

Appendix II Results of EPMA Analysis (Qualitative Analysis)

No.	Sample No.	Sector	Mineral	Elements																
				Zn	S															
1	6H010R	Chilwa Island	Sphalerite	Zn ⊙	S ○															
2	6H010R	Chilwa Island	Brucite	Mg ⊙	Fe ○	Mn △	Ca •	O •												
3	6M004R	Tundulu	Rutile	Ti ⊙	Nb ○	Ca △	Fe •	O •												
4	6M004R	Tundulu	Zircon	Zr ⊙	Si ○	Fe •	O •													
5	6M004R	Tundulu	Apatite	P ⊙	Ca ○	Sr •	F •	O •												
6	6M004R	Tundulu	Rutile	Ti ⊙	Nb ○	Ca △	Fe •	O •												
7	6M044R	Kangankunde	Monazite	P ⊙	Ce ⊙	La ○	Ca ○	Nd △	Sr •	O •										
8	6M044R	Kangankunde	Strontianite	Sr ⊙	C ○	Ca ○	O •													
9	6M045R	Kangankunde	Zircon	Zr ⊙	Si ○	O •														
10	6M045R	Kangankunde	Rutile	Ti ⊙	Nb △	Ca △	Fe △	O •												
11	6M045R	Kangankunde	Rutile	Ti ⊙	Nb △	Ca △	Fe △	O •	Si •											
12	6M053R	Kangankunde	Monazite	P ⊙	Ce ⊙	La ○	Ca ○	O •	Sr •	F •										
13	6M053R	Kangankunde	Rutile	Ti ⊙	Nb △	O •														
14	6M053R	Kangankunde	Monazite	P ⊙	Ce ⊙	La ○	Ca ○	O •	Sr •	F •										
15	6Y005R	Tundulu	Magnetite	Fe ⊙	Ti ○	Mn •	O •													
16	6Y005R	Tundulu	Ilmenite	Fe ⊙	Ti ○	Mn •	O •													
17	6Y005R	Tundulu	Biotite	K ⊙	Al ⊙	Mg ⊙	Si ⊙	Fe ○	Mn •	Ti •	O •									
18	6Y005R	Tundulu	Apatite	Ca ⊙	P ○	Sr •	O •													
19	6Y005R	Tundulu	Carbonate	Ca ⊙	C ⊙	Sr △	Fe •	Mn •	P •	O •										
20	6Y034R	Tundulu	Aegirine	Ca ⊙	Na ⊙	Si ⊙	Fe ○	Mg △	Al △	O •										
21	6Y034R	Tundulu	Goethite	Fe ⊙	Ca ○	Si △	Mg •	O •												
22	6Y034R	Tundulu	Pyrite	Fe ⊙	S ⊙															
23	6Y037R	Chilwa Island	Rutile	Ti ⊙	Nb △	Fe △	O •													
24	6Y037R	Chilwa Island	Calcite	Ca ⊙	C ⊙	O •														
25	6Y037R	Chilwa Island	K-felspar	K ⊙	Al ⊙	Si ⊙	Na •	Fe •	O •											

⊙ Abundant

○ Common

△ Little

• Rare

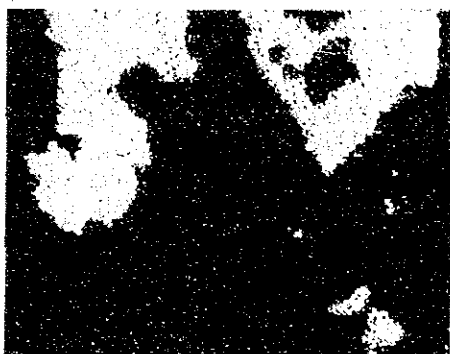
(X-Ray image )

Abbreviations

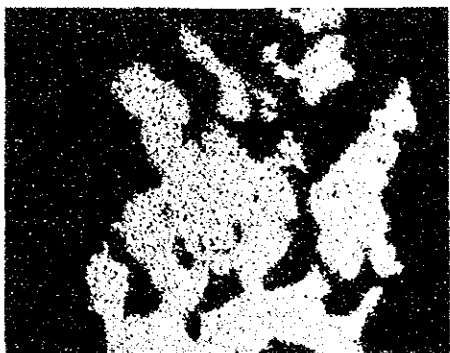
Kf : Alkali feldspar  
Rt : Rutile  
Fe : Fe-oxide  
Ap : Apatite  
Zr : Zircon  
Qz : Quartz  
Mz : Monazite  
St : Strontianite  
Goe : Goethite  
Carb : Carbonate mineral



Absorbed electron image  
Sample No : 6M004R, 10  
Rock Name : Apatite feldspathic rock  
Sector : Tundulu



