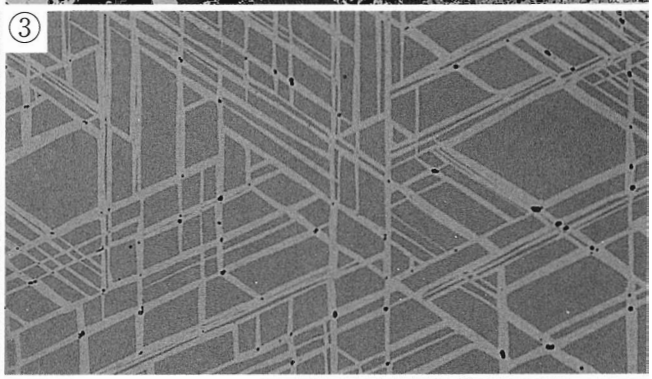
Photo.30　鍛造剥片の顕微鏡組織（疑似鍛造剥片を含む）

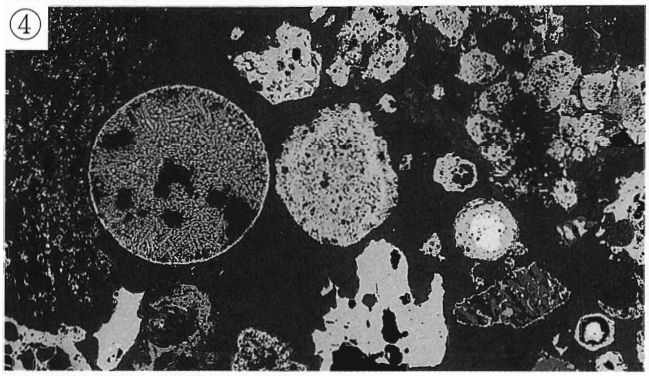
（45）DAN-34 ①
砂鉄混在物

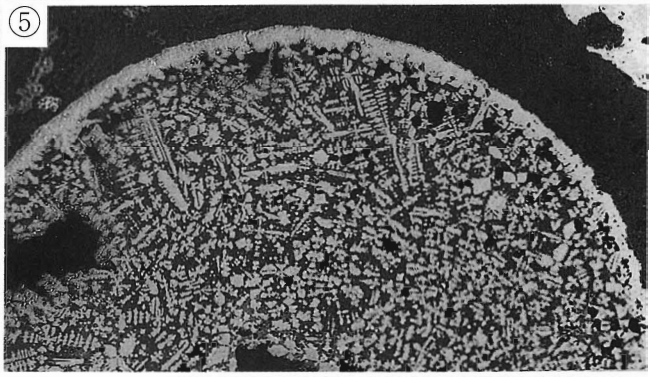
①×50　白色粒：磁鉄鉱粒子
②×100 ③×400
格子組織：チタン鉄鉱
④×100 ⑤×400 粒状滓
ウルボスピネル
ないしはマグネタイト
⑥×100 ⑦×400
銹化鉄粒？
⑧×100 ⑨×400
鍛造剥片

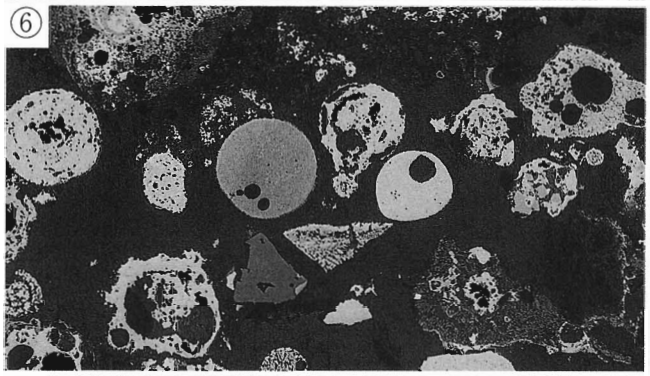


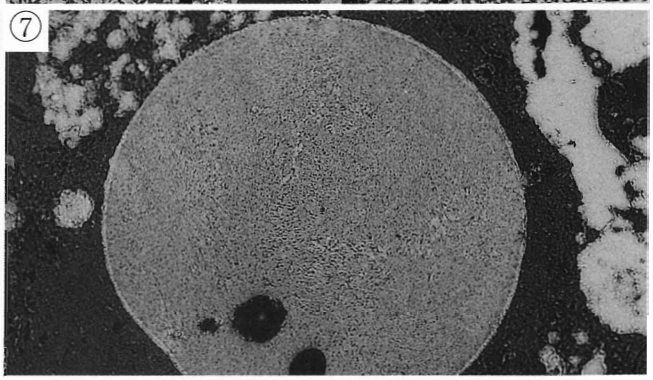


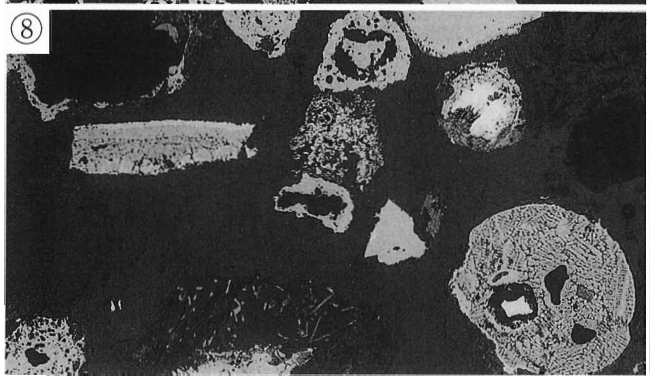












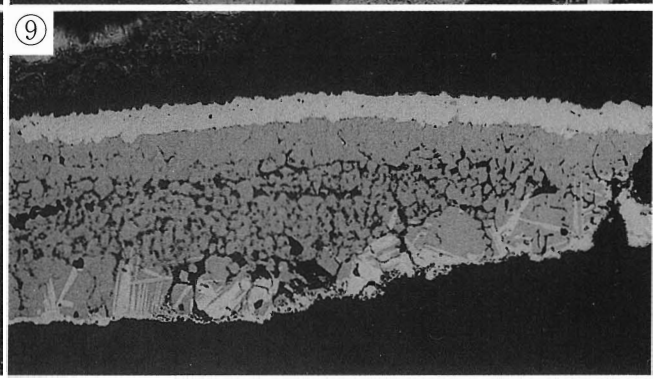
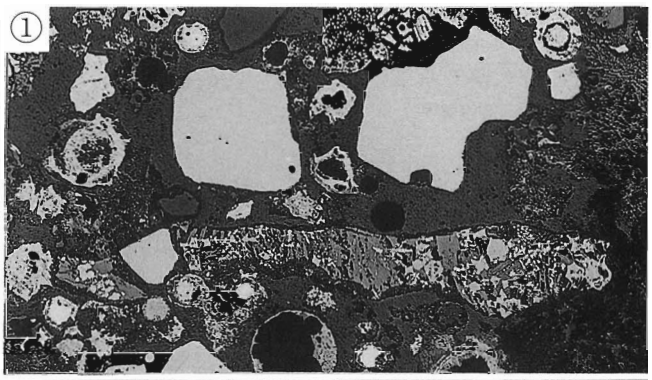
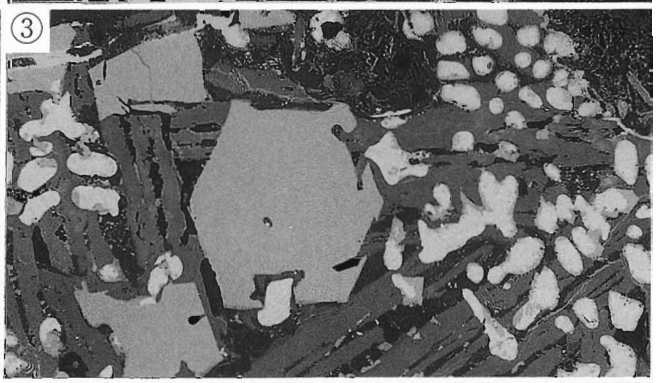


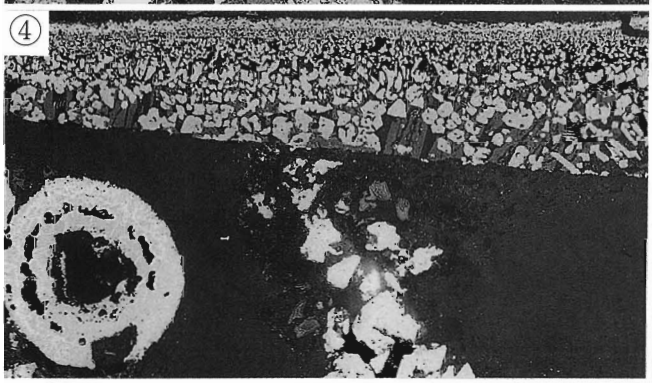
Photo.31　砂鉄混在物の顕微鏡組織

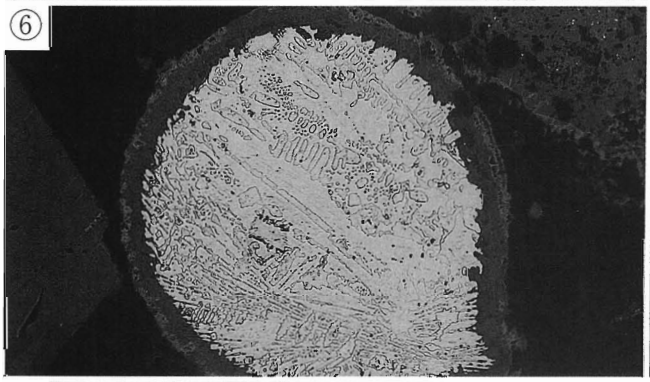
（45'）DAN-34②
砂鉄混在物

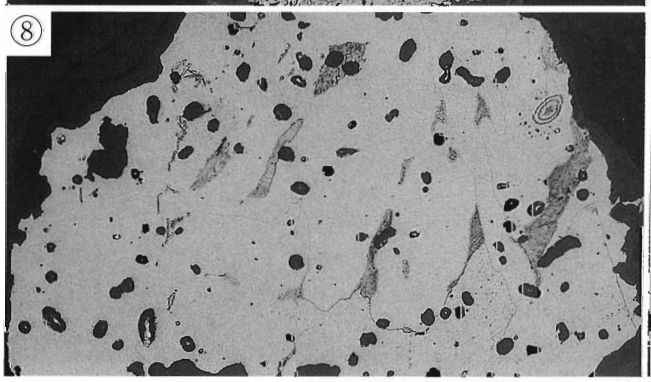
①×50 ②×100 ③×400
滓片：ウルボスピネル・
ヴスタイト・ファイヤライト
④×200 鍛造剥片？
⑤×400 金属鉄粒 黒鉛析出
⑥～⑨×400：金属鉄粒
ナイタルetch
⑥⑦：白鋳鉄組織
⑧：フェライト・少量パーライト
⑨：フェライト











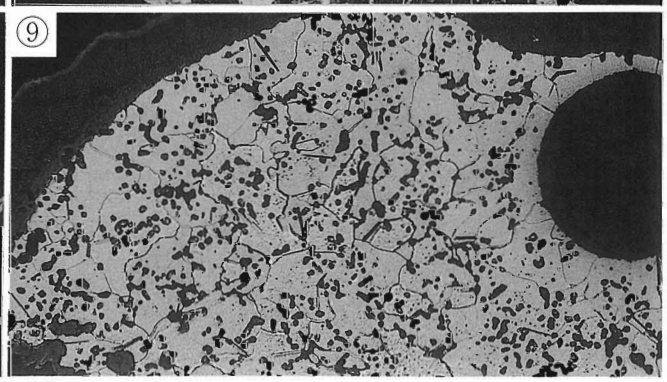
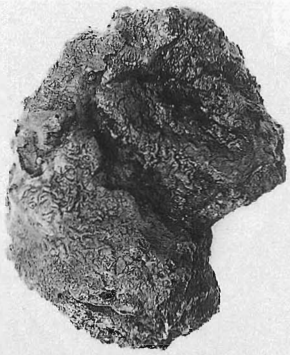
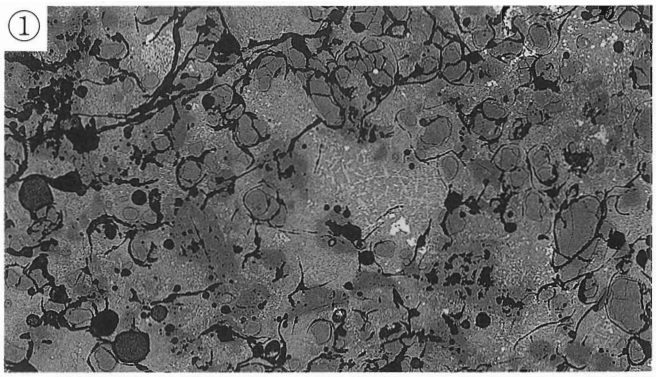


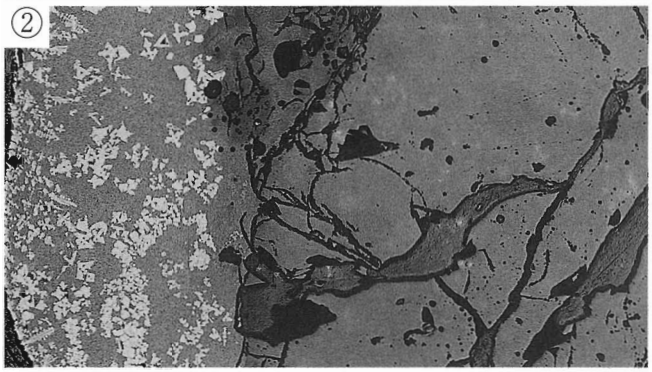
Photo.32 砂鉄混在物の顕微鏡組織

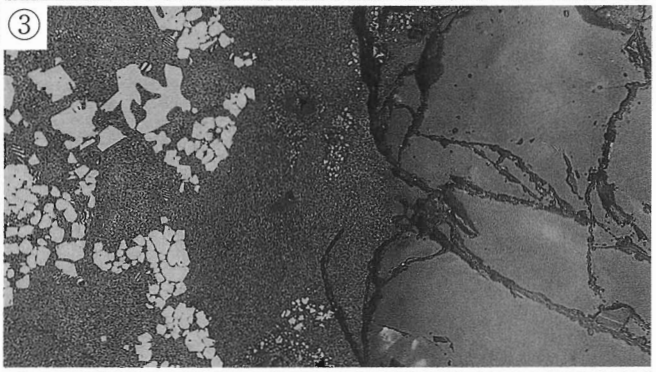
（46）DAN-35
炉壁

①×100 暗黒色ガラス質滓中の
微小析出物
②×100 ③×400
内面表層：
ガラス質滓中に
ウルボスピネル晶出



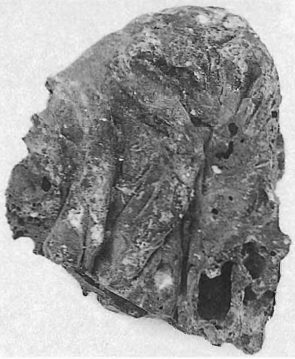


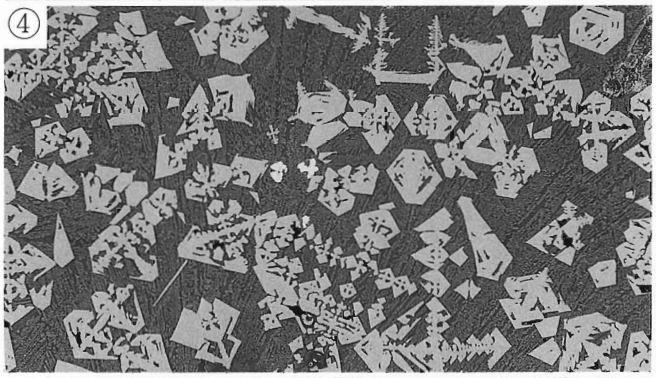




（47）DAN-36
流出滓

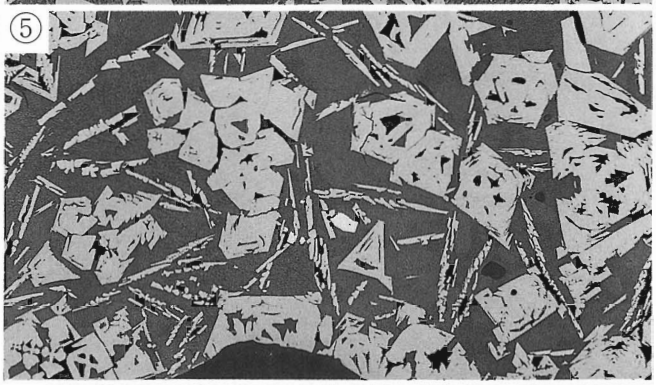
④×100 ウルボスピネル・
ファイヤライト
微小金属鉄粒晶出

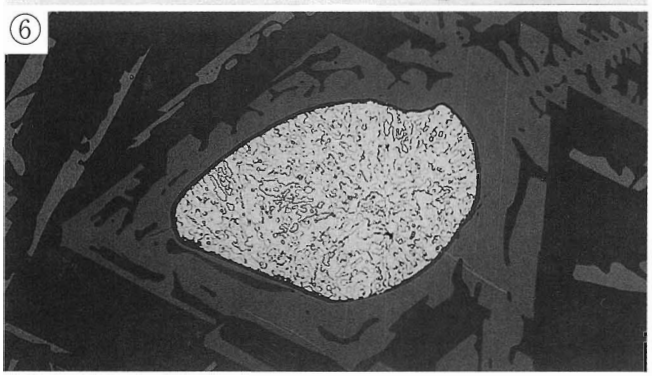




（48）DAN-37
流出滓

⑤×100 ウルボスピネル・
イルミナイト・
ファイヤライト
⑥⑦×400 ナイタルetch
中央：微小金属鉄粒
セメンタイト・
フェライト





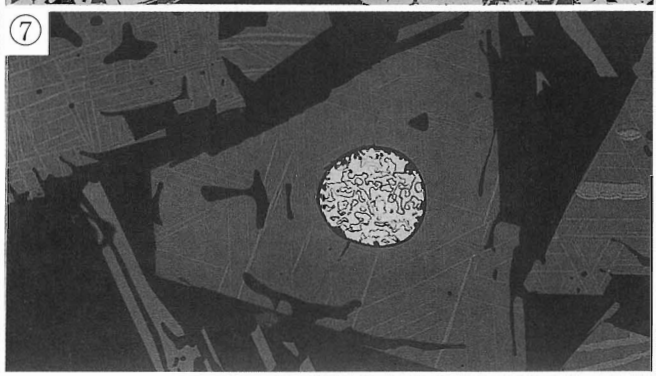
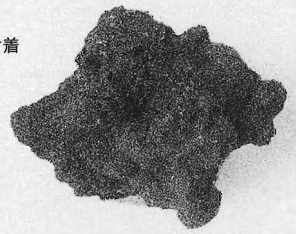
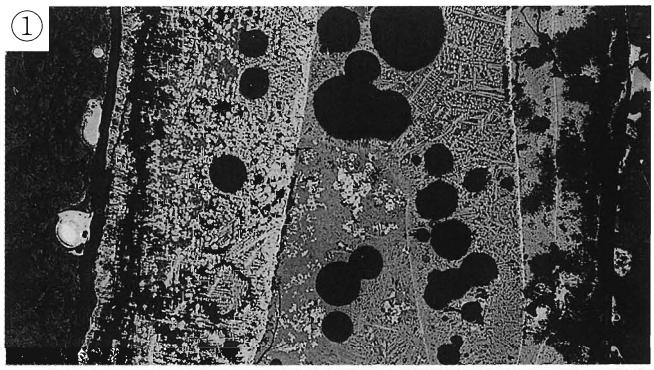


