U.S. DEPARTMENT OF ENERGY
OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

PRESENTATION TO THE NUCLEAR WASTE TECHNICAL REVIEW BOARD

SUBJECT: NEW GEOCHEMICAL DATA

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GOALS OF CRATER FLAT PETROLOGY STUDIES:

1. Understand overall Magmatic Evolution of the Crater Flat field.

2. Understand nature of Polycyclic Volcanism at individual eruptive centers.

EVIDENCE FOR DECLINING MAGMA FLUX:

1. Field evidence

   -Decline in eruptive volumes and lava effusion rates.

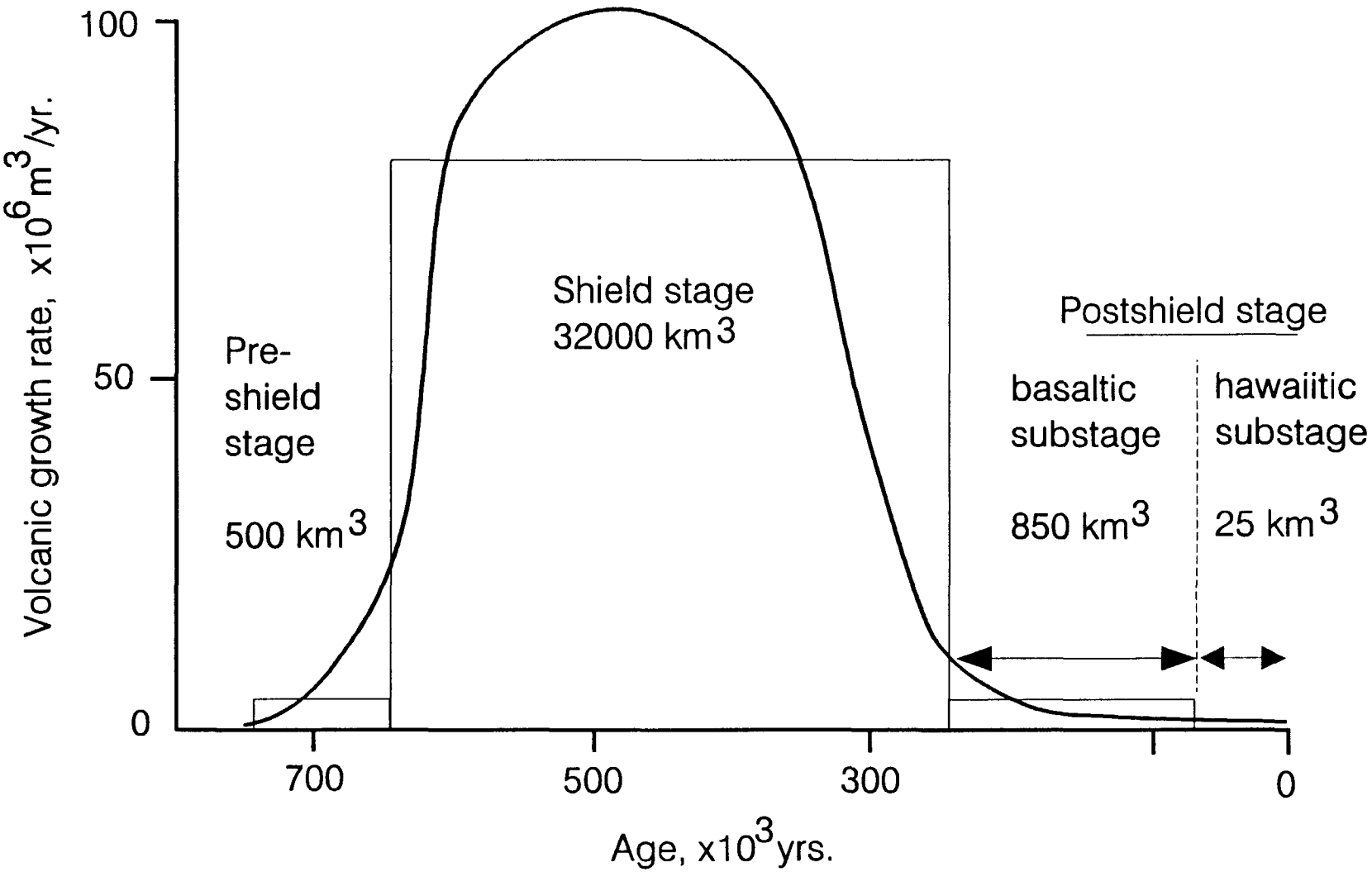
2. Petrologic evidence

   -Deepening of magma reservoirs

   (different phenocryst assemblages and trace element contents)