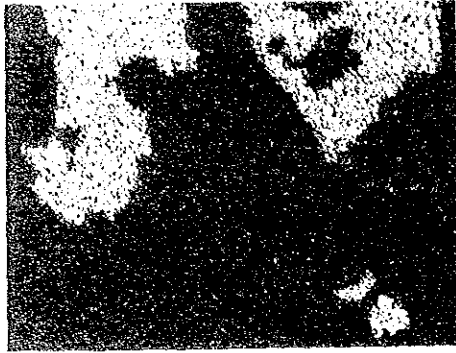
Al X-ray image



Ti X-ray image



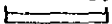
P X-ray image

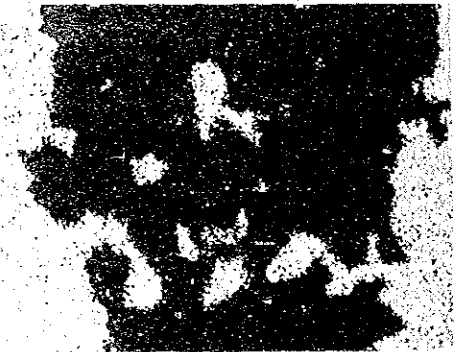


Continuation of 6M004R, 10  
Si X-ray image

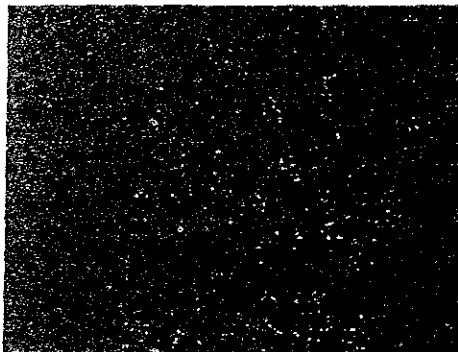


K X-ray image

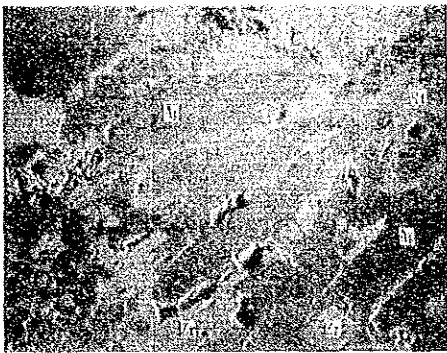
0 0.5mm  




Ca X-ray image



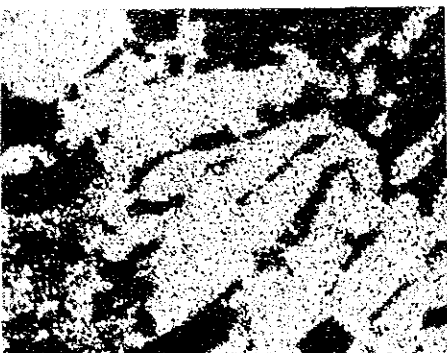
Fe X-ray image



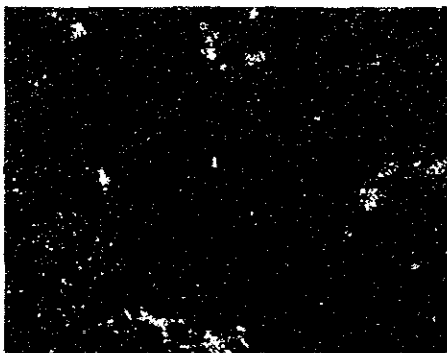
Absorbed electron image  
Sample No : 6M004R, 13  
Rock Name : Apatite feldspathic rock  
Sector : Tundulu



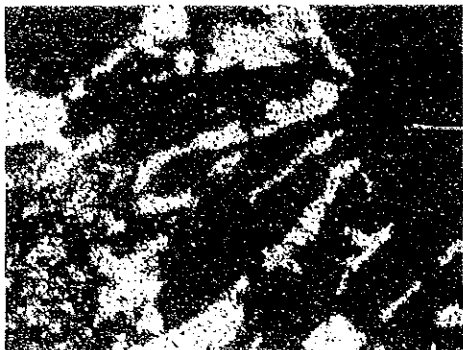
Si X-ray image



P X-ray image



Fe X-ray image



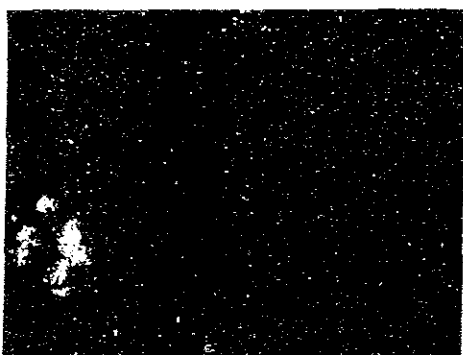
Continuation of 6M004R, 13  
Zr X-ray image