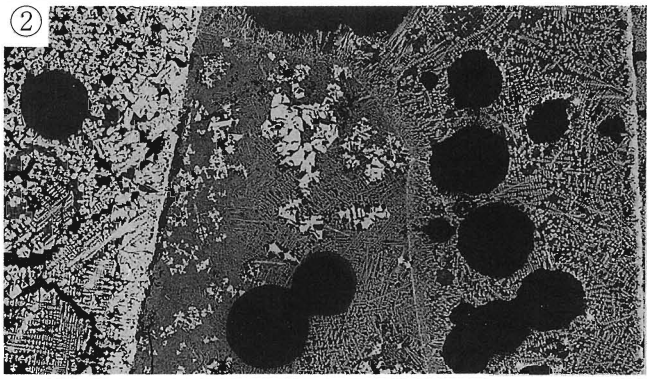
Photo.33　炉壁・流出滓の顕微鏡組織

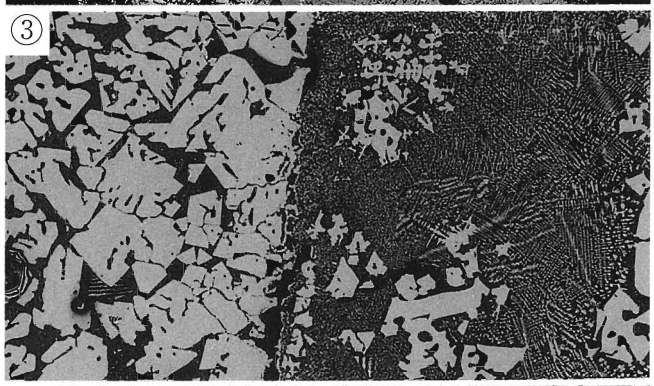
(49) DAN-38
含鉄鉄滓

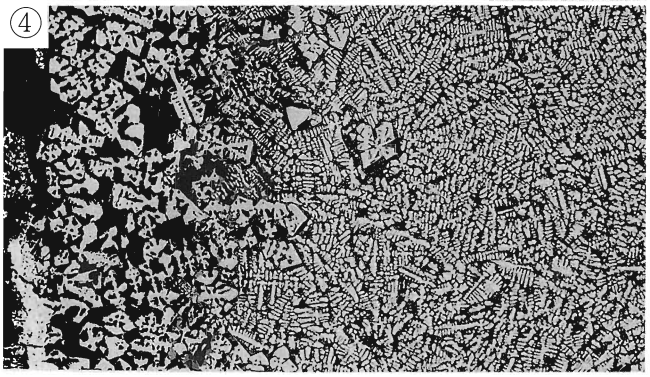
①×50 ②×100 ③×400 表層砂鉄付着
ウルボスピネル
ファイヤライト
④×100 ⑤×400
ウルボスピネル・
ヴスタイト・
ファイヤライト
鉄滓 3 層重なり

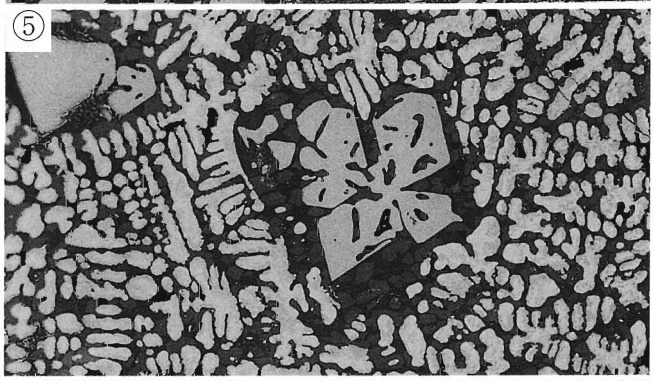






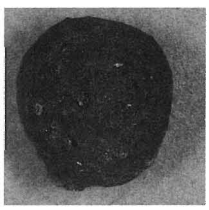


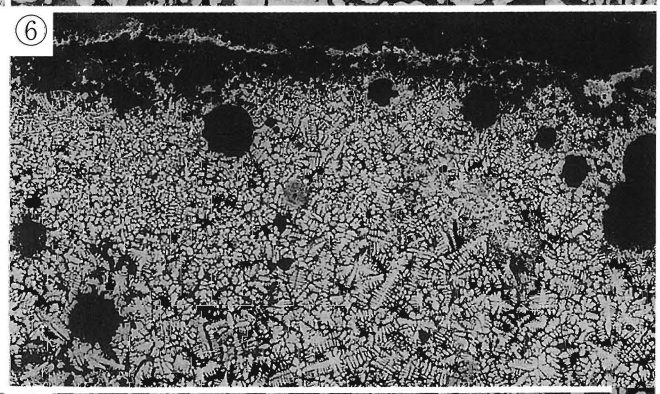


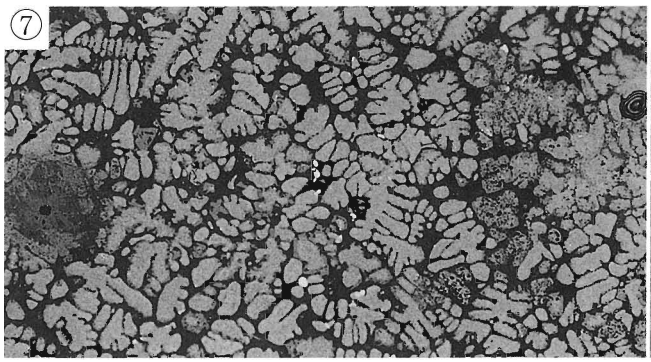


(50) DAN-39-1a
粒状滓様遺物

⑥×100 ⑦×400
ヴスタイト
(粒内析出物あり)
⑧×400 ウルボスピネル・ヴスタイト







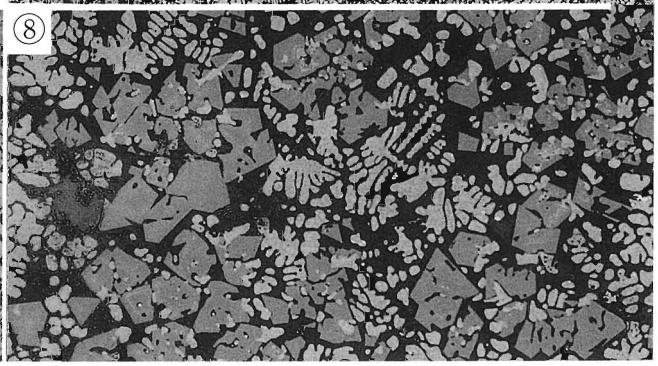
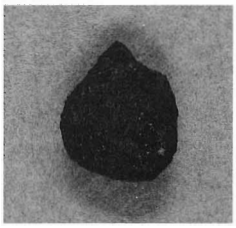
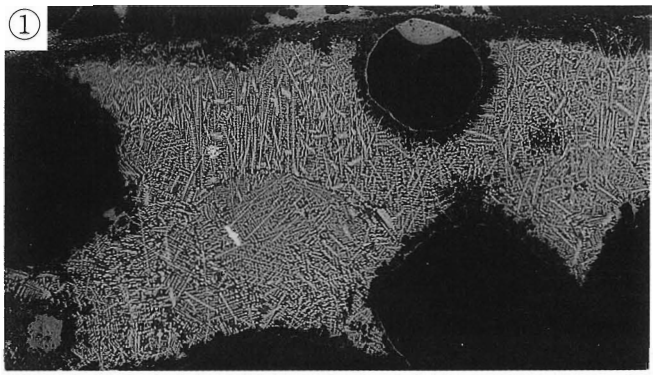


Photo.34 含鉄鉄滓・粒状滓の顕微鏡組織

（51）DAN-39-1 b
粒状滓

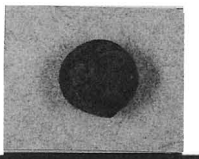
①×100
ヴスタイト・ファイヤライト

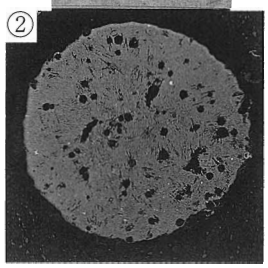


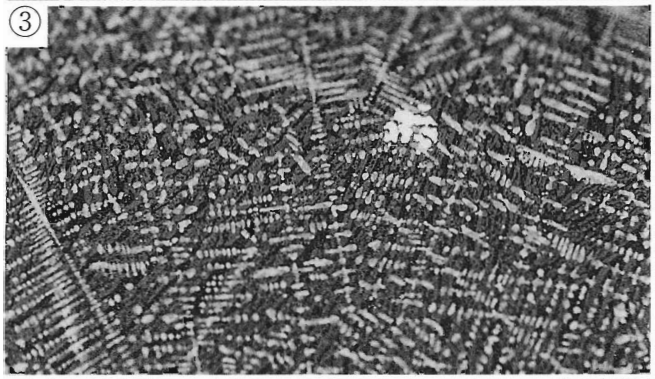


（52）DAN-39-2 a
粒状滓

②×10　マクロ組織
③×400 ヴスタイト・ファイヤライト
微小金属鉄粒

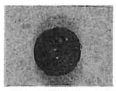


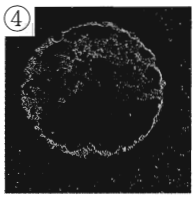


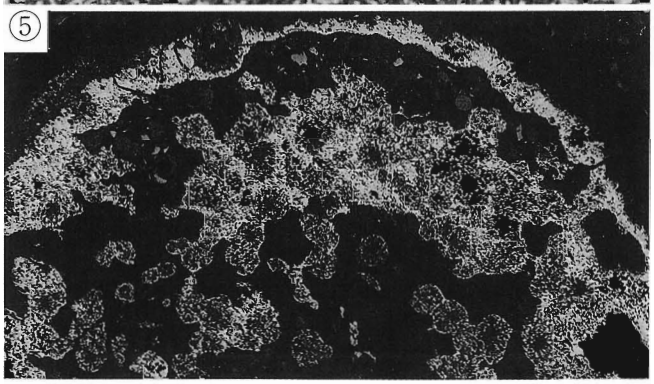


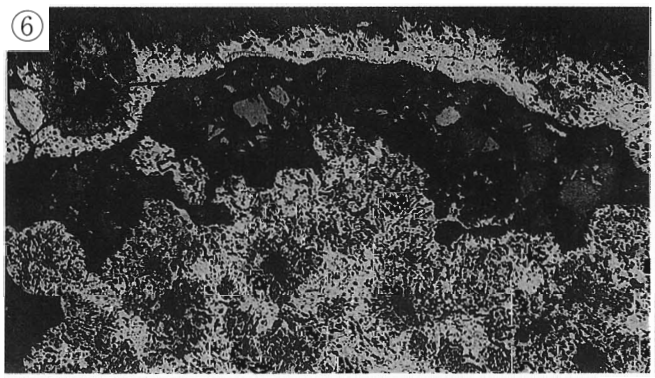
（53）DAN-39-2 b
銹化鉄粒

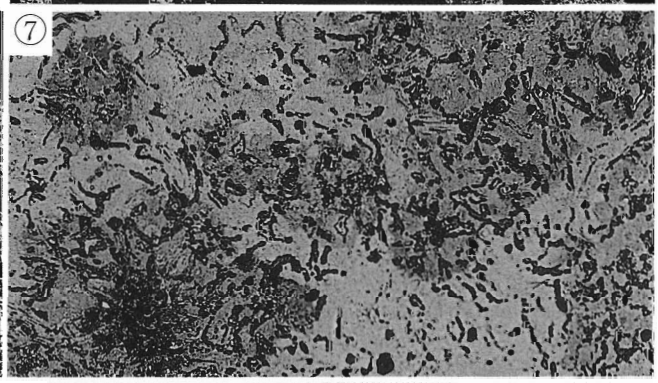
④×10　マクロ組織
⑤×50 ⑥×100 ⑦×400
銹化鉄
片状黒鉛・パーライト痕跡





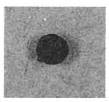


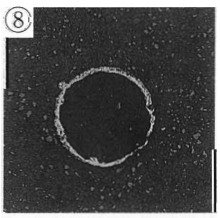




（54）DAN-39-3 a
銹化鉄粒

⑧×10　マクロ組織
⑨×400 銹化鉄：パーライト痕跡





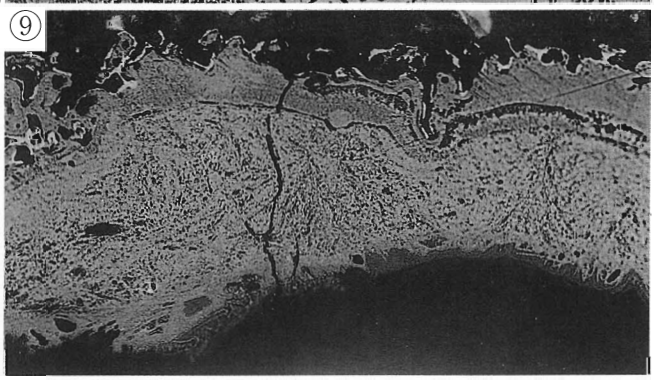
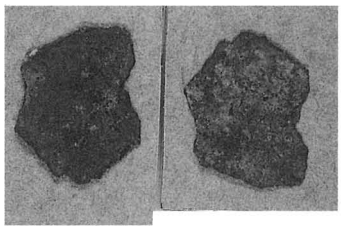
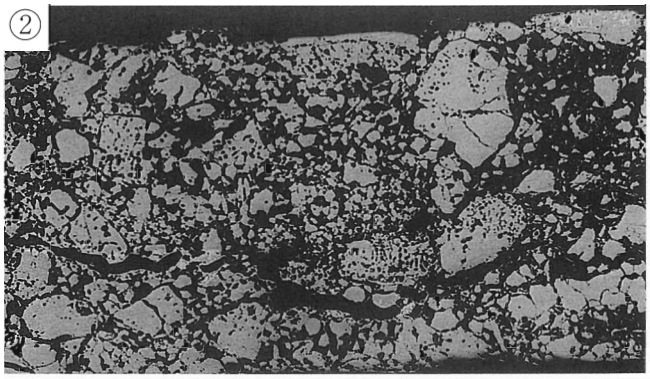