   -Increased magma evolution

Mauna Kea

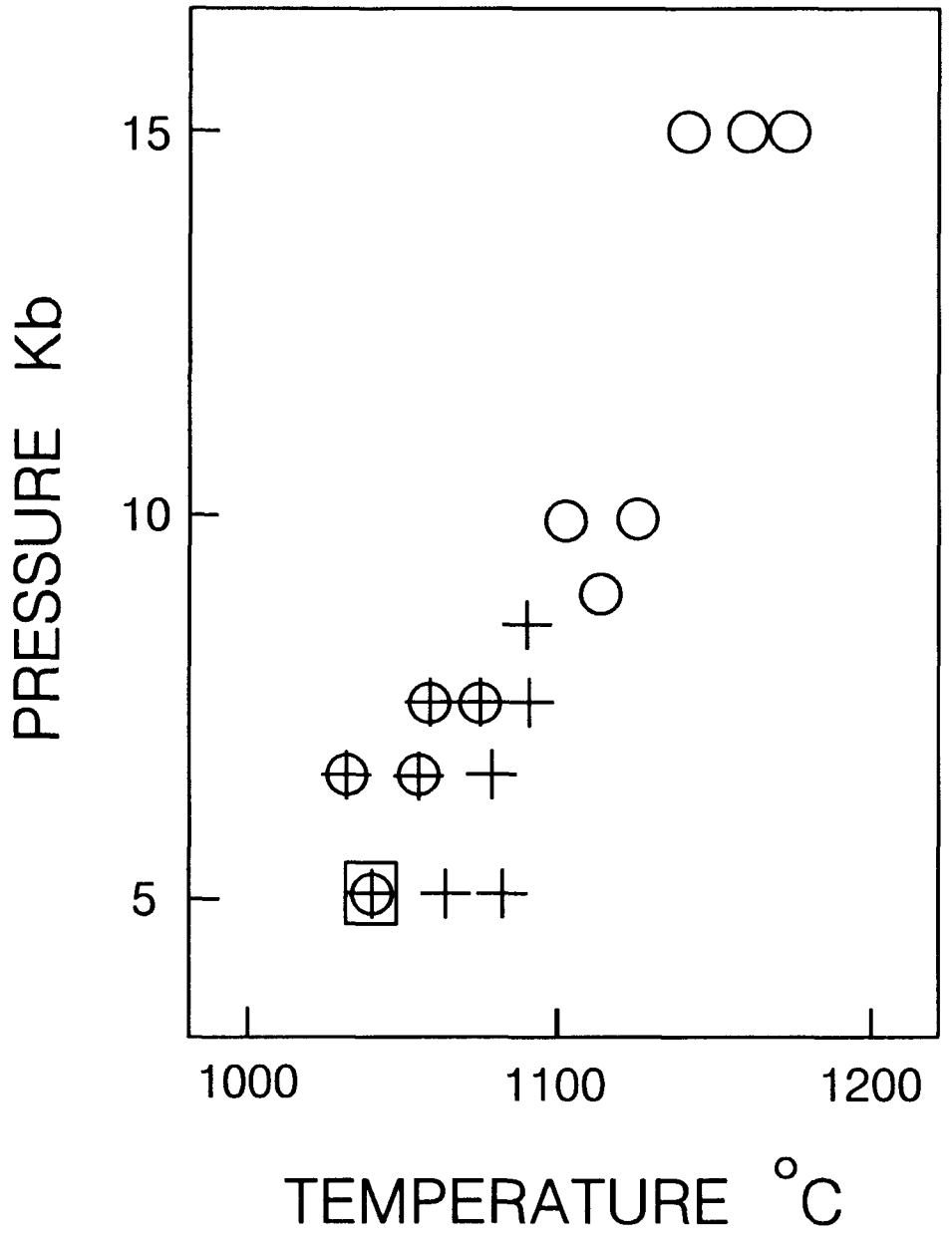


From Frey et al., 1990

MAUNA KEA POSTSHIELD VOLCANISM
(Frey et al., 1990)

	Basaltic substage	Hawaiitic substage
Composition	alkali basalt	hawaiite
Volume	850 km^3	25 km^3
Petrography	porphyritic	aphyric
Sr	400-700 ppm	1100-1300 ppm
Sc	20-40 ppm	5-15 ppm