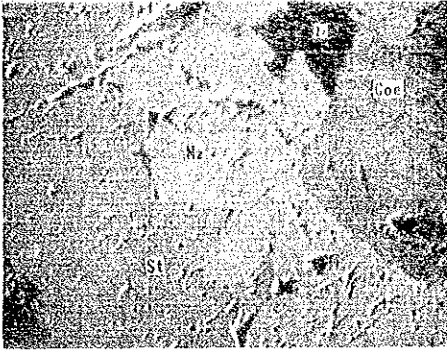
Ca X-ray image



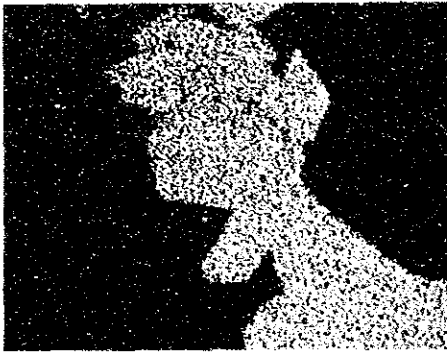
Ti X-ray image



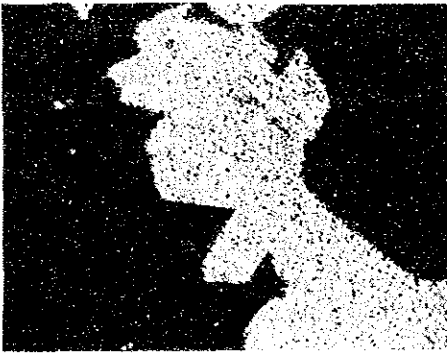
Al X-ray image



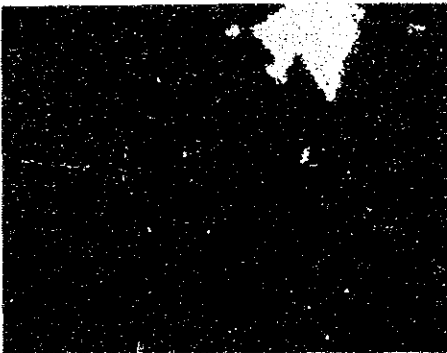
Absorbed electron image  
Sample No : 6M044R, 19  
Rock Name : Monzonite bearing Carbonatite  
Sector : Kangankunde