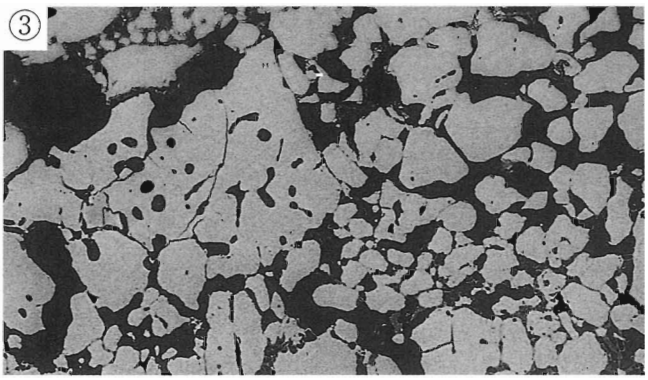
Photo.35　粒状滓の顕微鏡組織

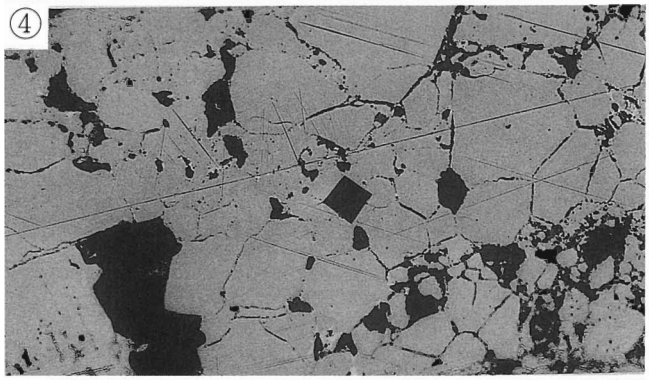
(55) DAN-40-1 a
鍛造剥片？

①×10　マクロ組織
②×100 ③×400
ヴスタイト凝集
④×200 硬度圧痕：350Hv
（軟質、誤差あり不採用）



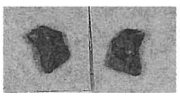


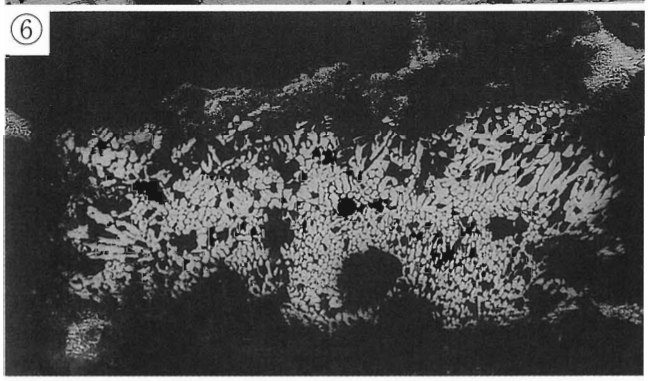




(56) DAN-40-2 a
鍛造剥片？

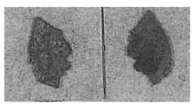
⑤×10　マクロ組織
⑥×100 ヴスタイト凝集
外層・中間層不明瞭

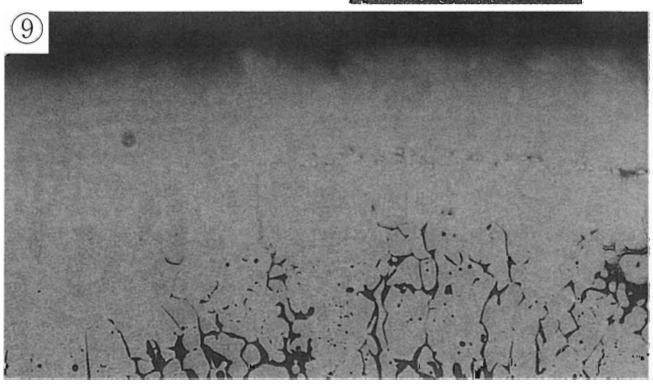




(57) DAN-40-3 a
鍛造剥片

⑦×10　マクロ組織
⑧×100 ⑨×400
ヴスタイト凝集
⑩×200 硬度圧痕：
測定値：記載もれ
（圧痕サイズから450Hv前後が想定される）





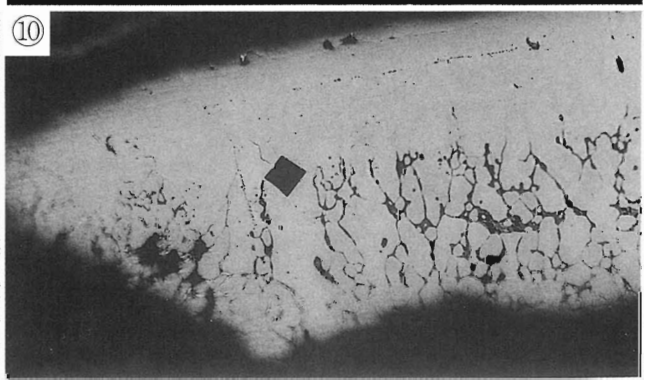
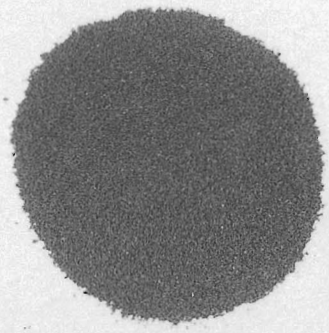
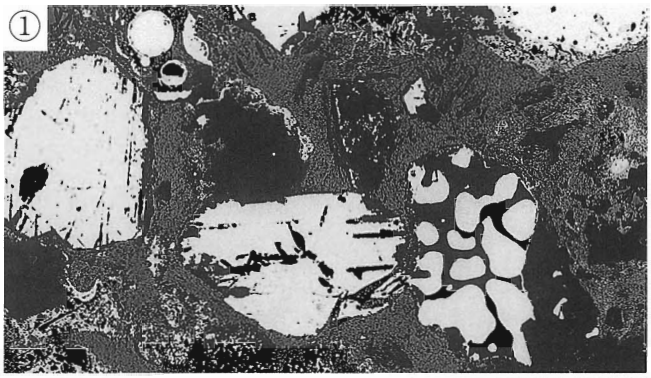


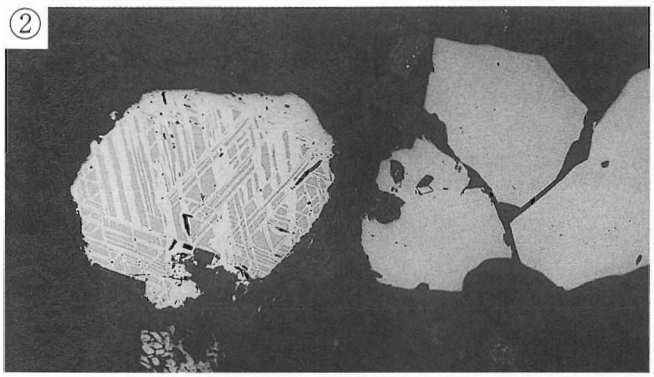
Photo.36　鍛造剥片の顕微鏡組織

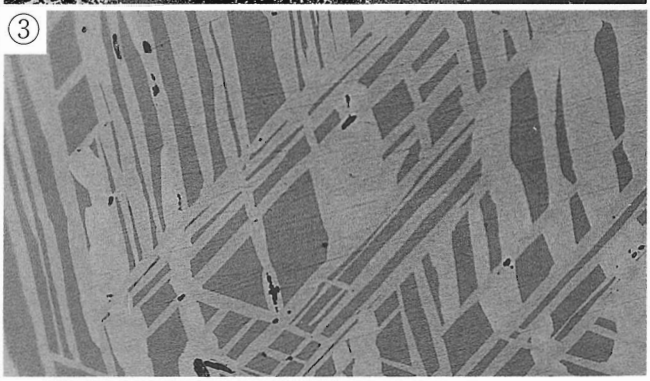
(58) DAN-41
砂鉄混在物

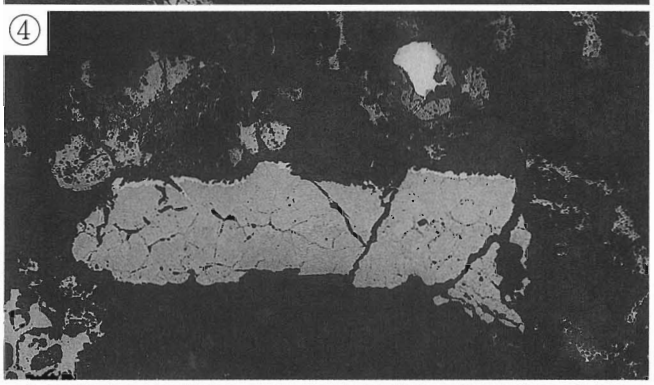
①×100 白色粒：磁鉄鉱
②×100 ③×400
格子組織：チタン鉄鉱
④×100 ⑤×400
鍛造剥片か
⑥～⑨×400
金属鉄粒：ナイタルetch
⑥・⑦ 白鋳鉄組織
⑧×400 フェライト・セメンタイト
⑨×400 フェライト

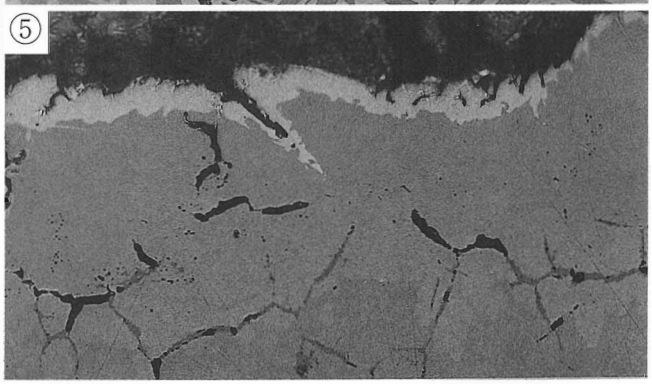


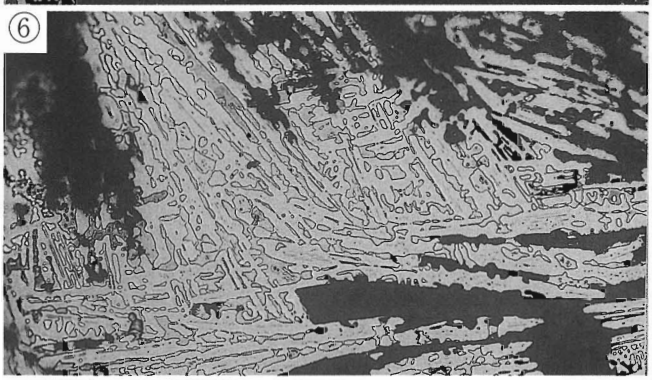


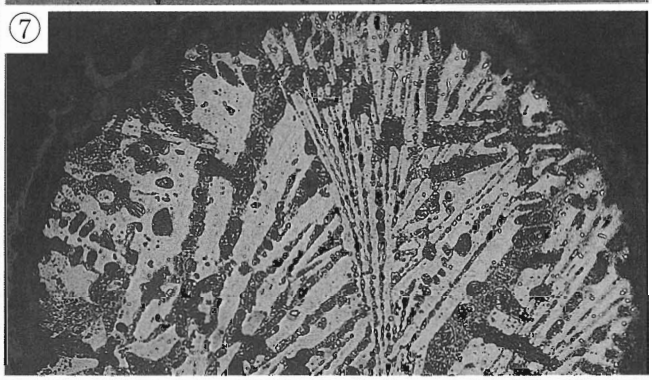


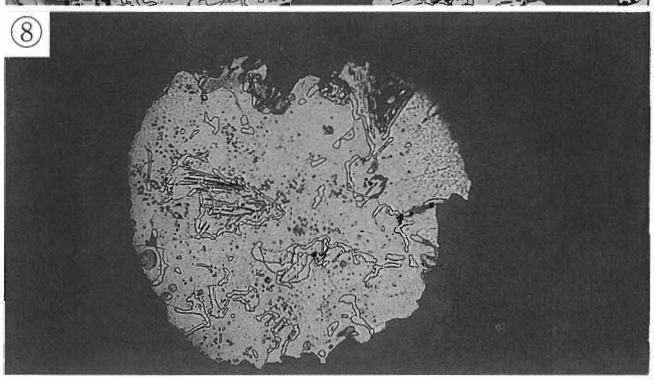












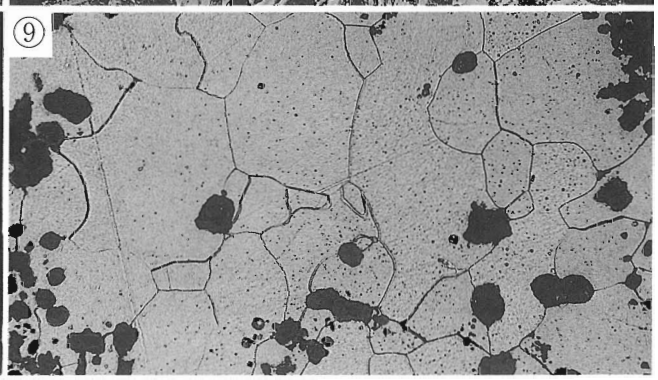
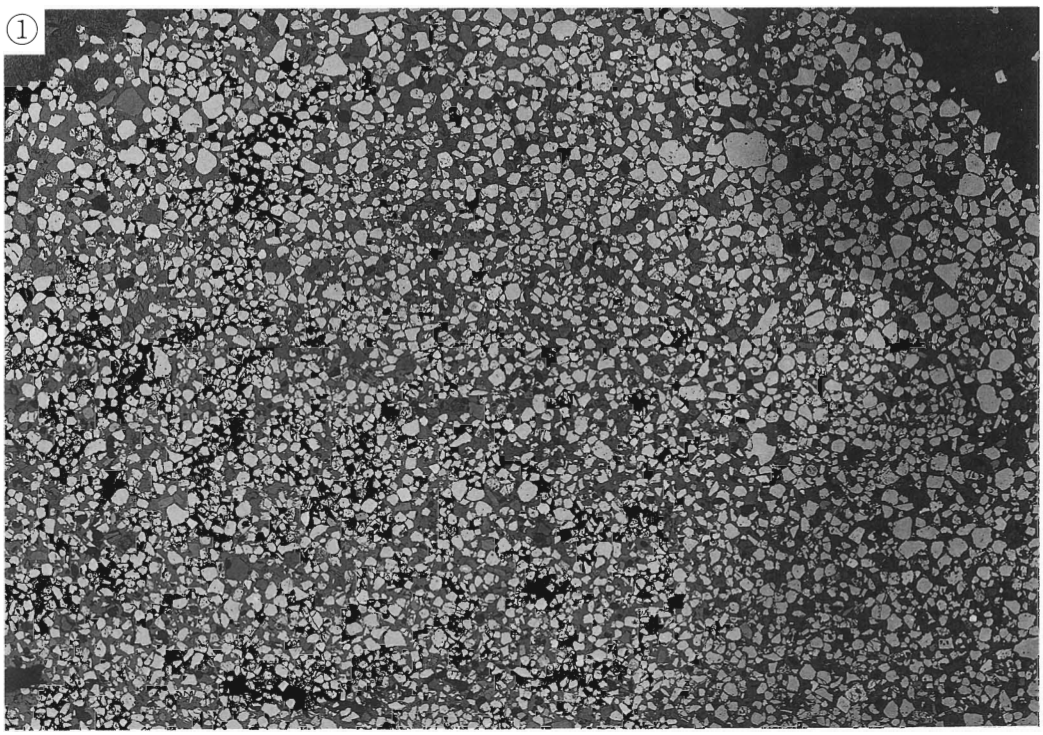
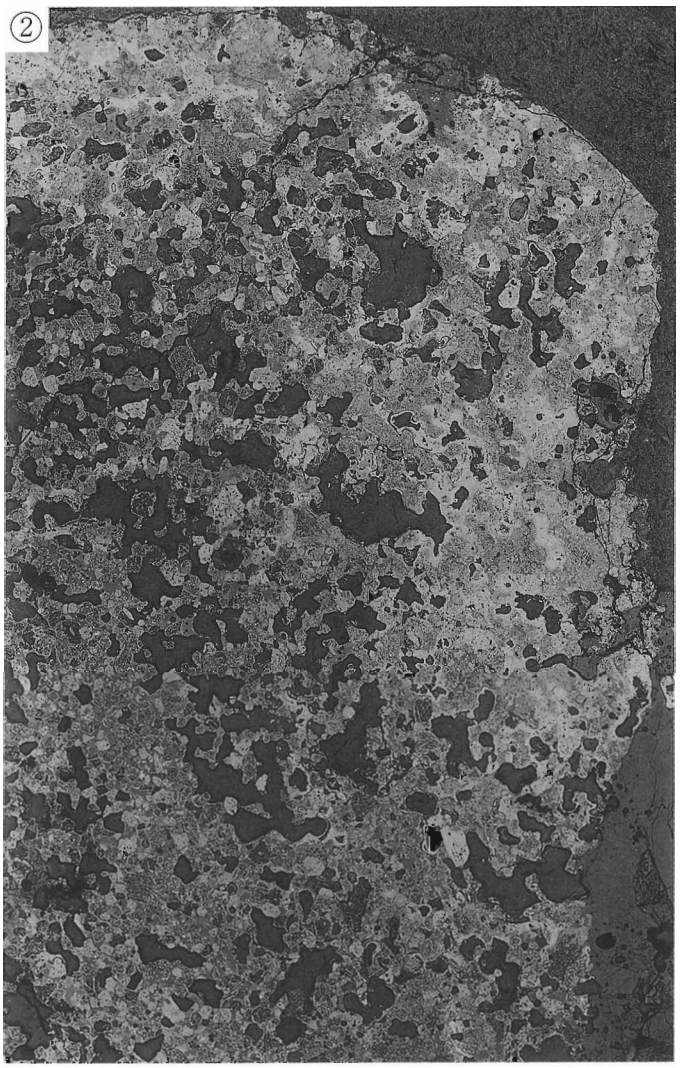