BASALT PETROGENESIS



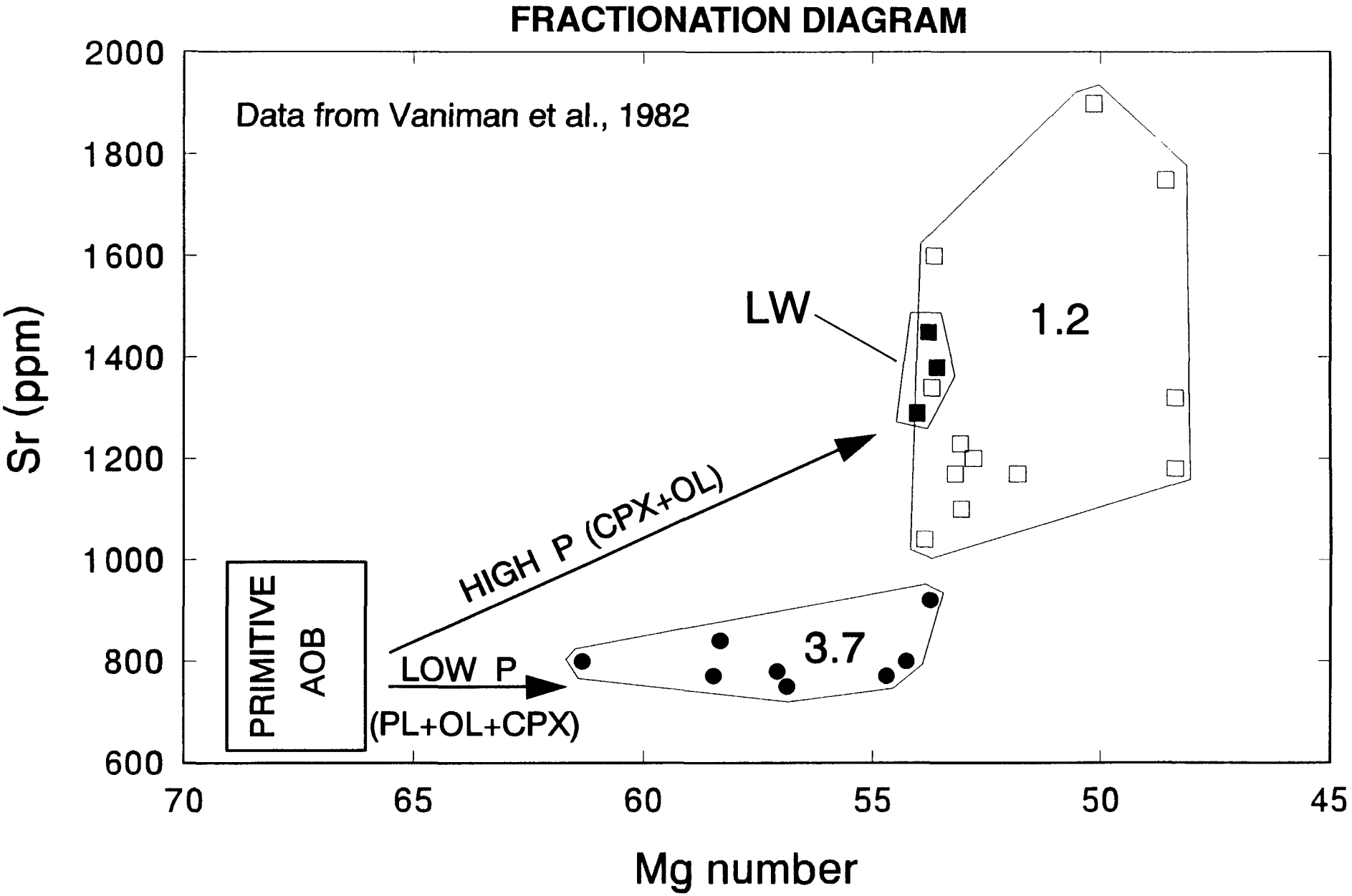
KNUTSON AND GREEN , 1975

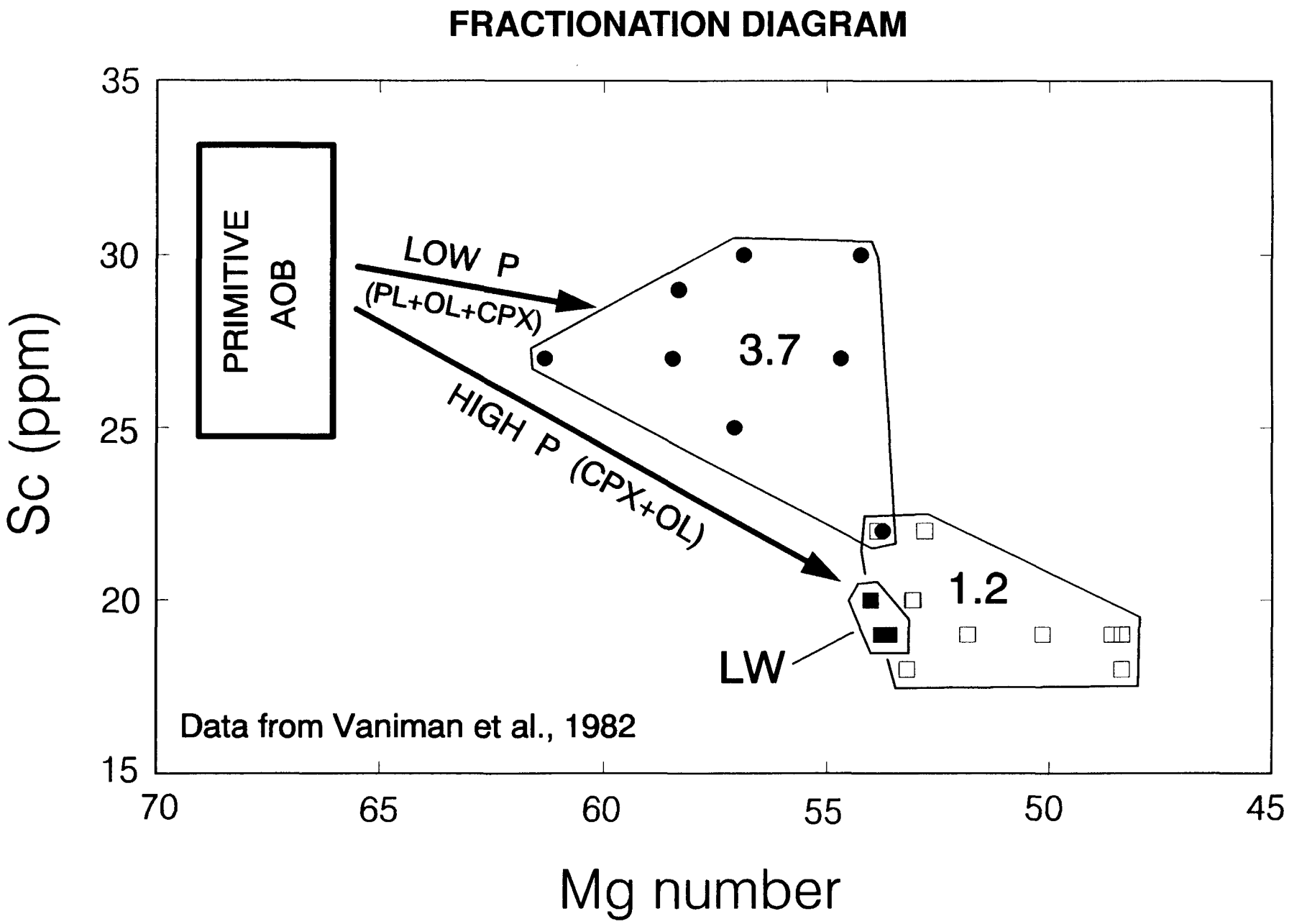
HAWAIITE, 2% H_2O

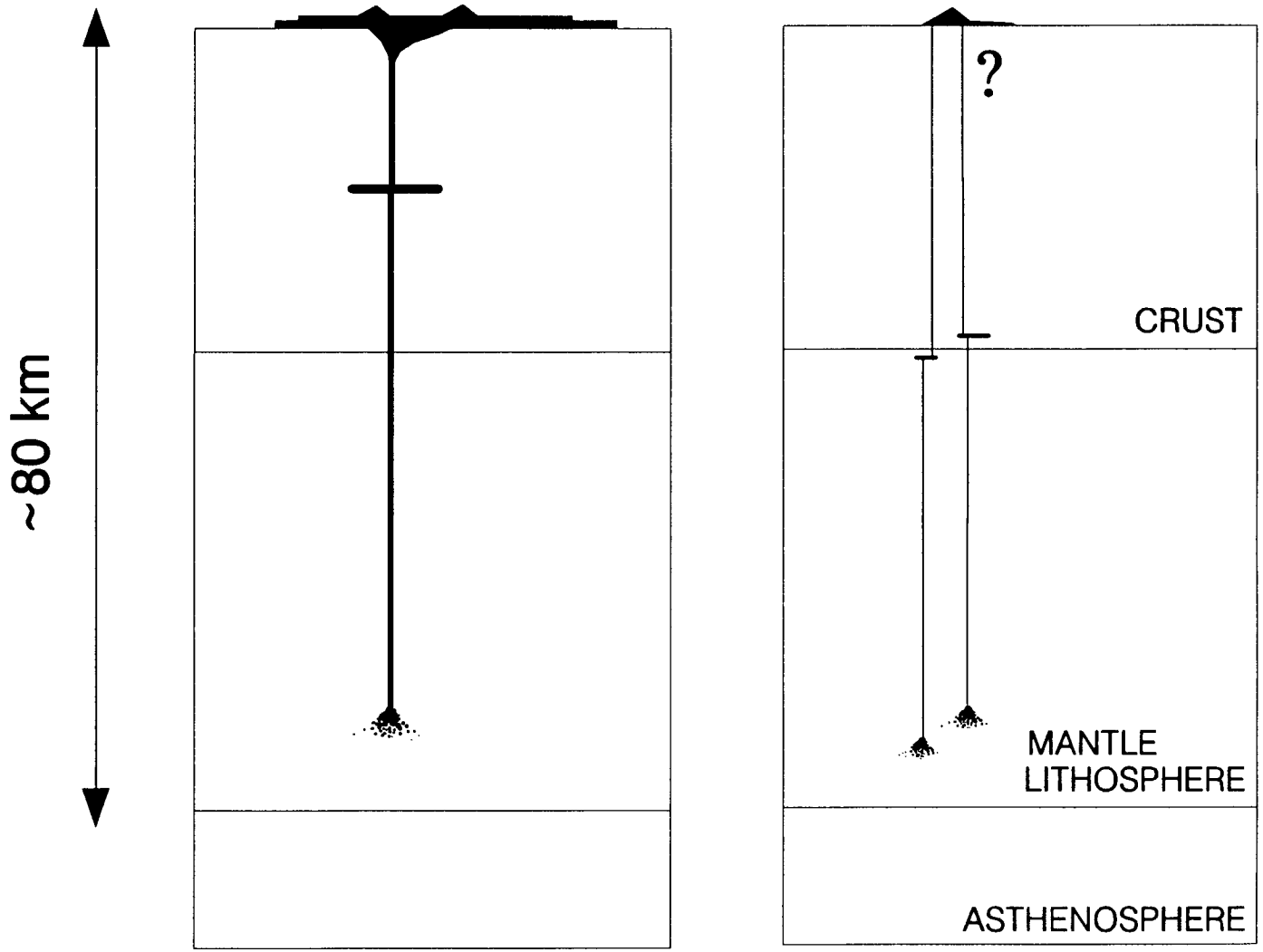
+ OLIVINE

○ CLINOPYROXENE

□ PLAGIOCLASE

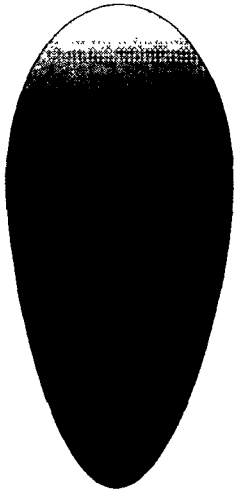

FRACTIONATION DIAGRAM
Data from Vaniman et al., 1982
2000
1800
1600
1400
1200
1000
800
600
Sr (ppm)
70
65
60
55
50
45
Mg number
LW
1.2
3.7
HIGH P (CPX+OL)
LOW P
(PL+OL+CPX)
PRIMITIVE
AOB


FRACTIONATION DIAGRAM
35
30
25
20
15
Sc (ppm)
70
65
60
55
50
45
Mg number
PRIMITIVE AOB
LOW P
(PL+OL+CPX)
HIGH P (CPX+OL)
3.7
1.2
LW
Data from Vaniman et al., 1982

