LATE-STAGE MICAS IN KIMBERLITE GROUNDMASS.

J. V. Smith and R. Brennesholtz, Department of the Geophysical Sciences, The University of Chicago, Chicago, Illinois 60637 U.S.A.
J. B. Dawson, Department of Geology, University of St. Andrews, Scotland

Micaceous kimberlites from South Africa contain two types of groundmass mica <1mm across. Very rare Type I micas are relatively iron-rich with mg [= Mg/(Mg+Fe)] 0.45-0.65, $TiO_2$ 3-6 wt.%, low $Cr_2O_3$, $Al_2O_3$ 14-16 wt.%, no $Fe^{3+}$ required in tetrahedral sites, low NiO (~0.02 wt.%), and relatively high na [$Na_2O/(Na_2O+K_2O)$] 0.02-0.03. The much more abundant Type II micas are variable in composition, but relative to Type I micas are more magnesian (mg 0.80-0.93), lower in $TiO_2$ (0.7-4.0 wt.%) and $Al_2O_3$ (6.8-14.2 wt.%), have substantial $Fe^{3+}$ in tetrahedral sites, and have relatively low na and variable $Cr_2O_3$. Inter-grain variations in composition of Type II micas may result from establishment of local reservoirs on a mm scale, with competition of other phases for minor elements (e.g. chromite for Cr, serpentine for Ni). Associated phases in the groundmass, varying from one kimberlite to another, are combinations of Fe-rich serpentines, Fe-rich talc, calcite, dolomite, diopside, chromite, Mg-ilmenite, perovskite, barite, pyrite, pentlandite, millerite?, heazlewoodite?, quartz.

Type I micas may result from an intrusive precursor (carbonatitic?) to kimberlite, perhaps genetically related, which was incorporated into a later pulse of kimberlite from which the Type II micas crystallized.