Photo.37　砂鉄混在物の顕微鏡組織





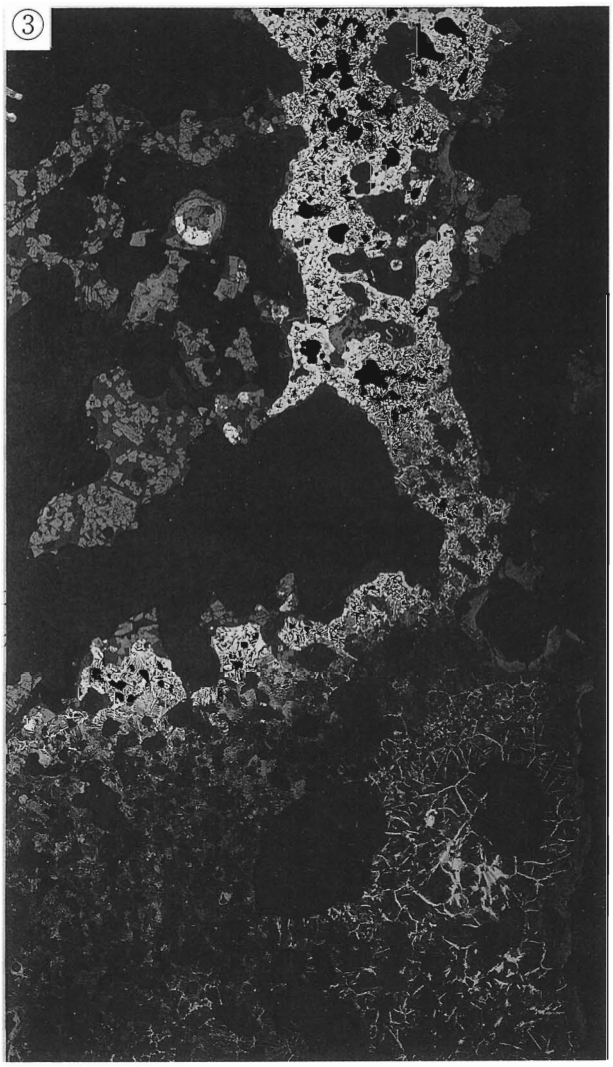


Photo.38　マクロ組織（×10）①DAN-3　②DAN-4　③DAN-11　（①～③：90%に縮小）

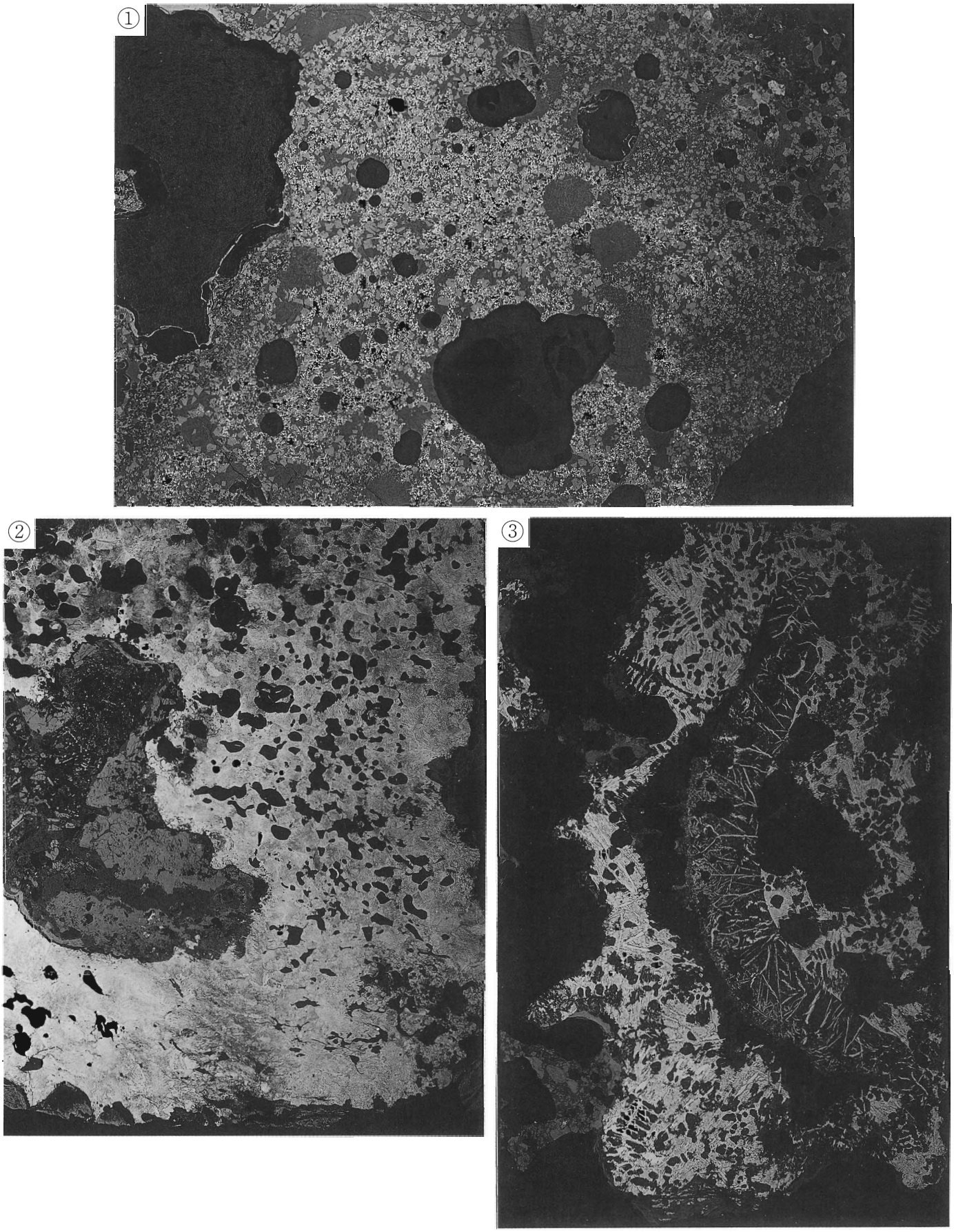
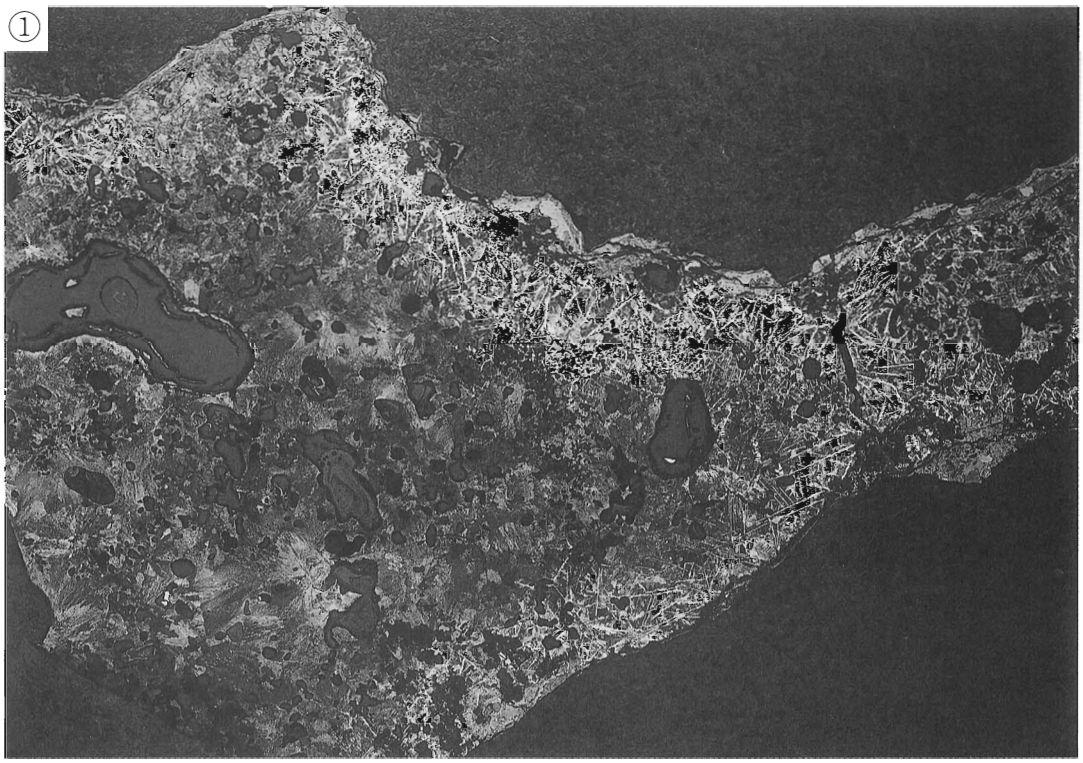
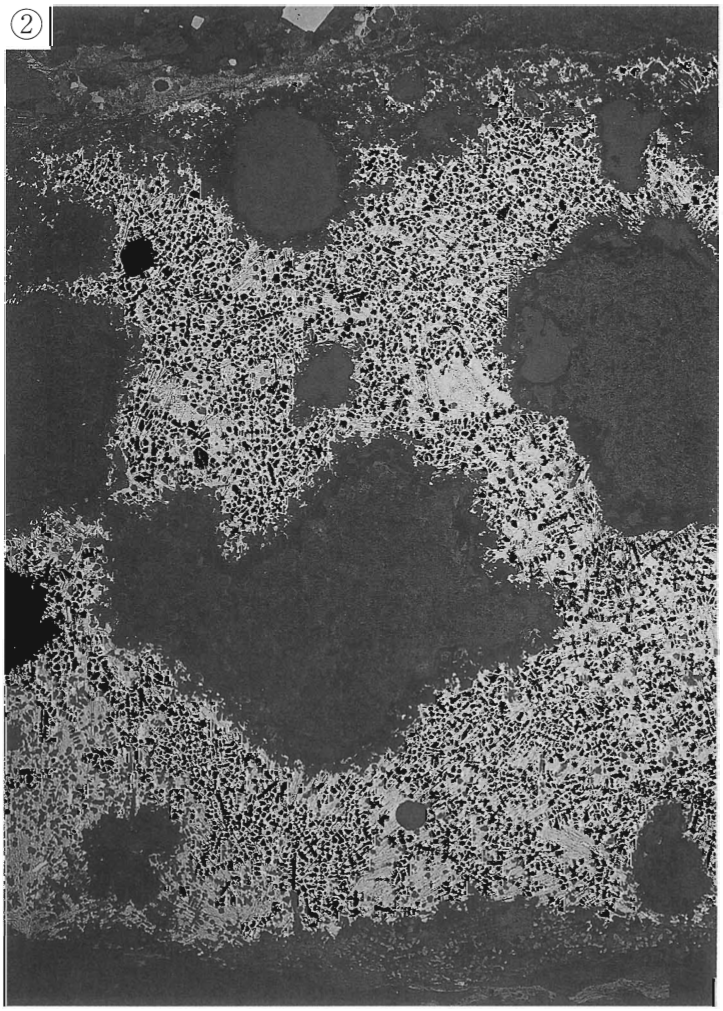


Photo.39　マクロ組織（×10）①DAN-12　②DAN-13　③DAN-14　（①～③：90%に縮小）





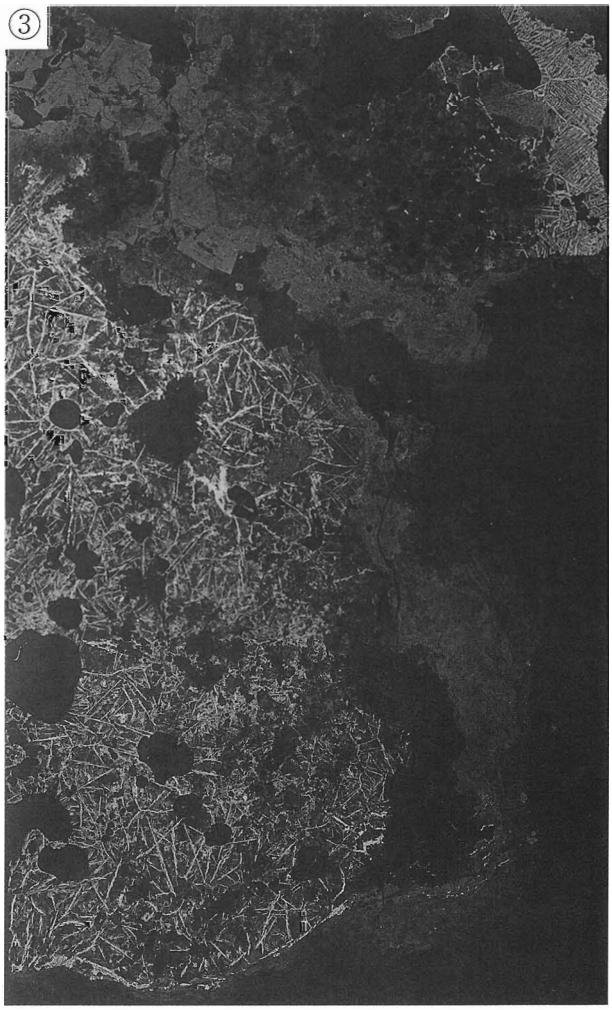


Photo.40　マクロ組織（×10）①DAN-15　②DAN-16　③DAN-17　（①～③：90%に縮小）

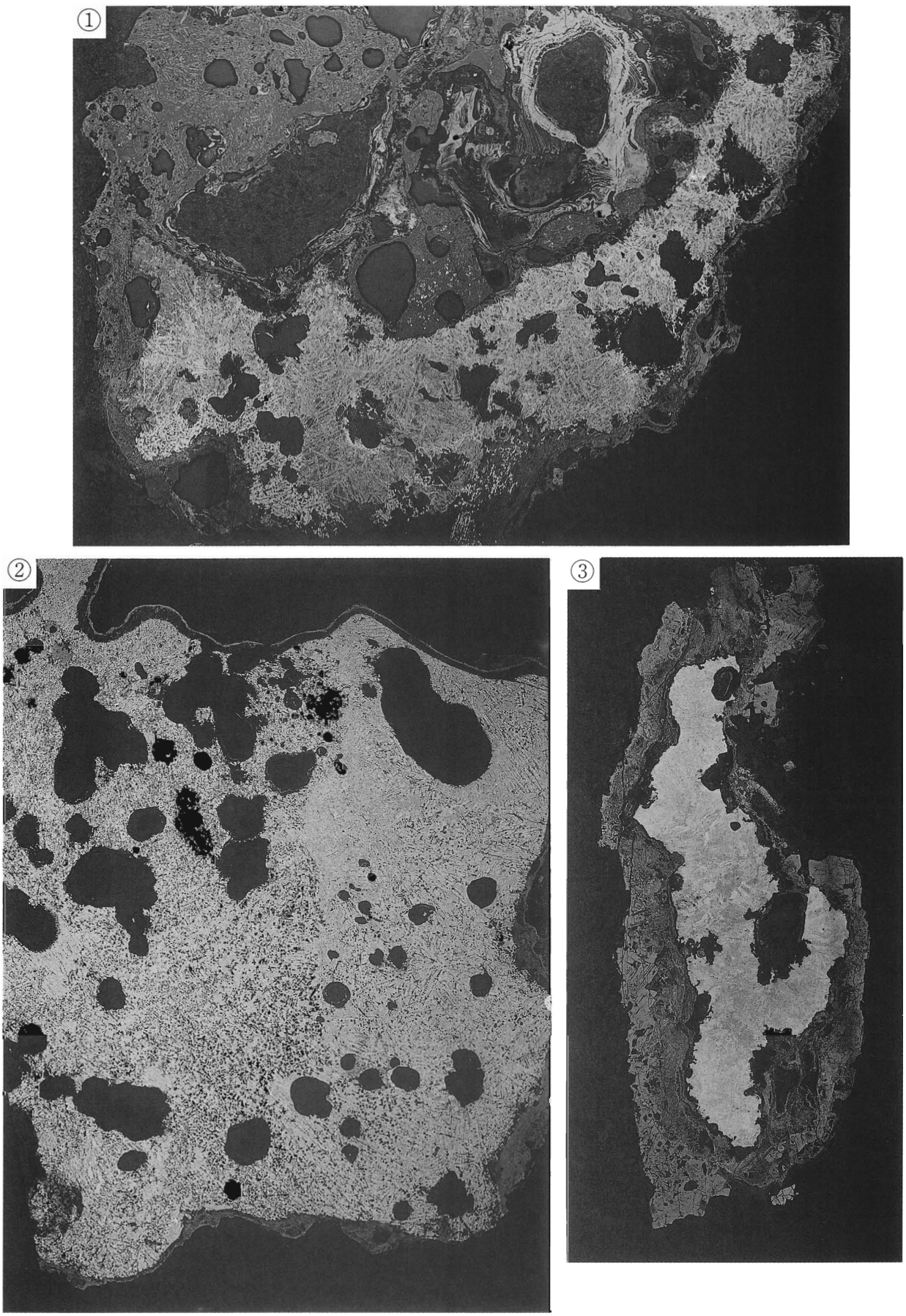
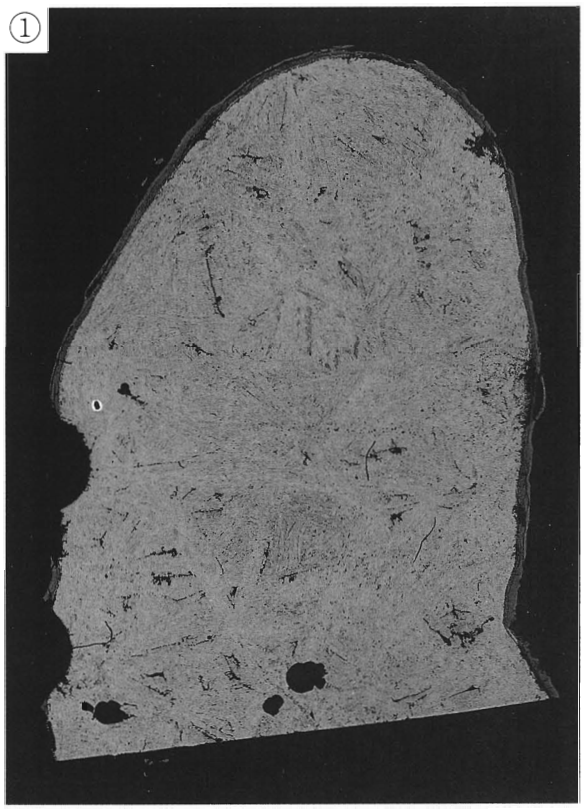