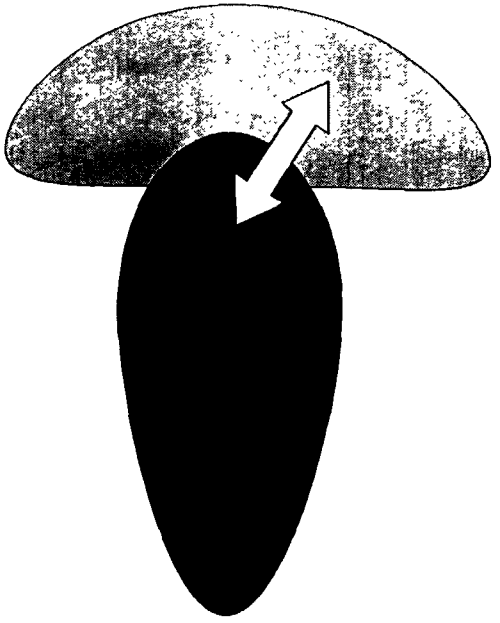


CRUST-MANTLE MODEL

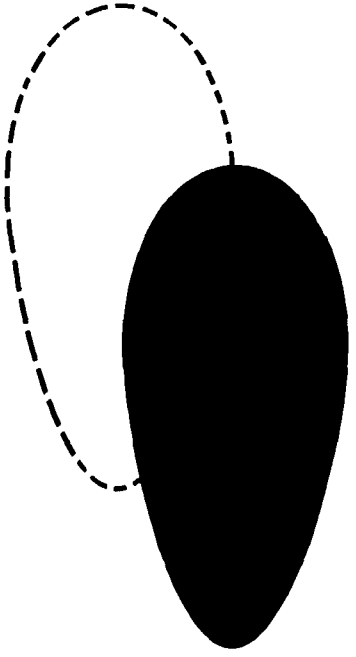