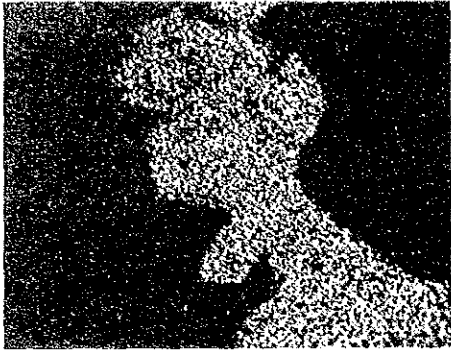
Ce X-ray image



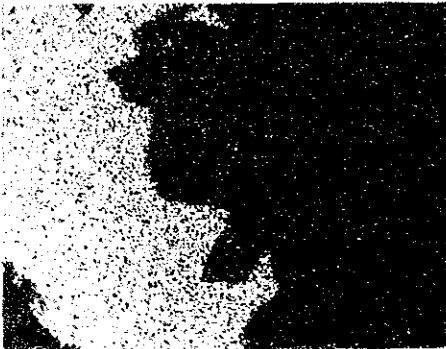
P X-ray image



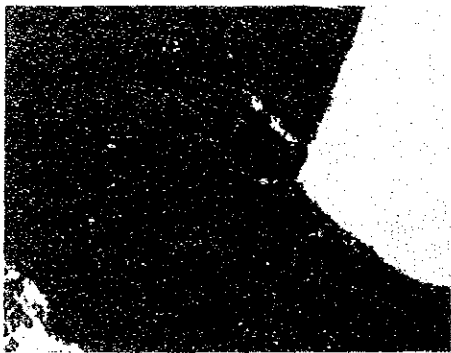
Si X-ray image



Continuation of 6M044 R, 19  
La X-ray image

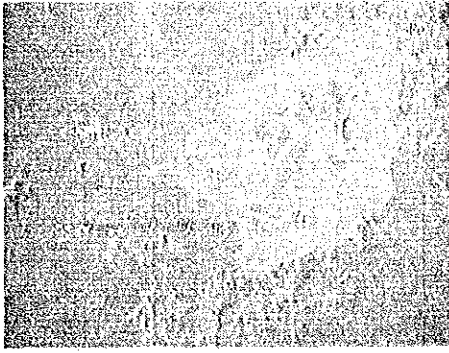


Sr X-ray image

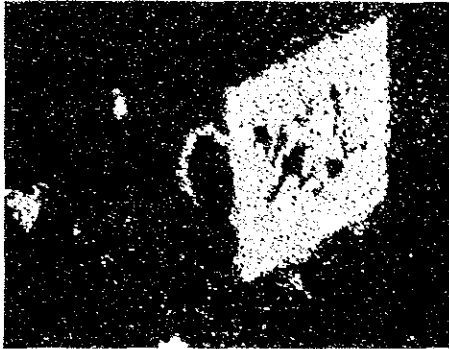


Fe X-ray image

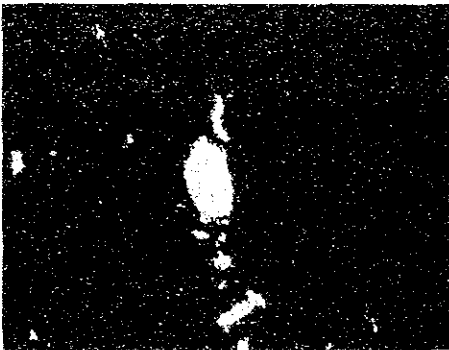




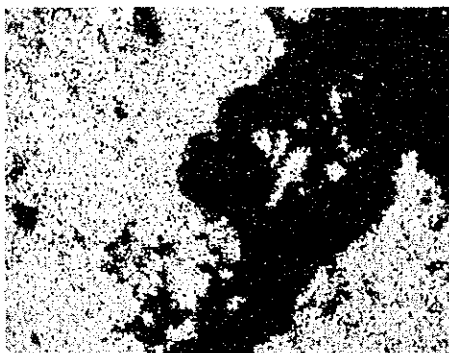
Absorbed electron image  
Sample No : 6M045R, 22  
Rock Name : Carbonatized feldspathic rock  
Sector : Kangankunde



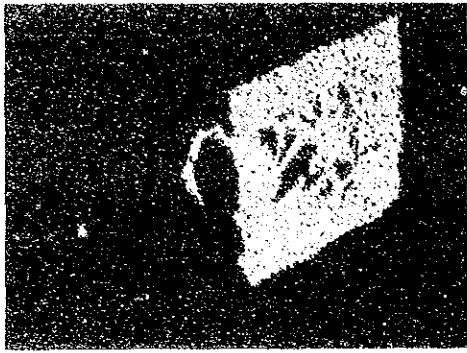
Si X-ray image



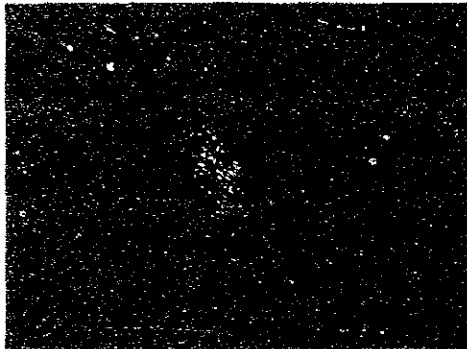
Ti X-ray image



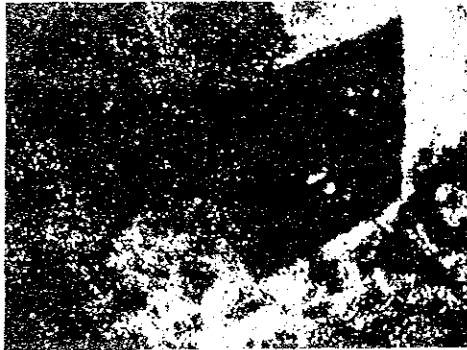
Ca X-ray image



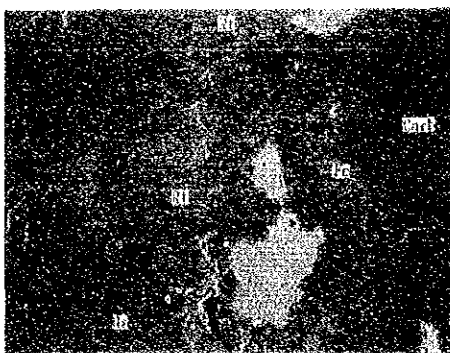
Continuation of 6M045R, 22  
Zr X-ray image