Photo.41　マクロ組織（×10）①DAN-18　②DAN-19　③DAN-20　（①～③：90%に縮小）



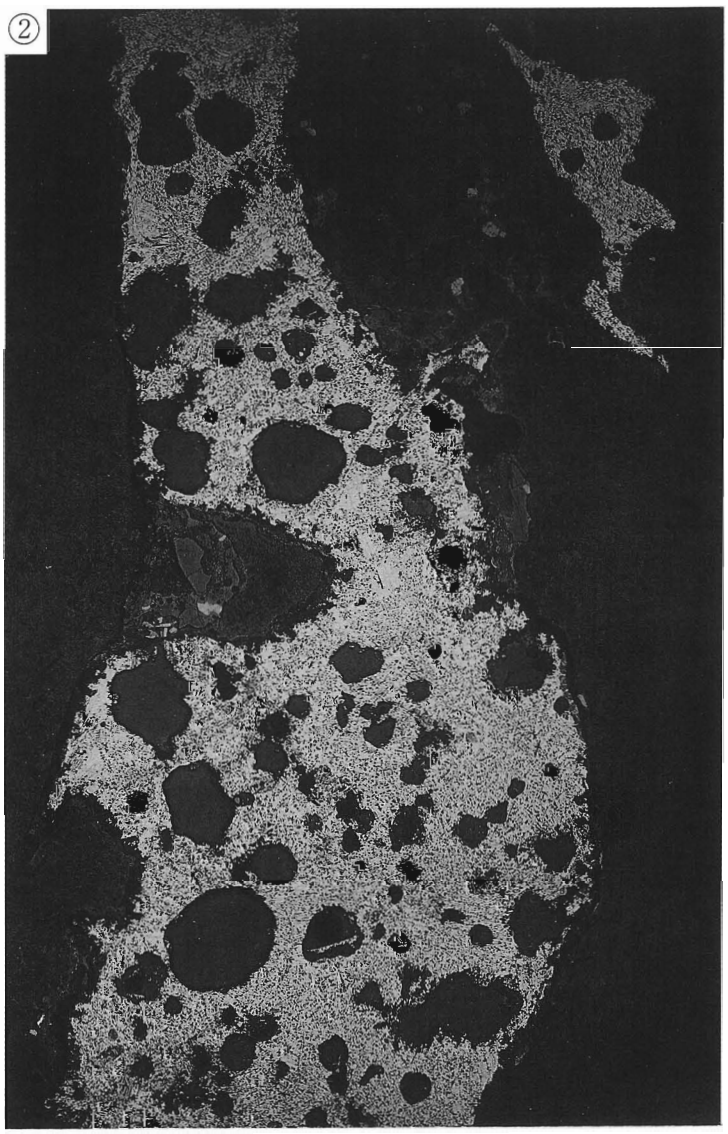
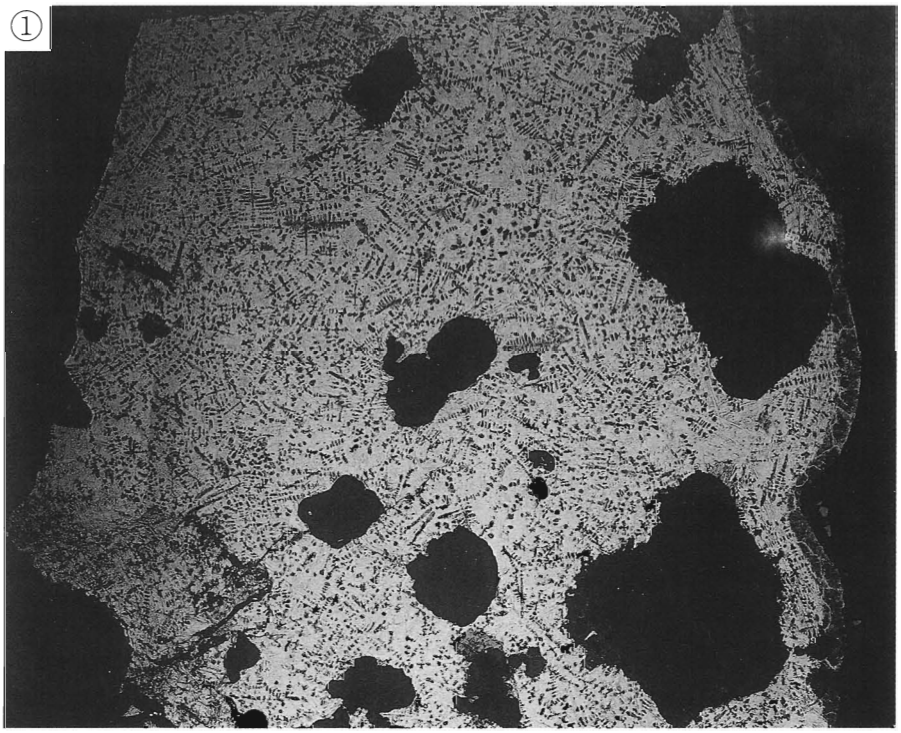
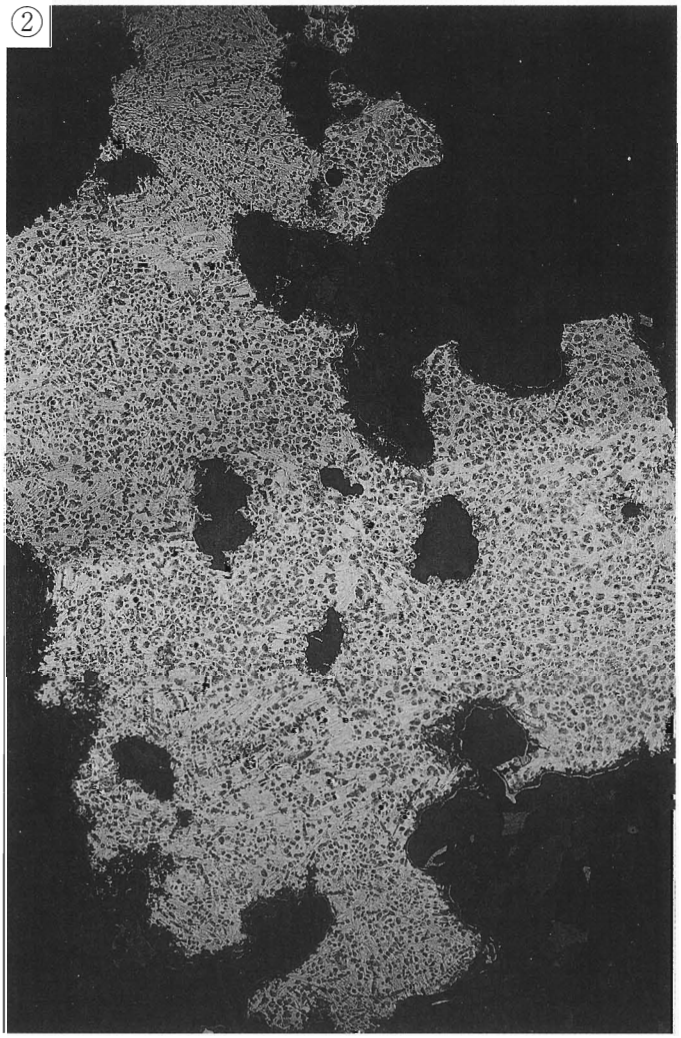


Photo.42　マクロ組織（×10）①DAN-21　②DAN-22　③DAN-23





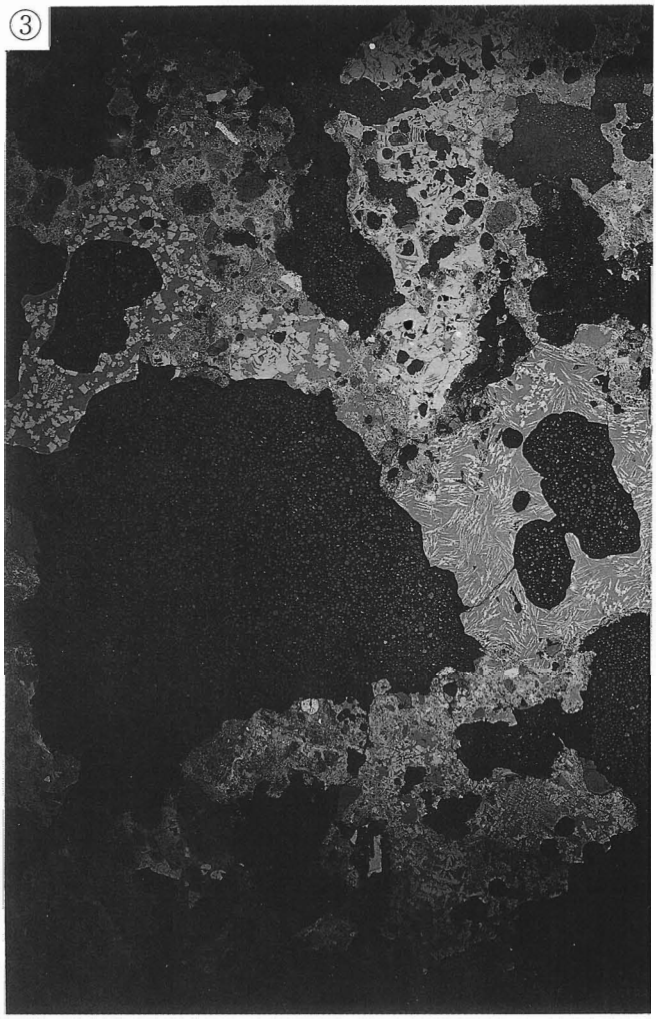


Photo.43　マクロ組織（×10）①DAN-24　②DAN-25　③DAN-26　（①～③：90%に縮小）

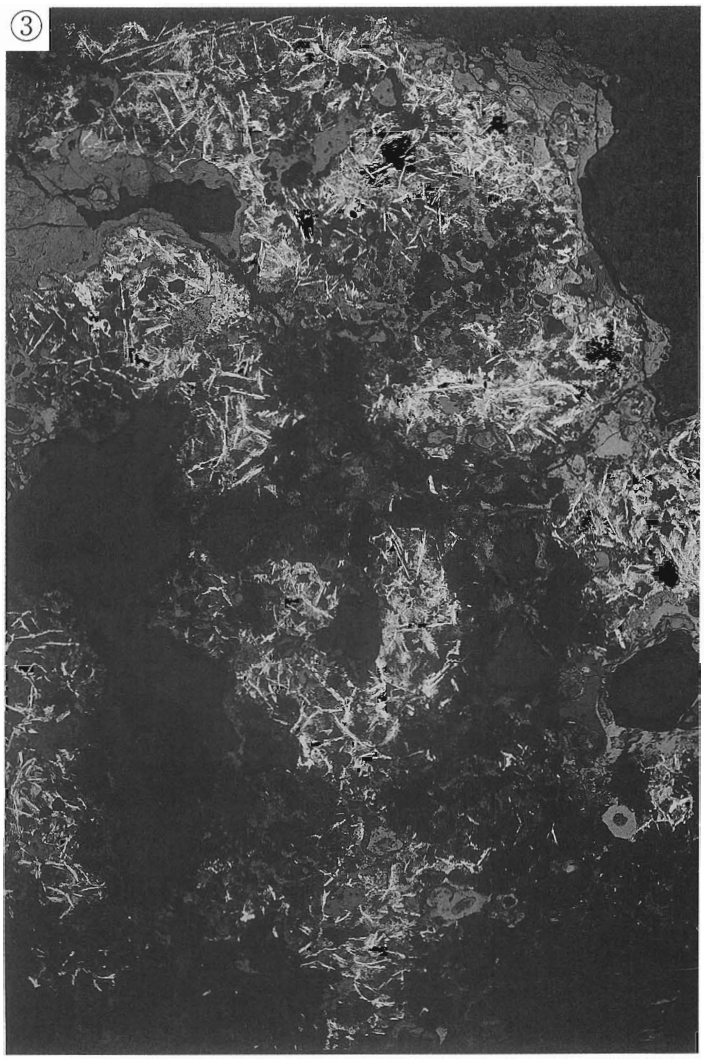


Photo.44　マクロ組織（×10）①DAN-27　②DAN-28　③DAN-31　（①～③：90%に縮小）

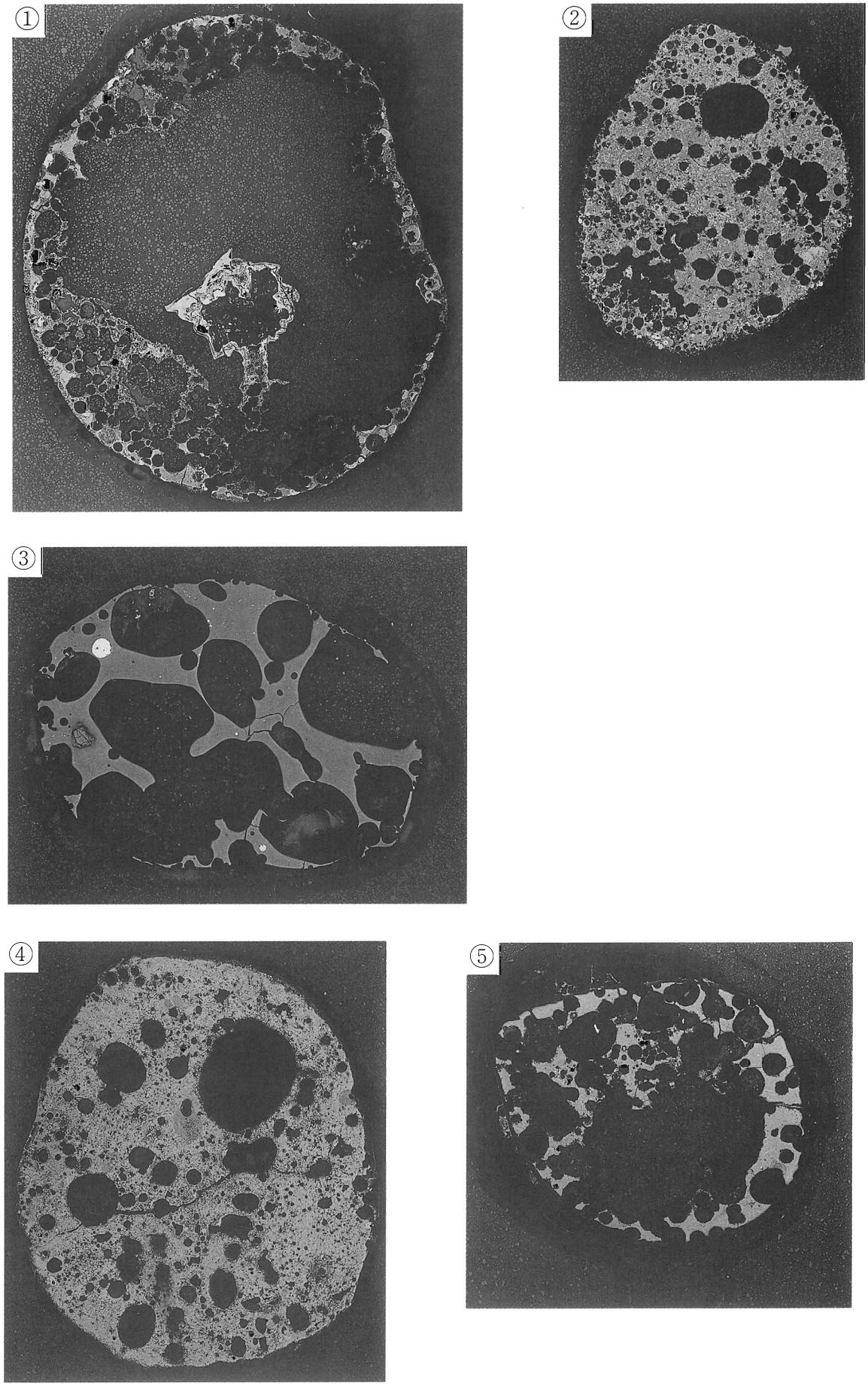
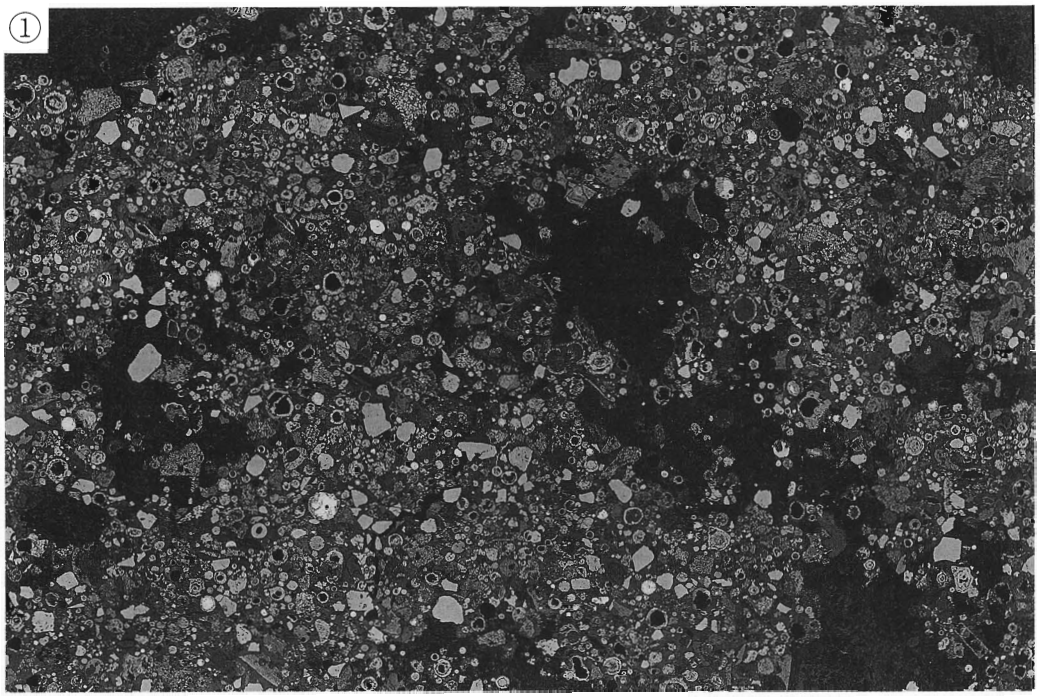
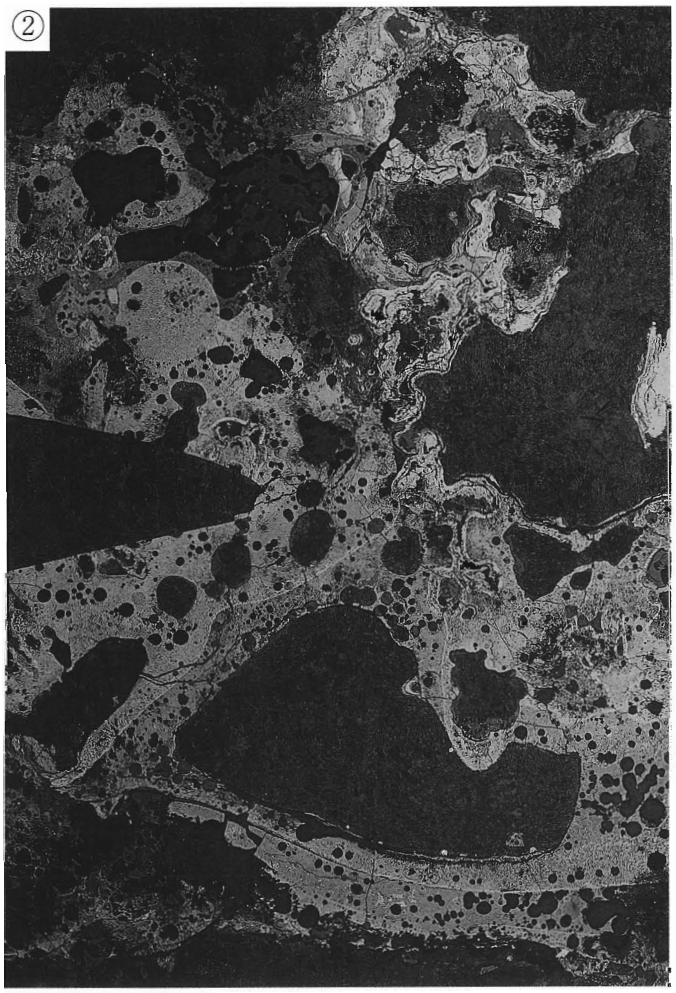