MODELS FOR GEOCHEMICAL VARIATIONS



FRACTIONATION

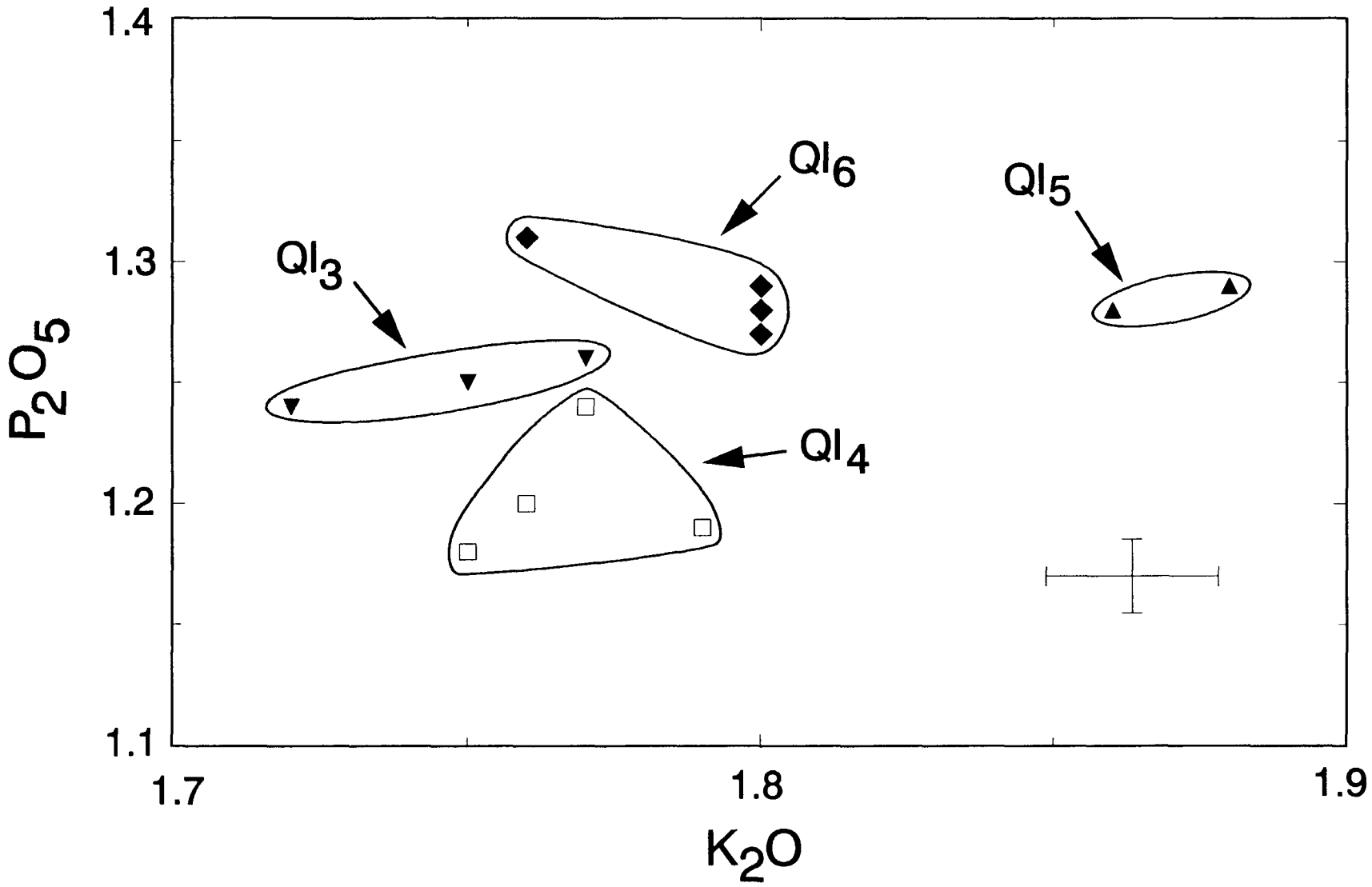