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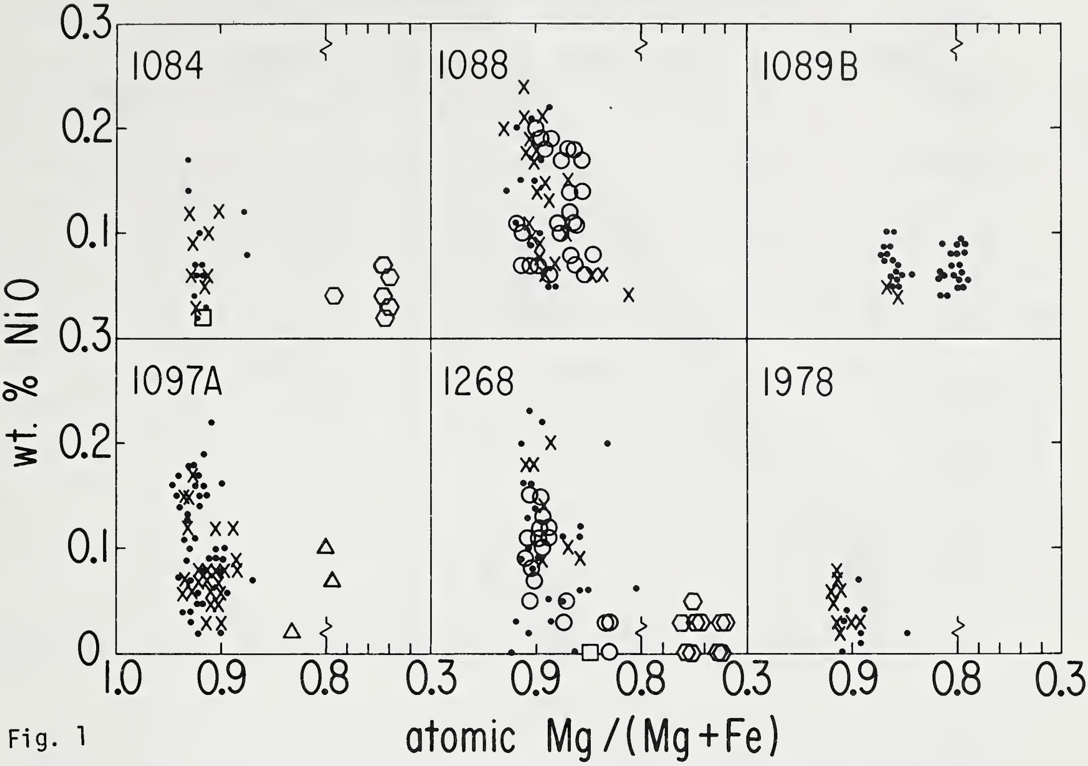
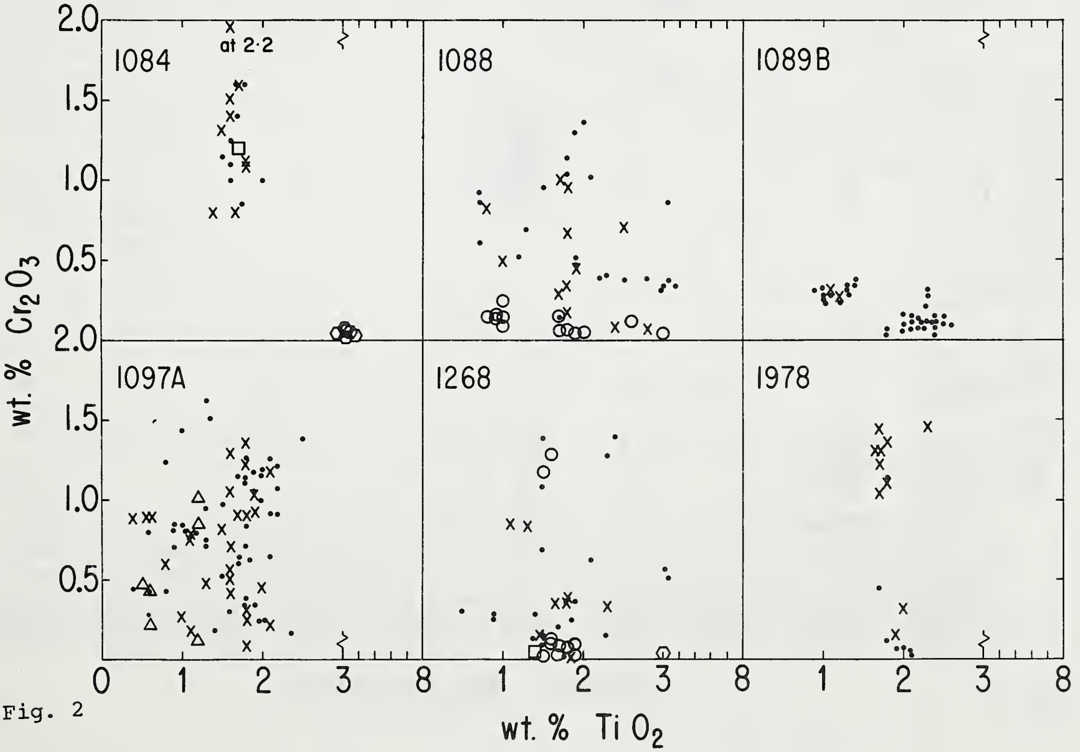
Figs. 1-4. Type I mica-hexagon. Type II mica-circle->$0.5mm^2$ area, dot - 0.05-$0.5mm^2$, cross-<$0.05mm^2$. Triangle-high-$Fe^{3+}$ rims on 1097A Type II mica, square Type II rim on Type I core. $\Delta T$ = 8-Al-Si in structural formula based on 22 oxygens ($H_2O$-free; microprobe data). Localities - 1084 Saltpeterpan dyke, 1088 Zout en Zuur dyke, 1089 New Elands Mine, 1097 Star Mine, 1268 Main dyke, Helam Mine, 1978 Lovedale Mine.



0.3
0.2
0.1
0.3
0.2
0.1
0
1084
1088
1089B
1097A
1268
1978
wt. % NiO
1.0
0.9
0.8
0.3
0.9
0.8
0.3
0.9
0.8
0.3
atomic Mg/(Mg+Fe)


Fig. 1



2.0
1.5
1.0
0.5
2.0
1.5
1.0
0.5
1084
at 2·2
1088
1089B
1097A
1268
1978
wt. % $Cr_2O_3$
0
1
2
3
8
1
2
3
8
1
2
3
8
wt. % $TiO_2$