Photo.45　マクロ組織（×10）①DAN-32-1a　②DAN-32-1b
③DAN-32-1c　④DAN-39-1a　⑤DAN-39-1b





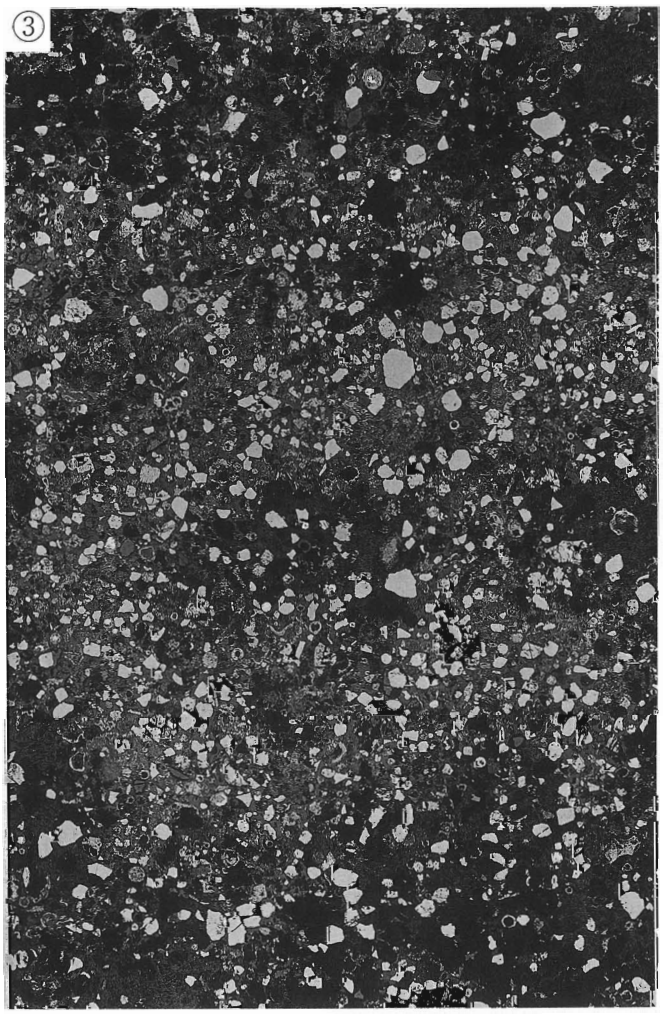


Photo.46　マクロ組織（×10）①DAN-34　②DAN-38　③DAN-41　（①～③：88%に縮小）

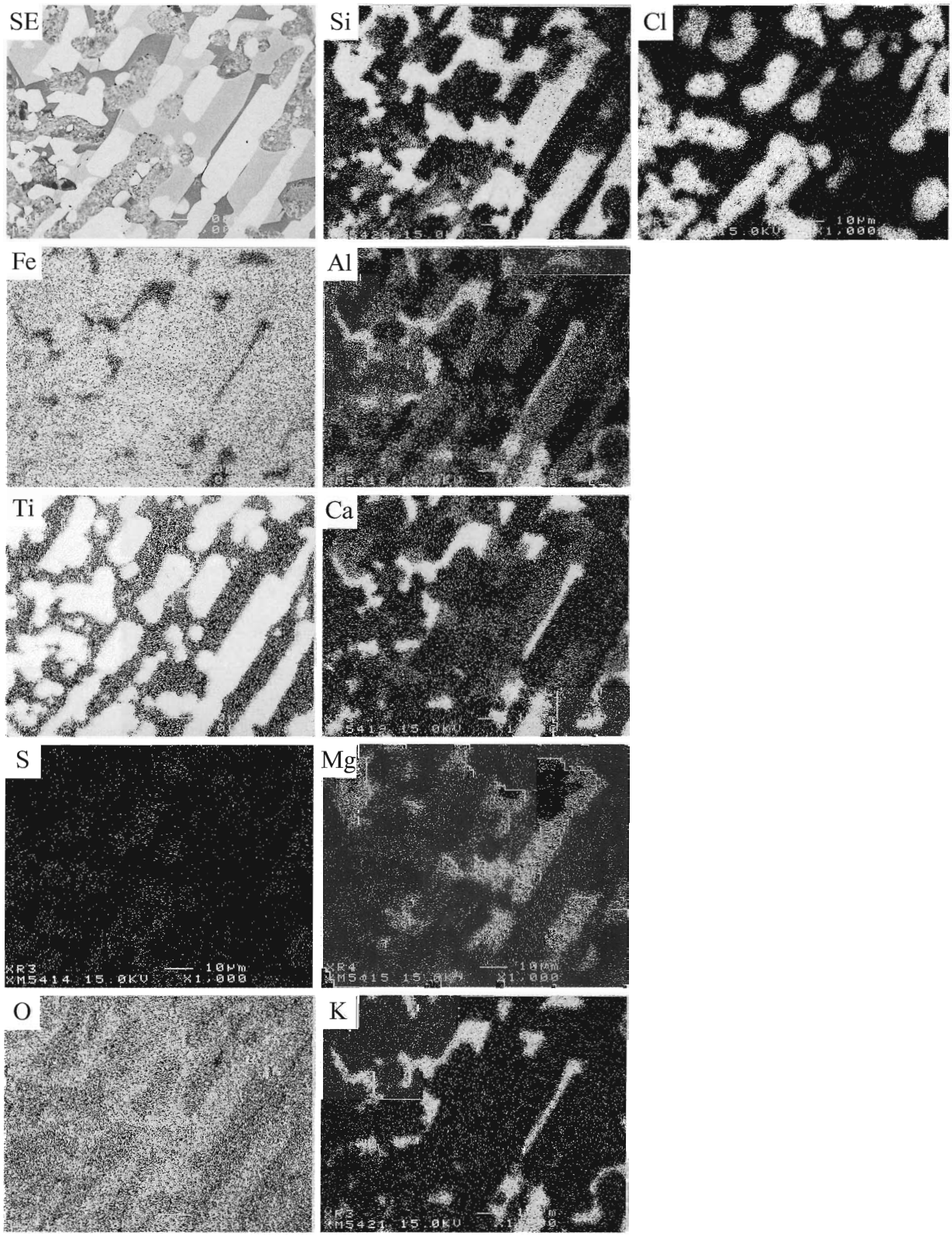


Photo.47　砂鉄焼結塊（DAN-4-1）鉱物相の特性X線像　（56%に縮小）

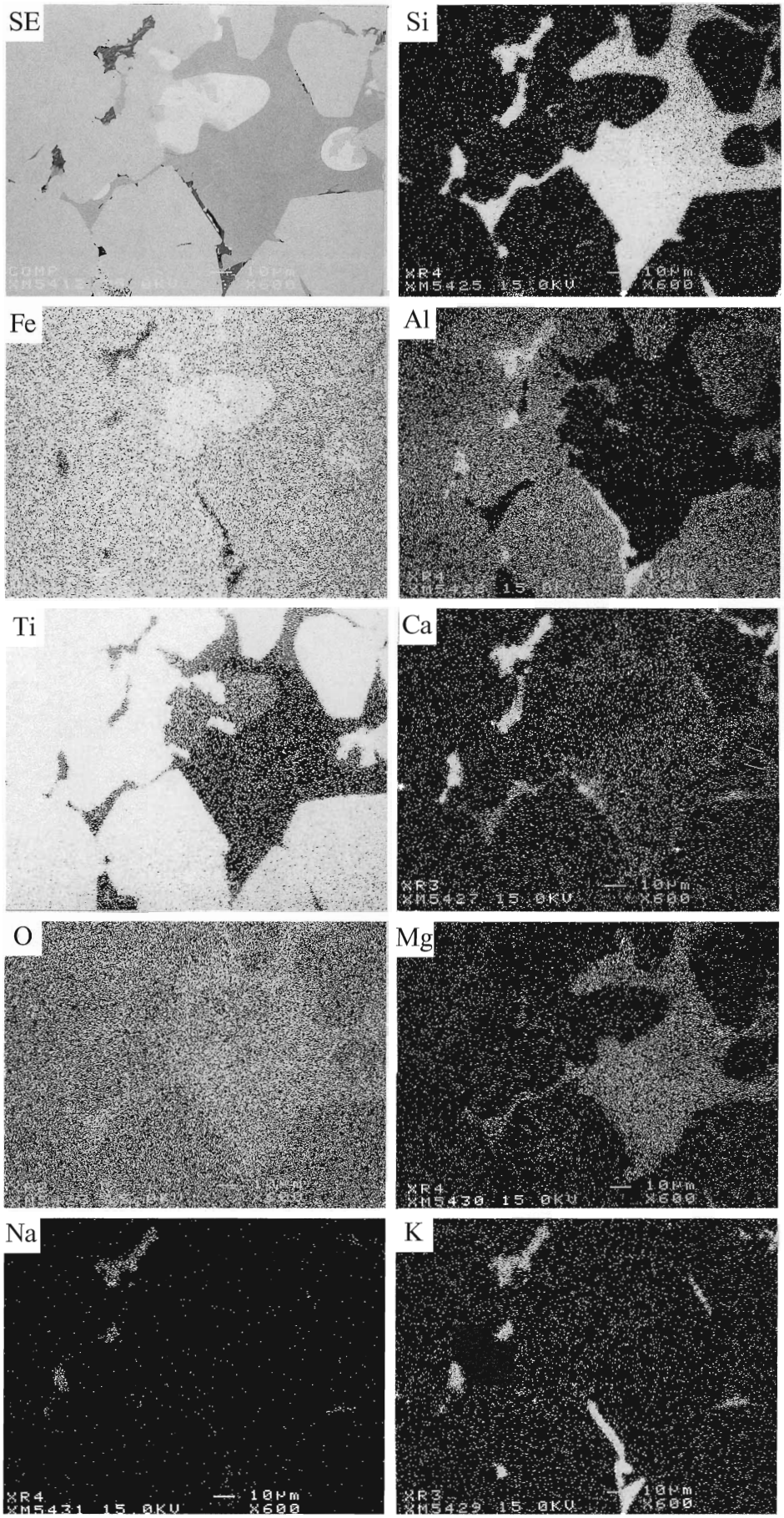
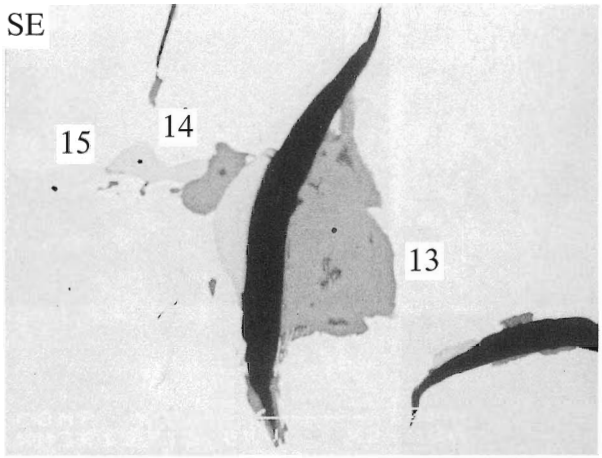
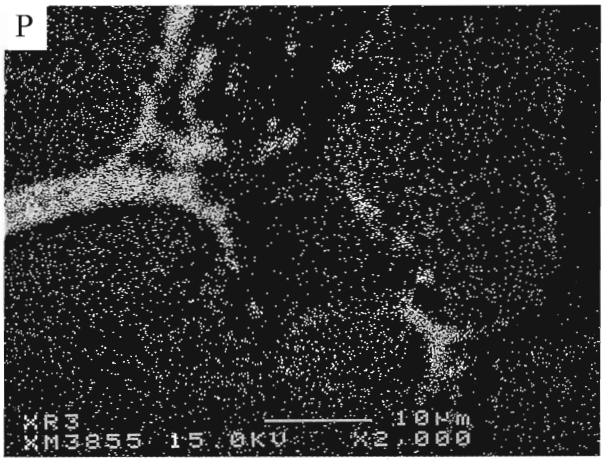
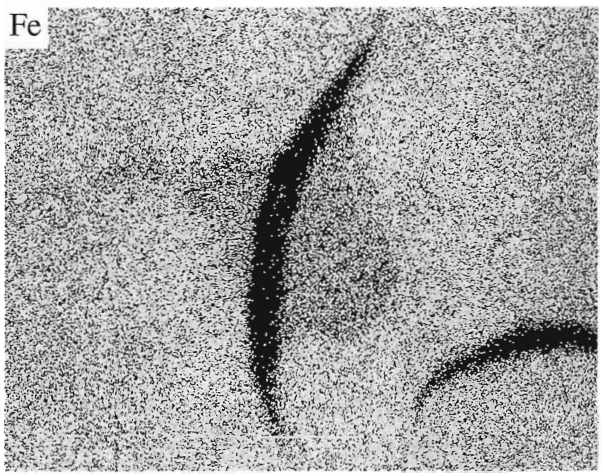
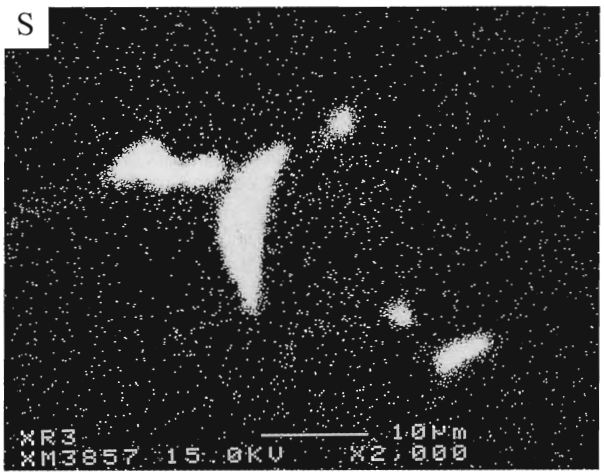


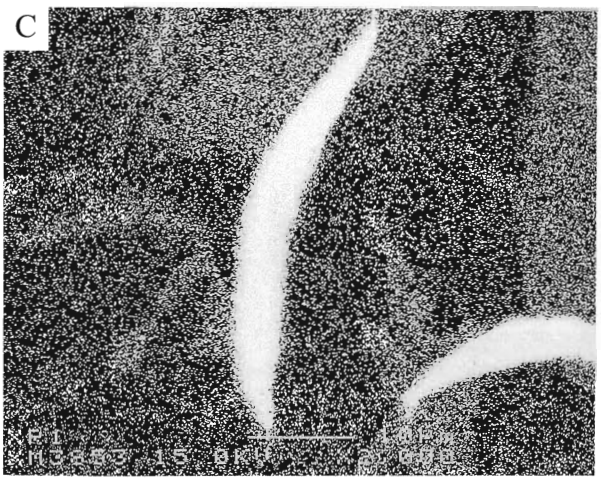
Photo.48　砂鉄焼結塊（DAN-4-2）鉱物相の特性X線像　（65%に縮小）