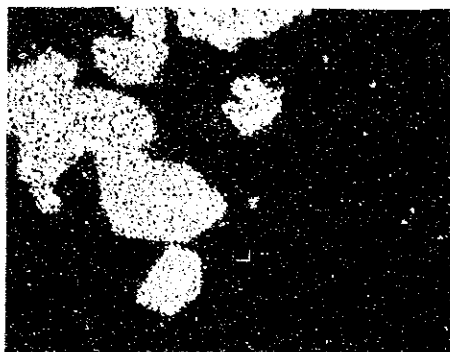
Nb X-ray image



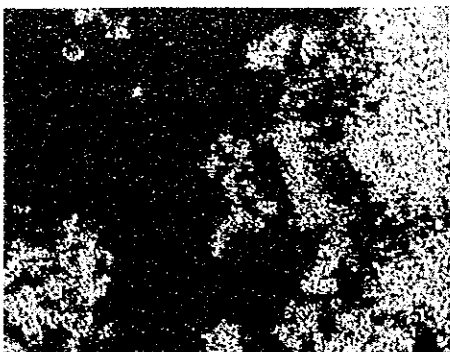
Fe X-ray image



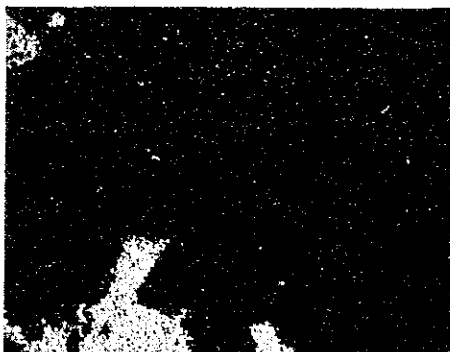
Absorbed electron image  
Sample No : 6M045R, 24  
Rock Name : Carbonatized feldspathic rock  
Sector : Kangankunde



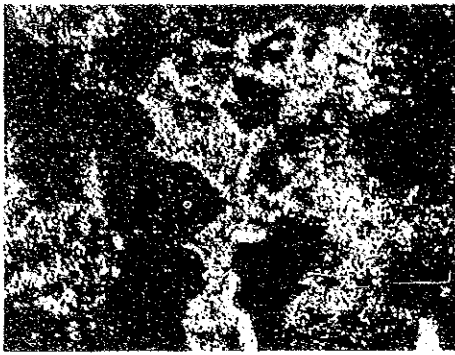
Ti X-ray image



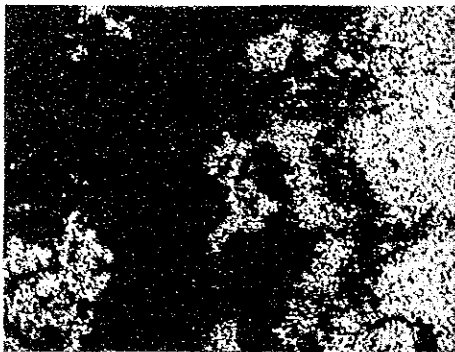
Ca X-ray image



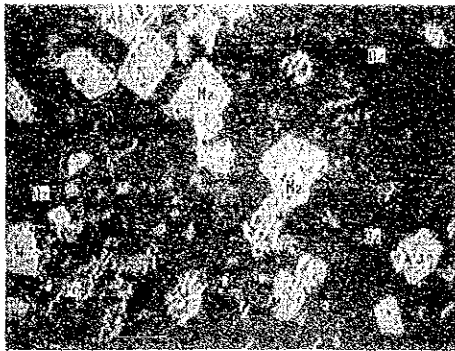
Si X-ray image



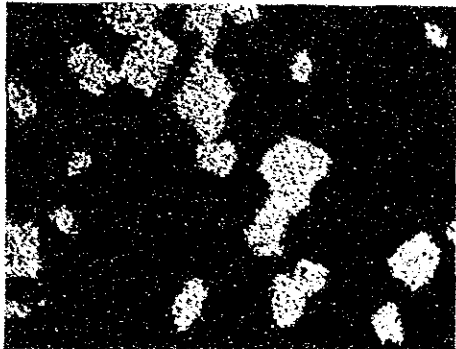
Continuation of 6M045R, 24  
Fe X-ray image



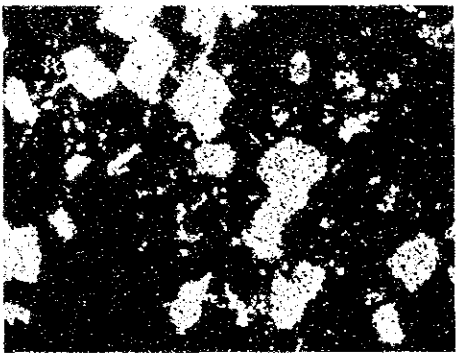
Mg X-ray image



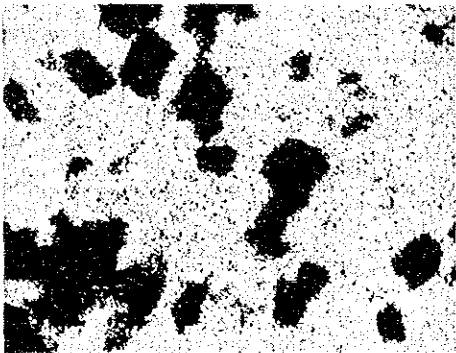
Absorbed electron image  
Sample No : 6M053R, 27  
Rock Name : Quatrz druse rock  
Sector : Kangankunde