Fig. 2

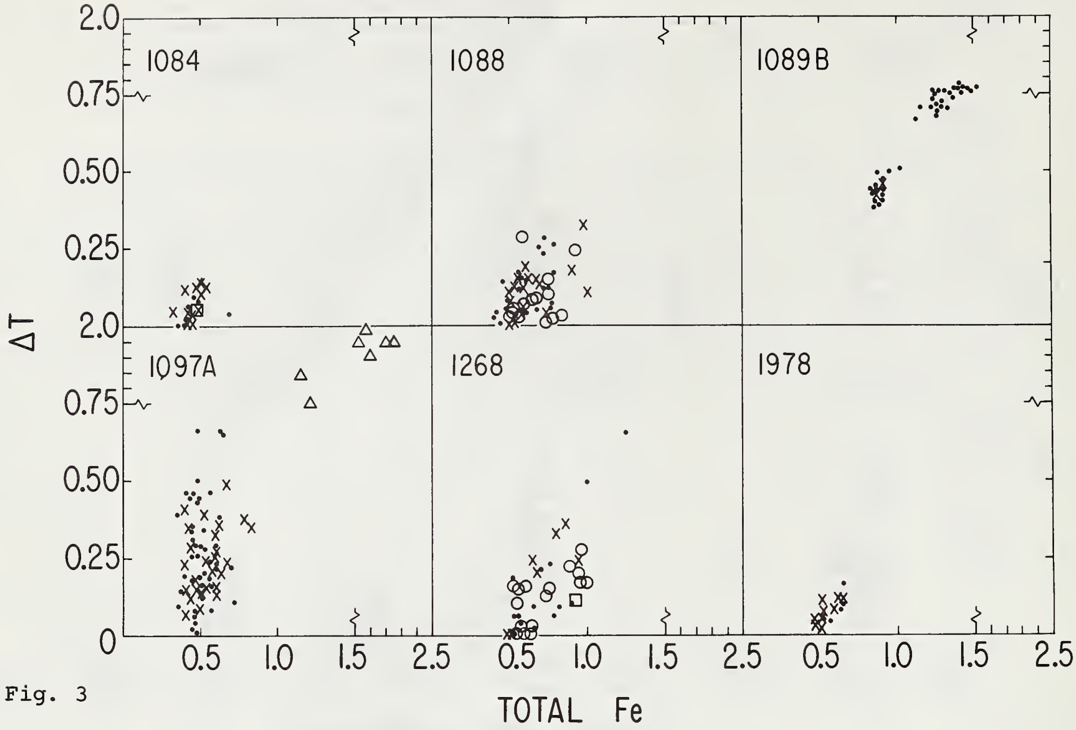

1084
1088
1089B
1097A
1268
1978
ΔT
2.0
0.75
0.50
0.25
0
0.5
1.0
1.5
2.5
TOTAL Fe

Fig. 3

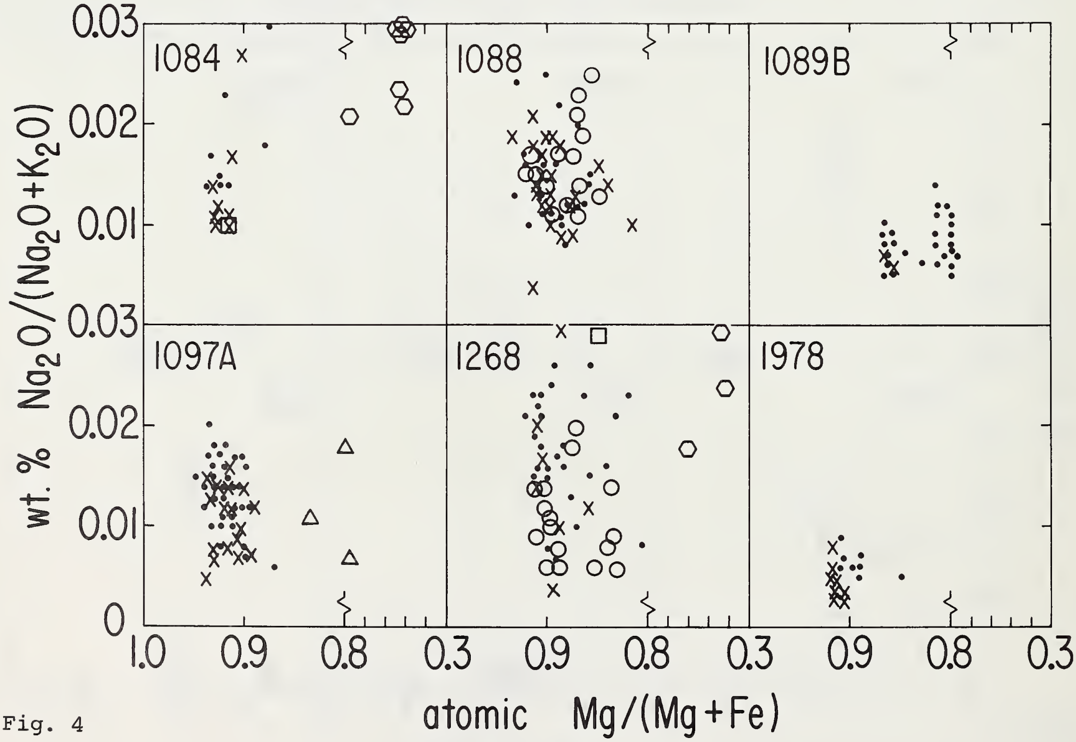

1084
1088
1089B
1097A
1268
1978
wt. % Na2O/(Na2O+K2O)
0.03
0.02
0.01
0
1.0
0.9
0.8
0.3
atomic Mg/(Mg+Fe)

Fig. 4