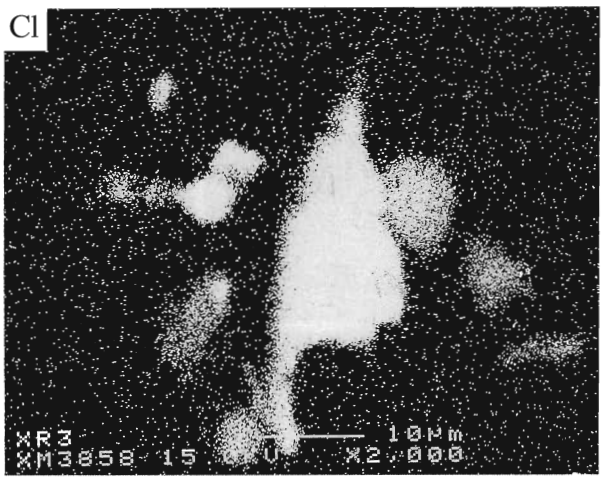


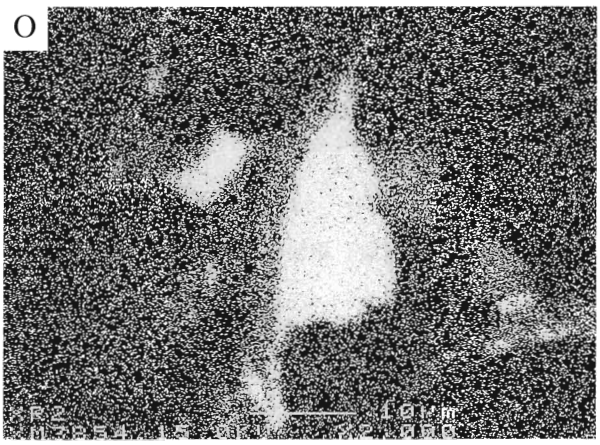






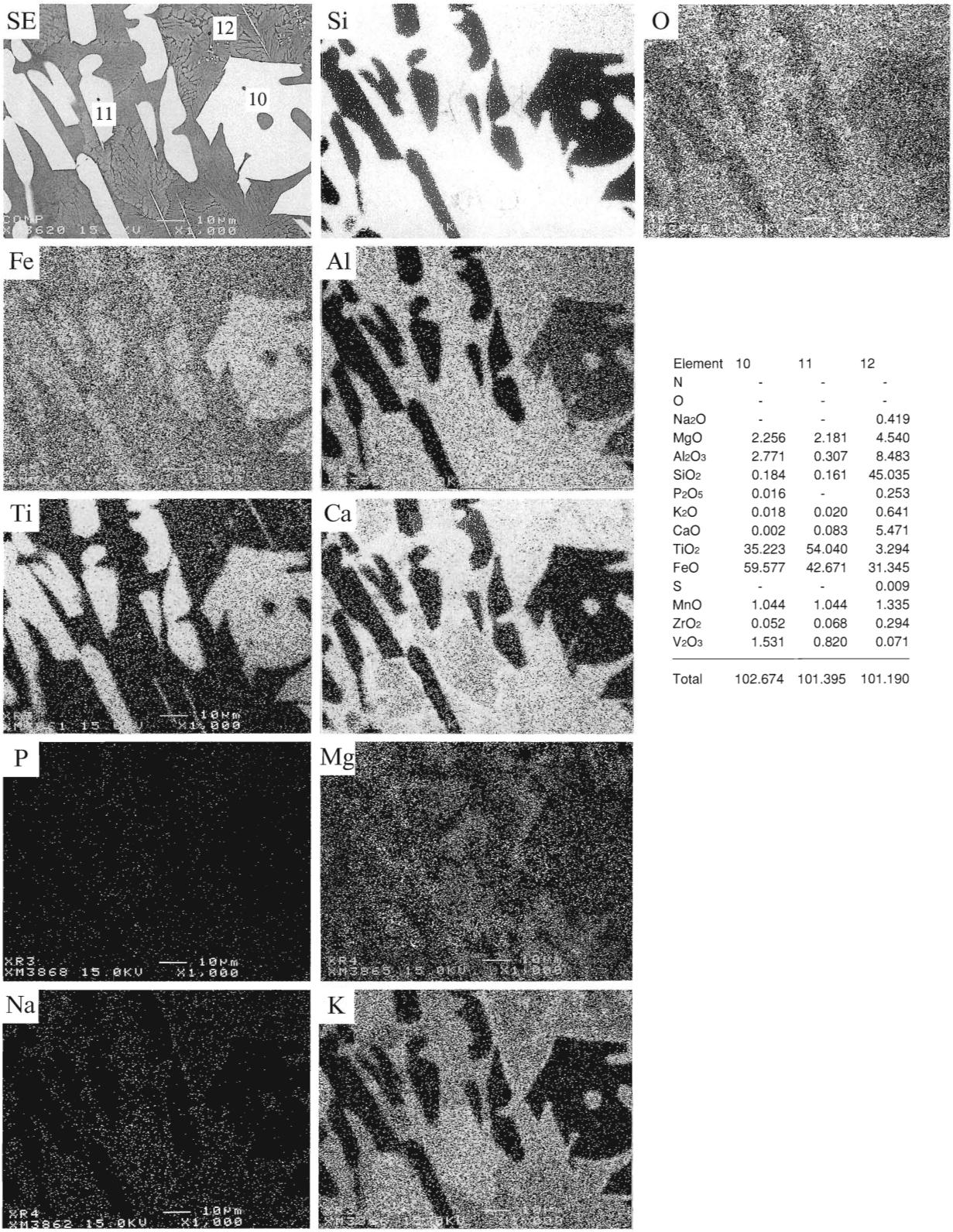






Element	13	14	15
N	-	-	-
O	-	-	-
Na_2O	-	-	0.012
MgO	-	-	-
Al_2O_3	-	0.018	-
SiO_2	0.011	0.031	0.009
P_2O_5	3.994	0.082	11.587
K_2O	-	-	-
CaO	-	-	-
TiO_2	-	0.019	0.041
FeO	80.703	86.050	127.899
S	0.101	36.100	0.118
MnO	-	0.101	-
ZrO_2	-	0.059	-
V_2O_3	0.012	0.538	-
Total	84.821	122.998	139.666

Photo.49　流出孔滓（含鉄）（DAN-7-1）鉄中非金属介在物の特性X線像と定量分析値　（83%に縮小）



Element	10	11	12
N	-	-	-
O	-	-	-
Na_2O	-	-	0.419
MgO	2.256	2.181	4.540
Al_2O_3	2.771	0.307	8.483
SiO_2	0.184	0.161	45.035
P_2O_5	0.016	-	0.253
K_2O	0.018	0.020	0.641
CaO	0.002	0.083	5.471
TiO_2	35.223	54.040	3.294
FeO	59.577	42.671	31.345
S	-	-	0.009
MnO	1.044	1.044	1.335
ZrO_2	0.052	0.068	0.294
V_2O_3	1.531	0.820	0.071
Total	102.674	101.395	101.190

Photo.50　流出孔滓（含鉄）（DAN-7-2）滓部鉱物相の特性X線像と定量分析値　（56%に縮小）

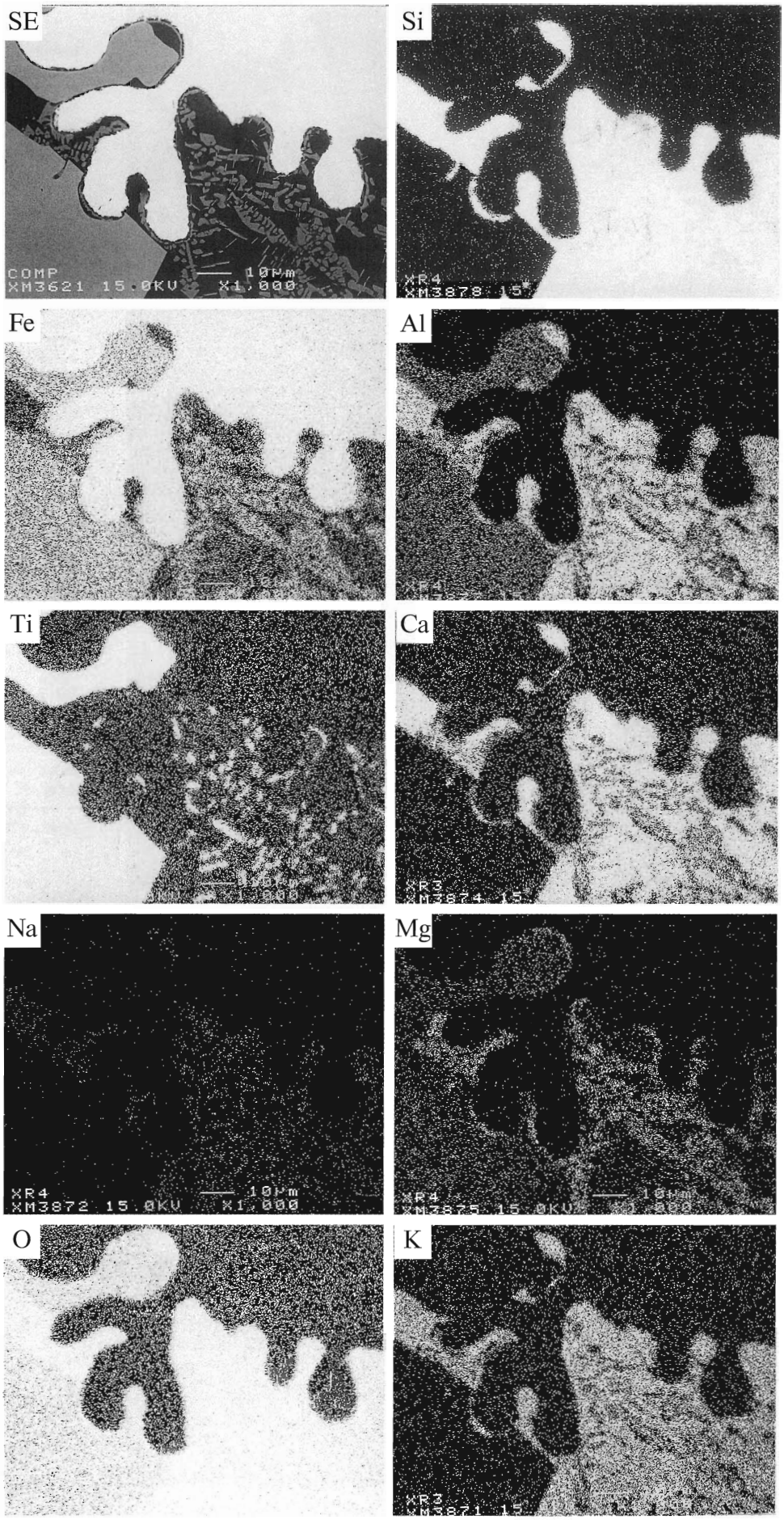
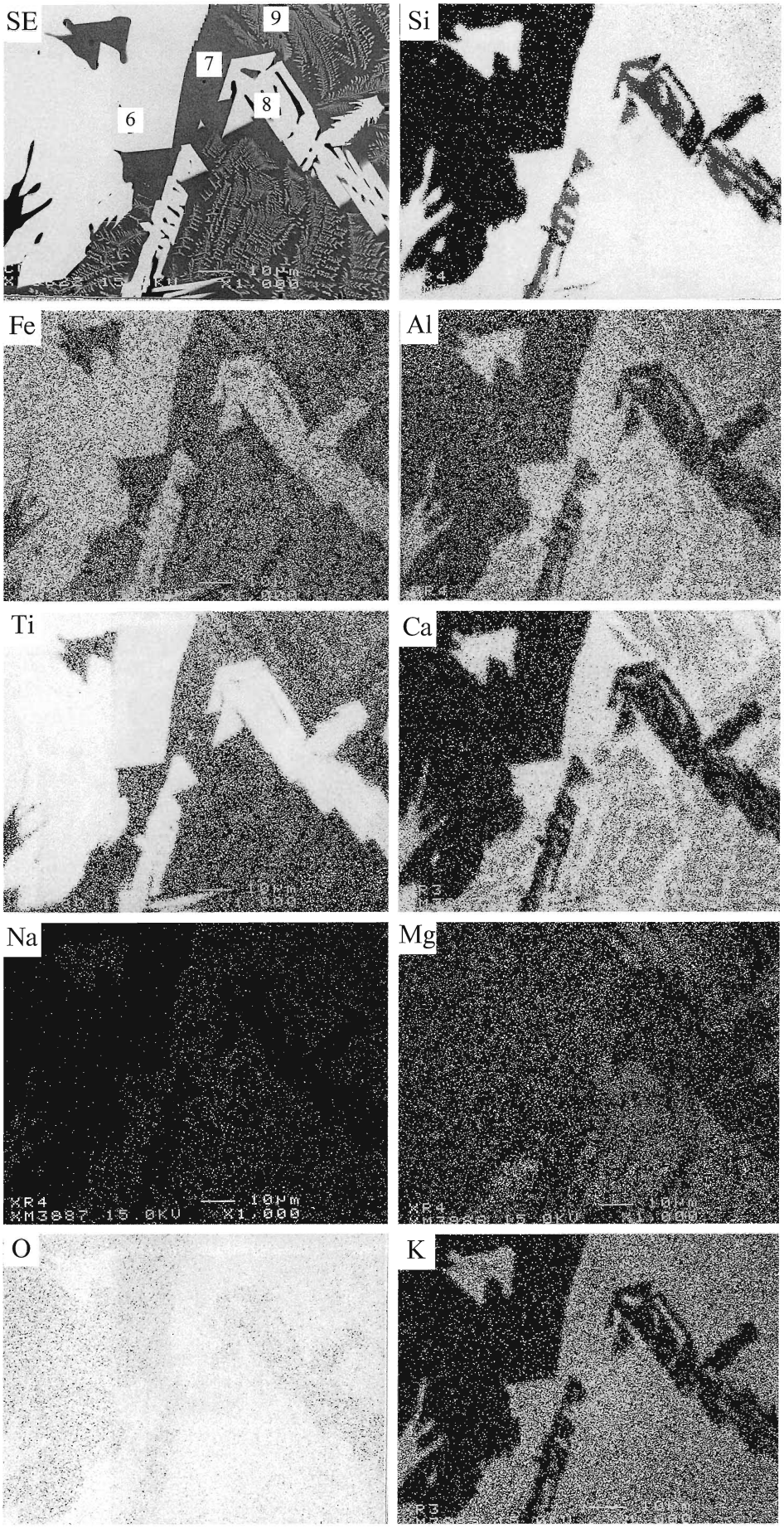


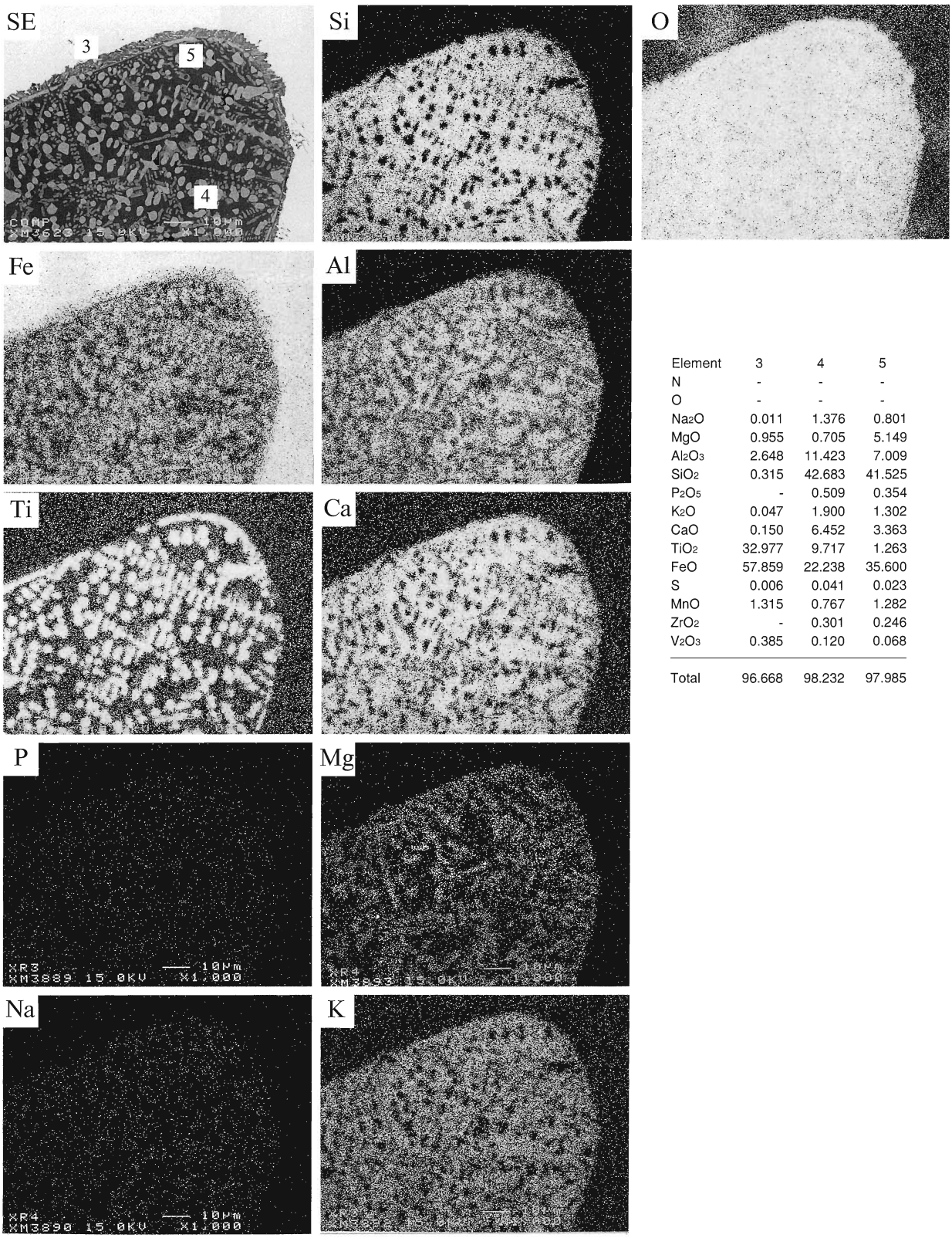
Photo.51　流出滓（DAN-8）金属鉄部分及び滓部鉱物相の特性X線像　（66%に縮小）



Element	6	7
N	-	-
O	-	-
Na_2O	-	1.083
MgO	2.049	2.148
Al_2O_3	3.162	11.290
SiO_2	0.128	52.113
P_2O_5	0.001	0.240
K_2O	0.002	1.788
CaO	-	6.586
TiO_2	35.254	2.343
FeO	57.995	19.104
S	0.010	0.016
MnO	1.228	0.903
ZrO_2	0.035	0.249
V_2O_3	2.824	-
Total	102.688	97.863