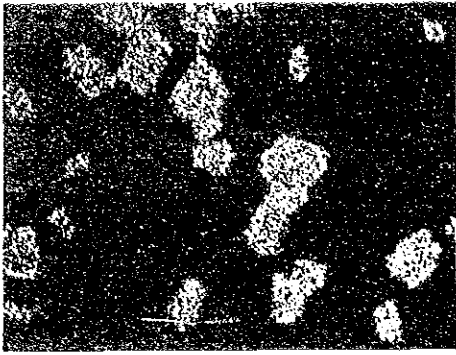
Ce X-ray image



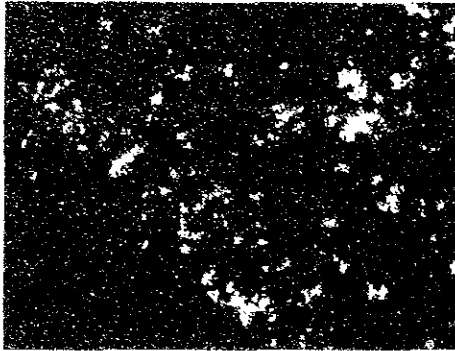
P X-ray image



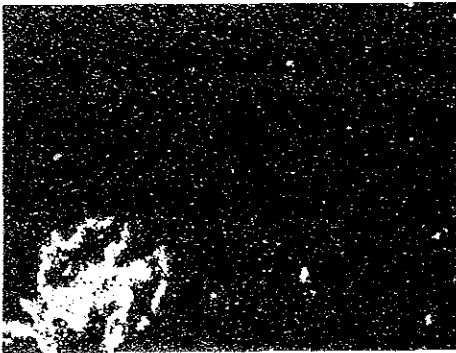
Si X-ray image



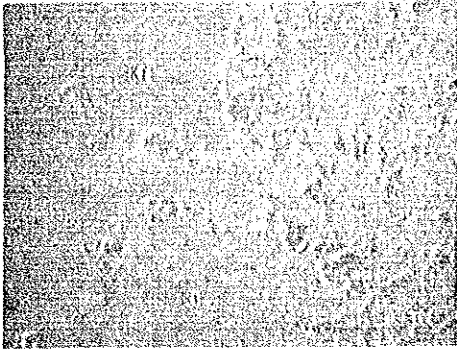
Continuation of 6M053R, 27  
La X-ray image



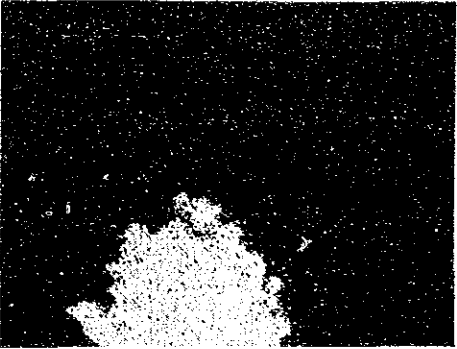
Ca X-ray image



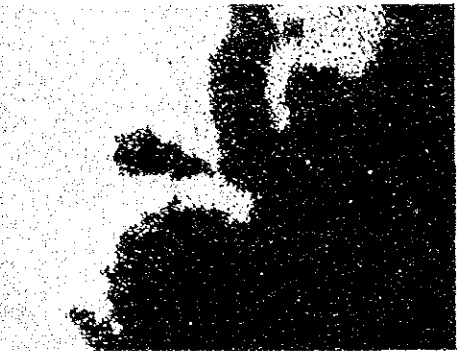
Fe X-ray image



Absorbed electron image  
Sample No : 6Y037R, 8  
Rock Name : Ankeritic-Carbonatite  
Sector : Chilwa Island