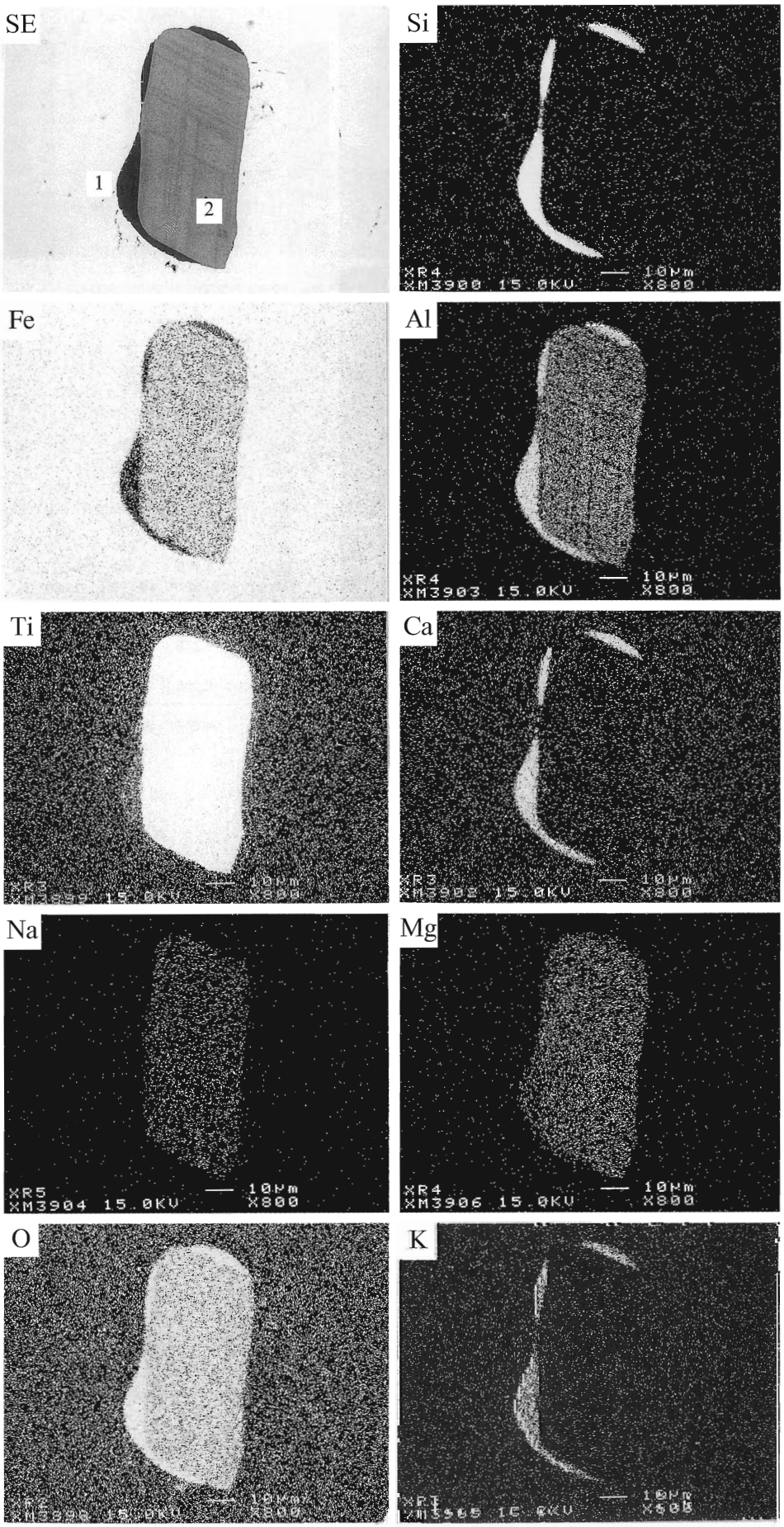
Element	8	9
N	-	-
O	-	-
Na_2O	-	0.850
MgO	2.323	5.233
Al_2O_3	2.389	7.322
SiO_2	0.257	46.052
P_2O_5	0.022	0.257
K_2O	0.036	1.742
CaO	0.083	2.539
TiO_2	34.907	1.566
FeO	59.049	33.205
S	-	0.002
MnO	1.271	1.406
ZrO_2	0.079	0.098
V_2O_3	0.473	0.004
Total	100.889	100.276

Photo.52　流出滓（DAN-10）滓部鉱物相の特性X線像と定量分析値　（65%に縮小）



Element	3	4	5
N	-	-	-
O	-	-	-
Na_2O	0.011	1.376	0.801
MgO	0.955	0.705	5.149
Al_2O_3	2.648	11.423	7.009
SiO_2	0.315	42.683	41.525
P_2O_5	-	0.509	0.354
K_2O	0.047	1.900	1.302
CaO	0.150	6.452	3.363
TiO_2	32.977	9.717	1.263
FeO	57.859	22.238	35.600
S	0.006	0.041	0.023
MnO	1.315	0.767	1.282
ZrO_2	-	0.301	0.246
V_2O_3	0.385	0.120	0.068
Total	96.668	98.232	97.985

Photo.53　含鉄鉄滓（DAN-11-1）捲込みスラグ鉱物相の特性X線像と定量分析値　（56%に縮小）



Element	1
N	-
O	-
Na_2O	1.113
MgO	1.282
Al_2O_3	15.573
SiO_2	52.708
P_2O_5	0.080
K_2O	2.026
CaO	7.154
TiO_2	3.675
FeO	8.880
S	0.016
MnO	0.413
ZrO_2	0.332
V_2O_3	0.115
Total	93.367

Element	2
N	-
O	-
Na_2O	0.070
MgO	2.773
Al_2O_3	2.934
SiO_2	0.087
P_2O_5	0.014
K_2O	0.006
CaO	-
TiO_2	39.358
FeO	44.812
S	0.009
MnO	1.116
ZrO_2	-
V_2O_3	6.666
Total	97.845

Photo.54　含鉄鉄滓（DAN-11-2）鉄中非金属介在物の特性X線像と定量分析値　（65%に縮小）

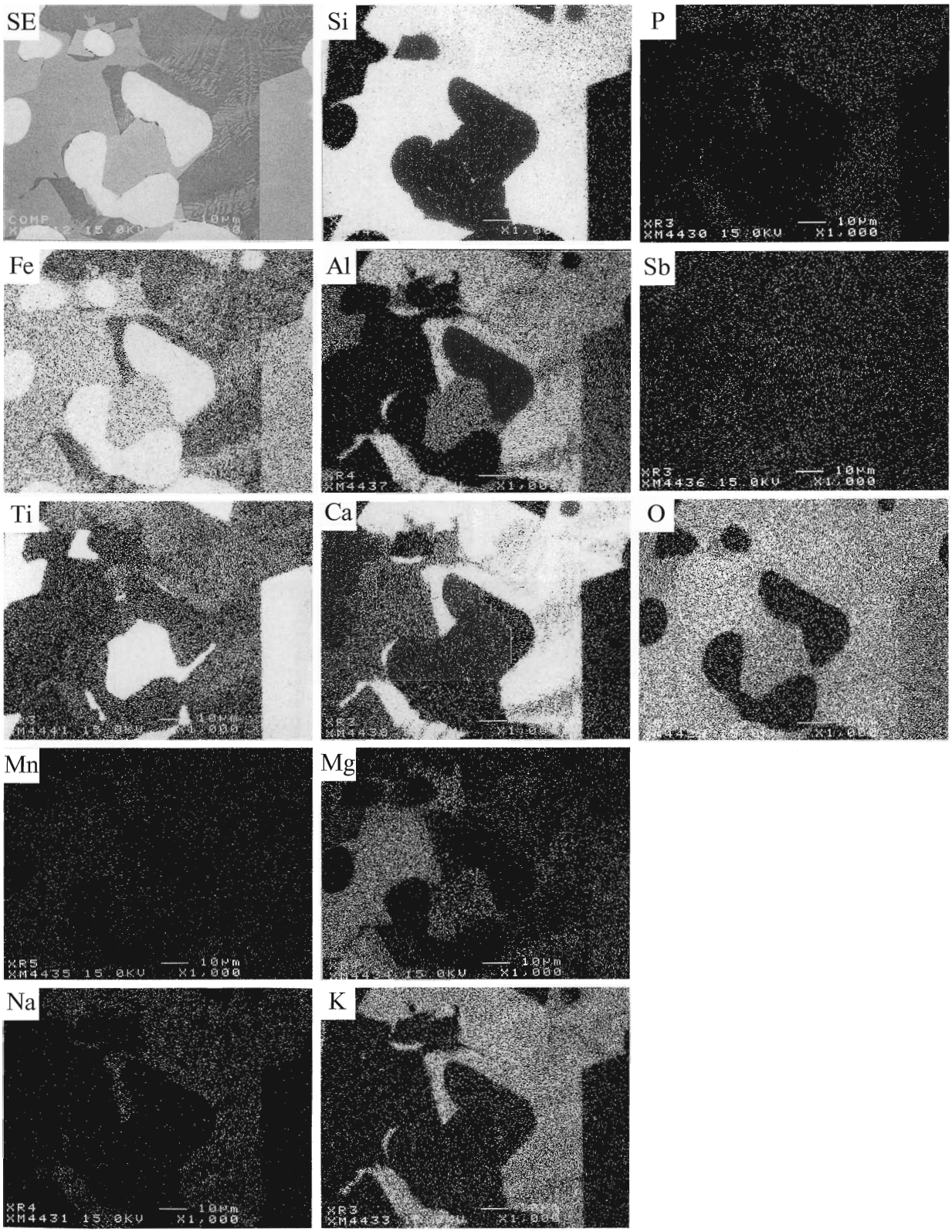
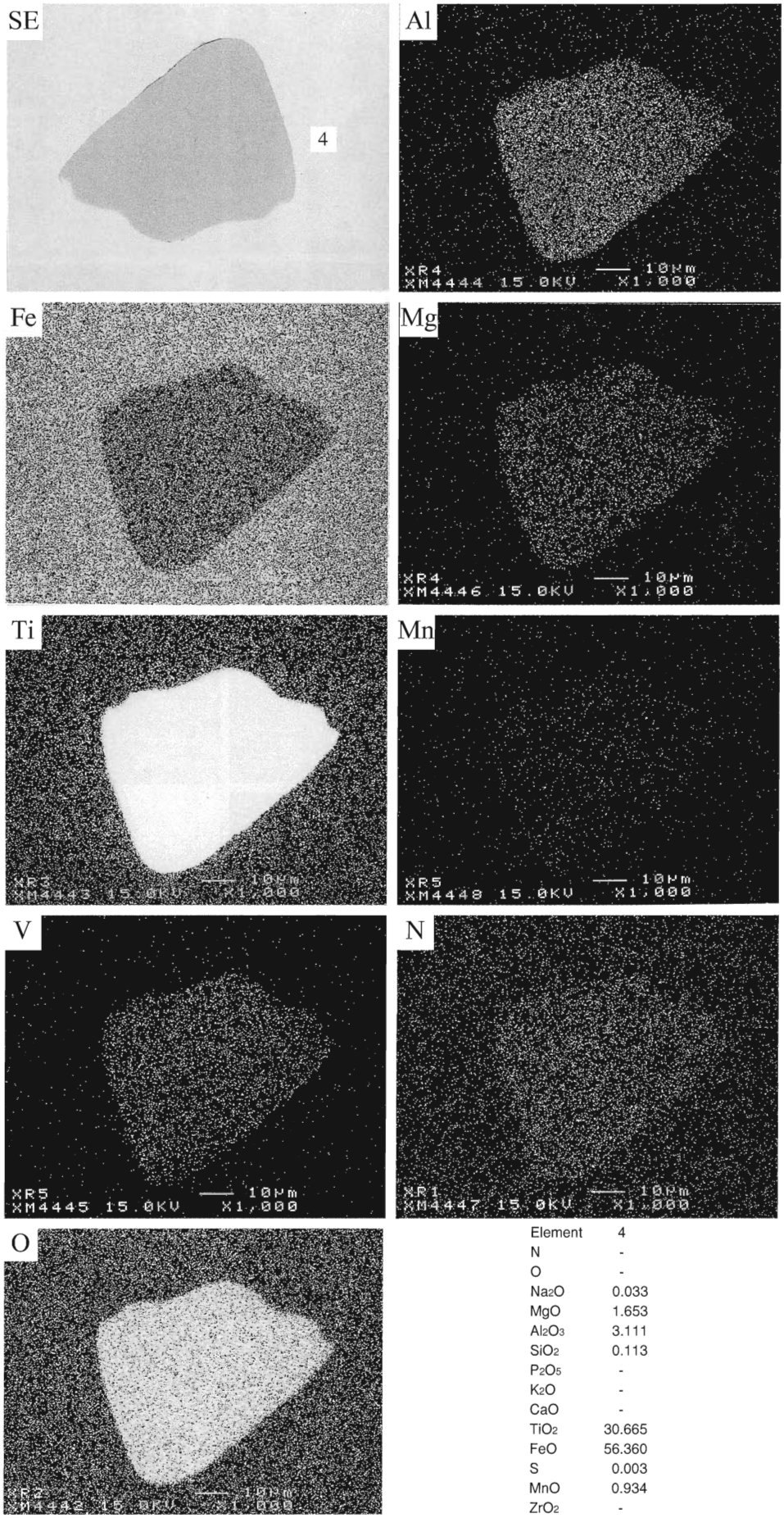
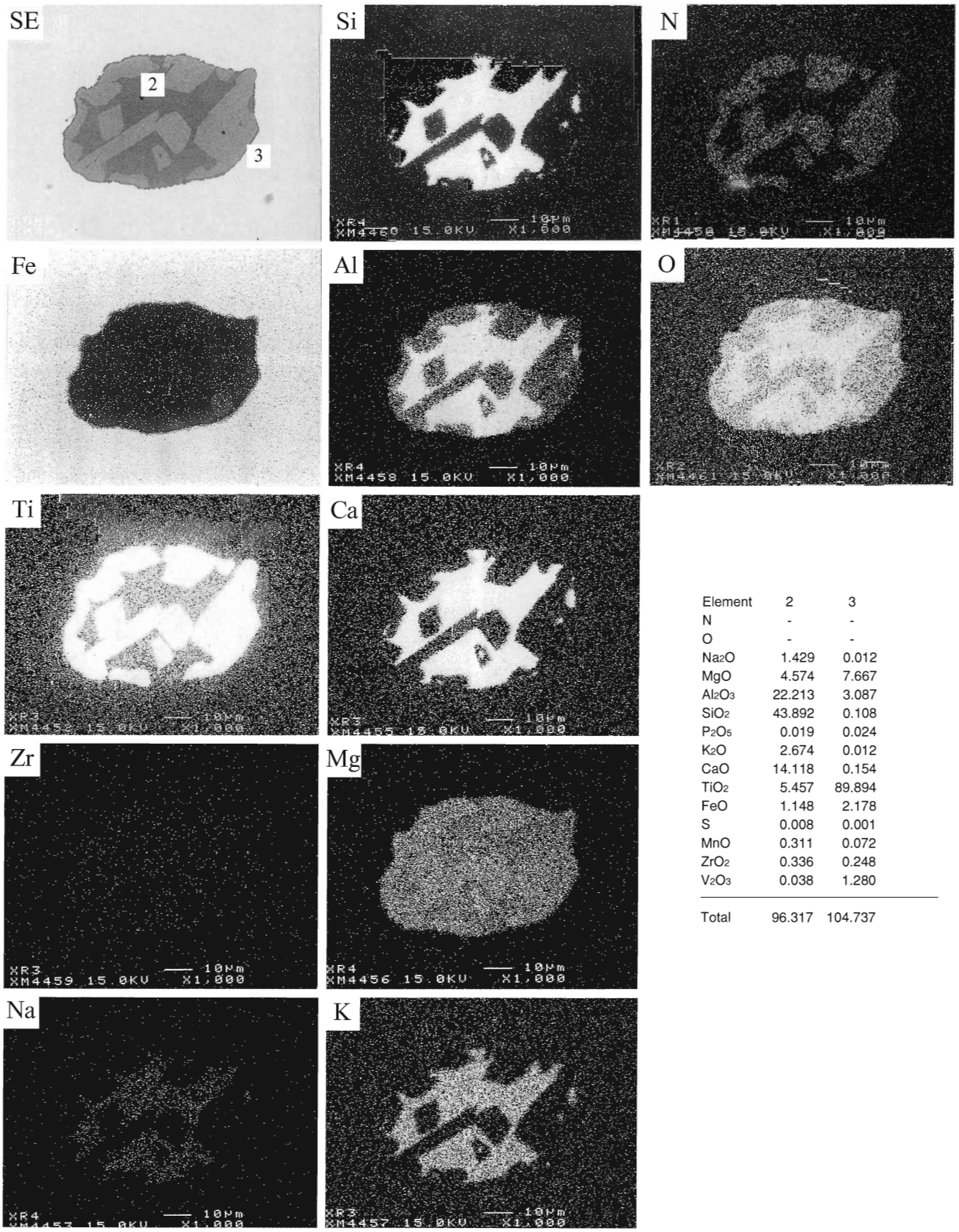


Photo.55　含鉄鉄滓（DAN-12）金属鉄粒及び滓部鉱物相の特性X線像　（56%に縮小）



Element	4
N	-
O	-
Na_2O	0.033
MgO	1.653
Al_2O_3	3.111
SiO_2	0.113
P_2O_5	-
K_2O	-
CaO	-
TiO_2	30.665
FeO	56.360
S	0.003
MnO	0.934
ZrO_2	-
V_2O_3	9.127
Total	101.999

Photo.56　鉄塊系遺物（DAN-13）鉄中非金属介在物の特性X線像と定量分析値　（65%に縮小）



Element	2	3
N	-	-
O	-	-
Na_2O	1.429	0.012
MgO	4.574	7.667
Al_2O_3	22.213	3.087
SiO_2	43.892	0.108
P_2O_5	0.019	0.024
K_2O	2.674	0.012
CaO	14.118	0.154
TiO_2	5.457	89.894
FeO	1.148	2.178
S	0.008	0.001
MnO	0.311	0.072
ZrO_2	0.336	0.248
V_2O_3	0.038	1.280
Total	96.317	104.737

Photo.57　鉄塊系遺物（DAN-15-1）鉄中非金属介在物の特性X線像と定量分析値　（56%に縮小）