Ti X-ray image



K X-ray image



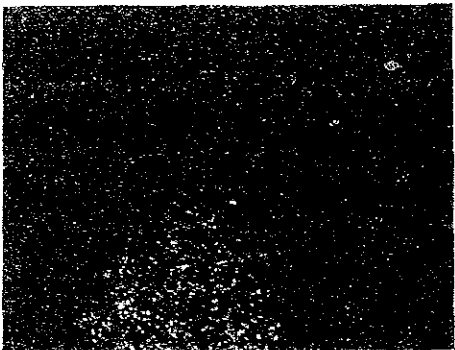
Al X-ray image



Continuation of 6Y037R, 8  
Fe X-ray image



Si X-ray image



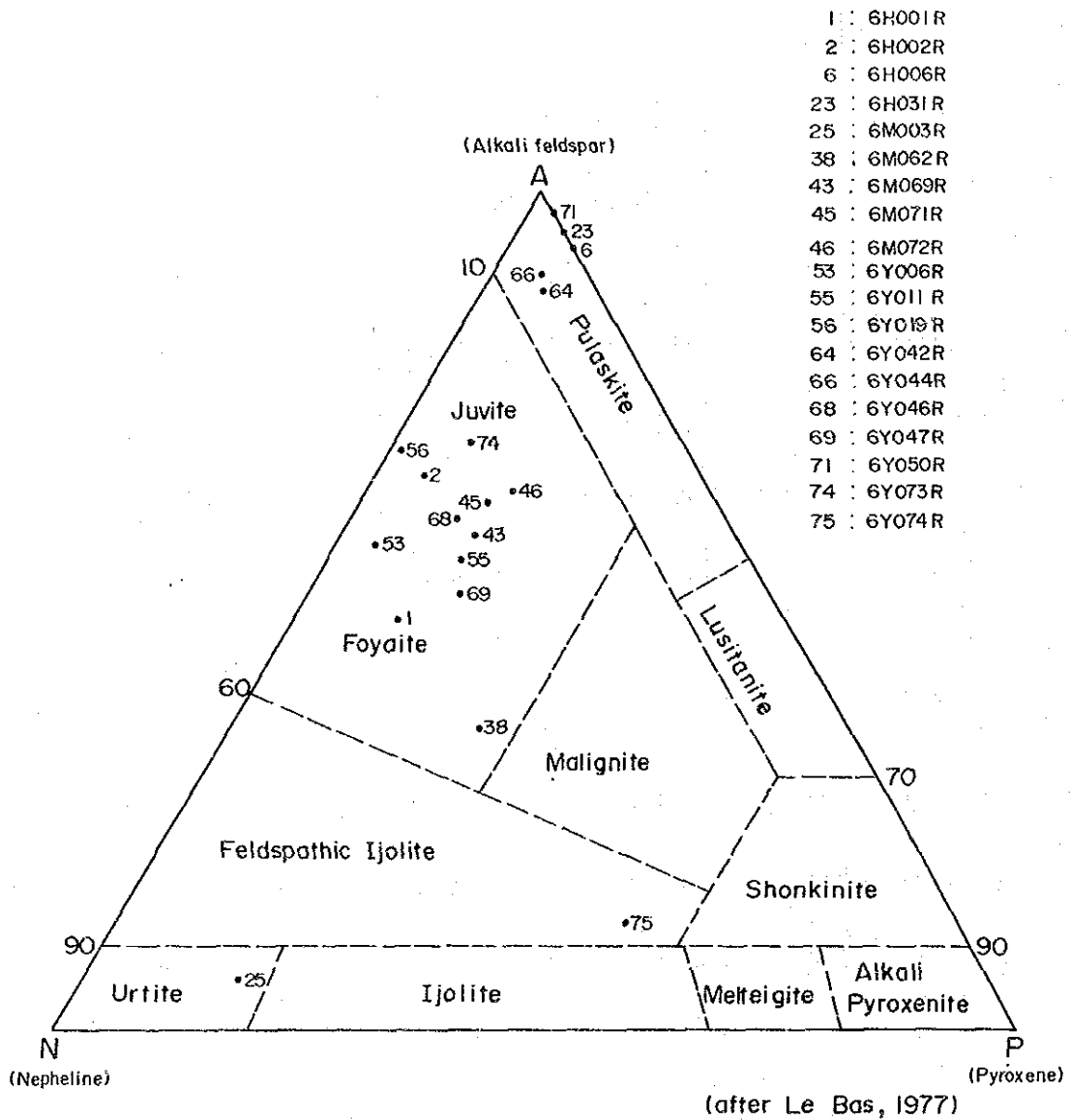
Nb X-ray image



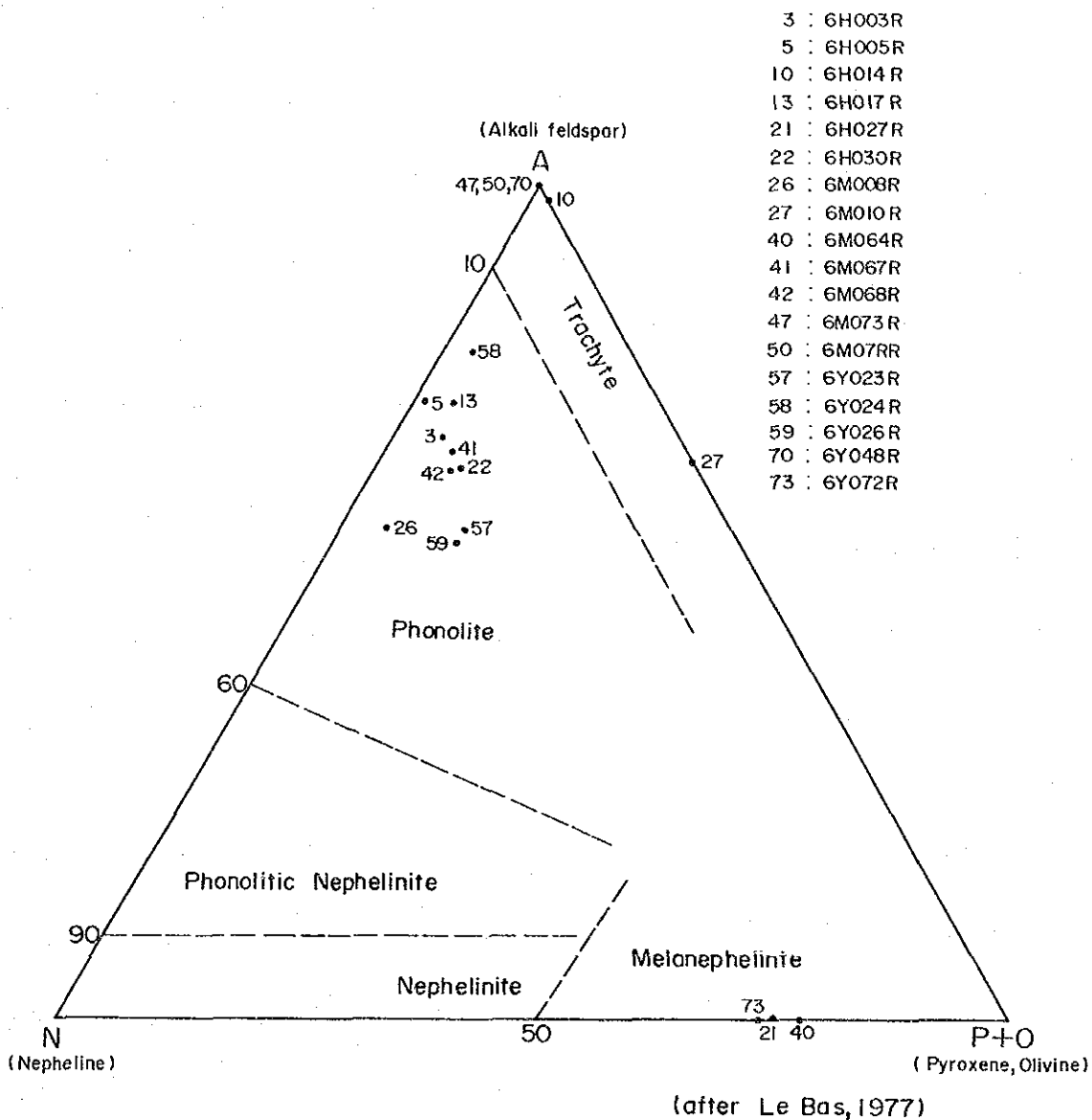
(Quantitative Analysis)

No. Sample No.	Sector	Mineral	Elements and Components																Total
			Zn	Fe	Cu	Mn	Ag	Cd	Sb	As	S	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Nb <sub>2</sub> O <sub>5</sub>	F	O			
1	6H010R	Chilwa Island Sphalerite	63.22	4.00	0.00	0.06	0.00	0.00	0.01	0.00	32.91						100.19		
			SiO <sub>2</sub>	TiO <sub>2</sub>	Al <sub>2</sub> O <sub>3</sub>	FeO	MnO	MgO	SrO	CaO	Na <sub>2</sub> O	K <sub>2</sub> O	P <sub>2</sub> O <sub>5</sub>	Nb <sub>2</sub> O <sub>5</sub>	F	O	Total		
2	6M004R	Tundulu Apatite	0.205	0.020	0.020	0.041	0.039	0.030	1.568	53.861	0.164	0.004	42.033	0.000	2.539	0.000	100.523		
3	6M004R	Tundulu Rutile	0.086	85.789	0.011	3.896	0.017	0.046	0.048	0.278	0.006	0.009	0.023	9.988			100.196		
4	6M053R	Kangankunde Rutile	0.017	95.689	0.007	0.152	0.039	0.041	0.022	0.093	0.042	0.016	0.013	3.622			99.754		
5	6Y005R	Tundulu Biotite	35.873	4.029	11.995	24.014	0.405	10.231	0.154	0.082	0.252	9.259	0.000	0.154	1.267	2.287	100.000		
6	6Y034R	Tundulu Aegirine	54.431	0.682	0.429	27.723	0.096	2.588	0.039	4.254	11.706	0.019					98.968		
7	6Y037R	Chilwa Island K-feldspar	63.401	0.037	18.302	0.480	0.014	0.028	0.033	0.000	0.306	16.894					99.495		

(Weight %)



Appendix 12 Model Variation of Plutonic Rocks in Alkali Rock Series



Appendix 13 Model Variation of Volcanic Rocks in Alkali Rock Series





1101