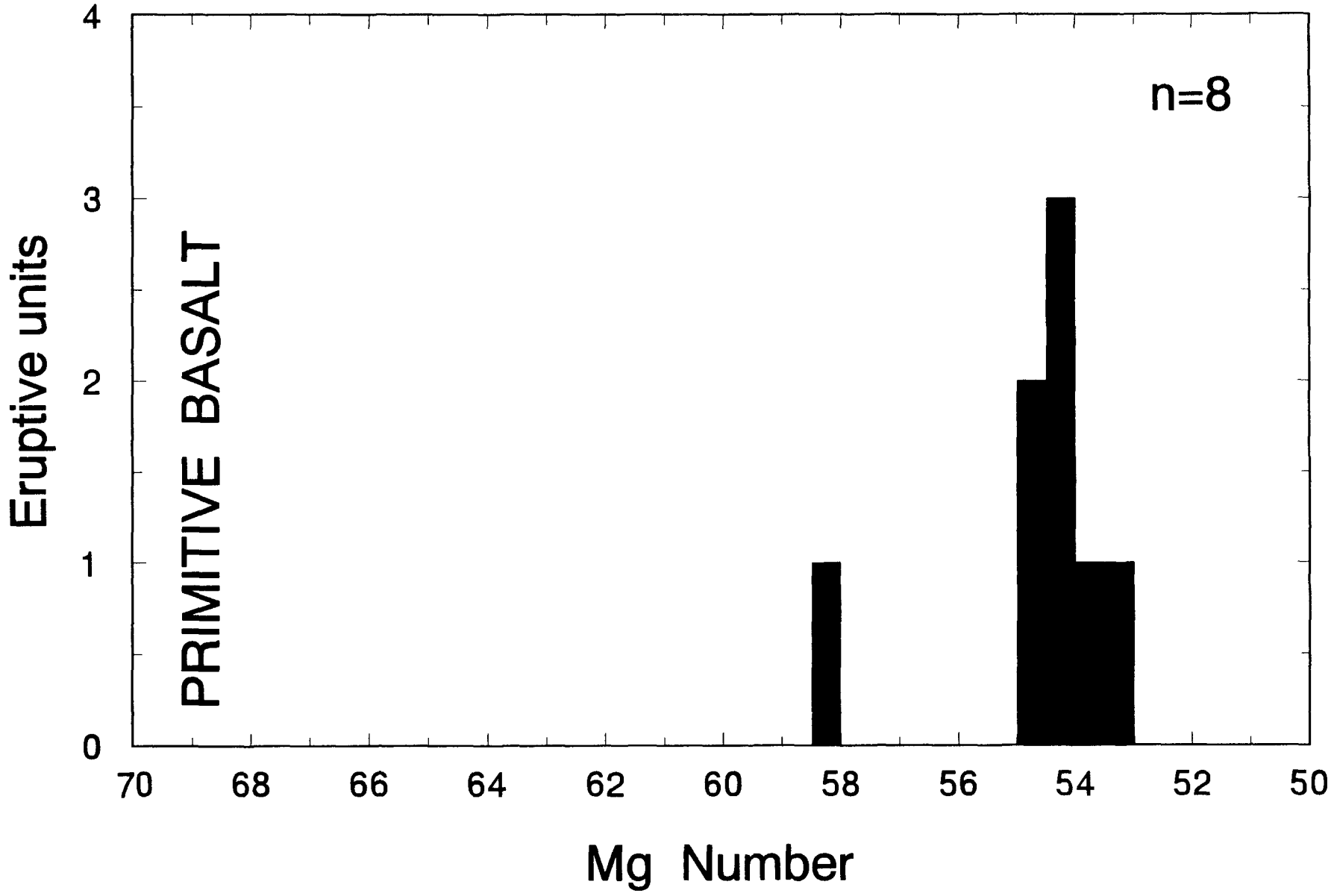
MIXING

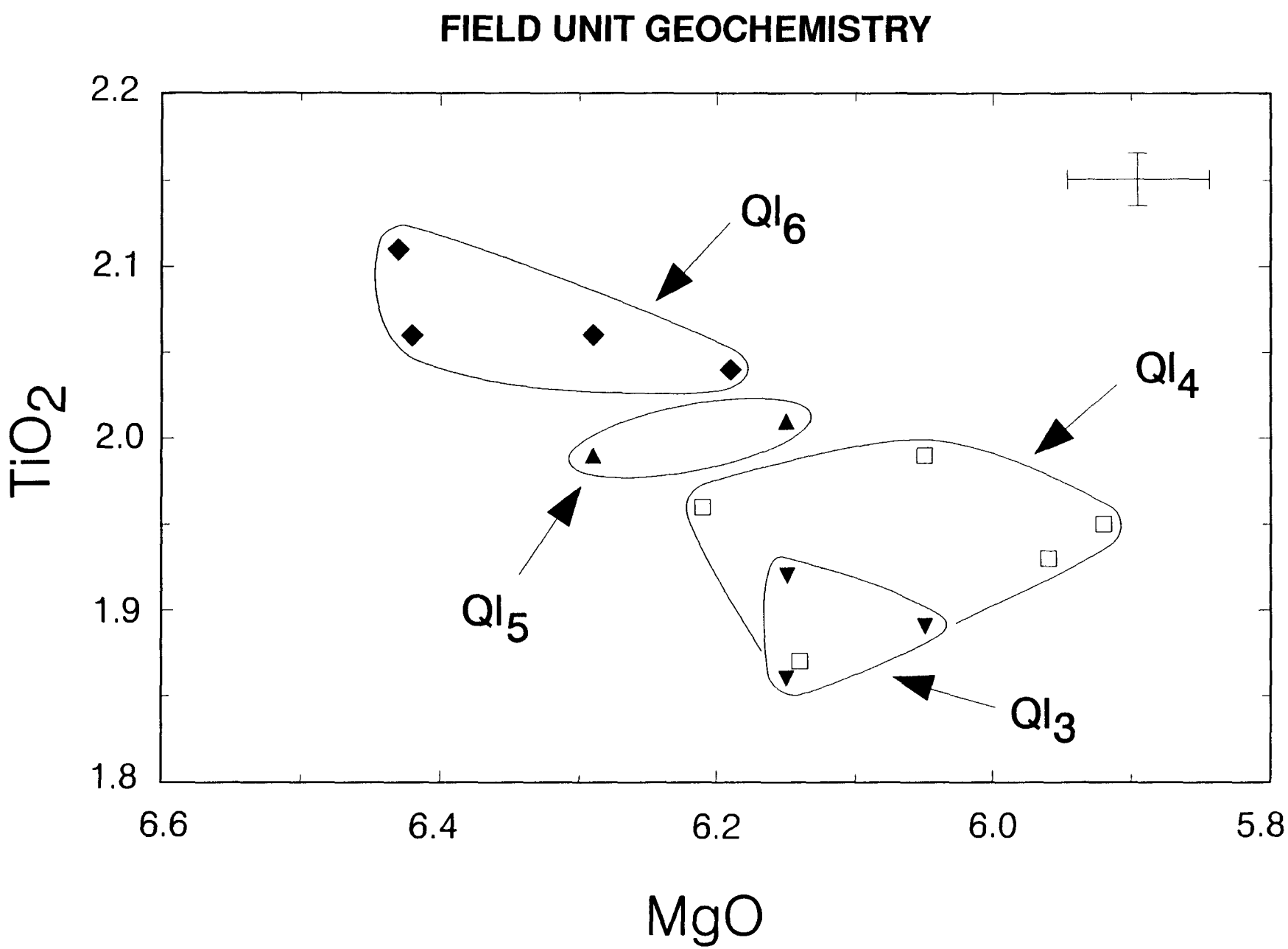


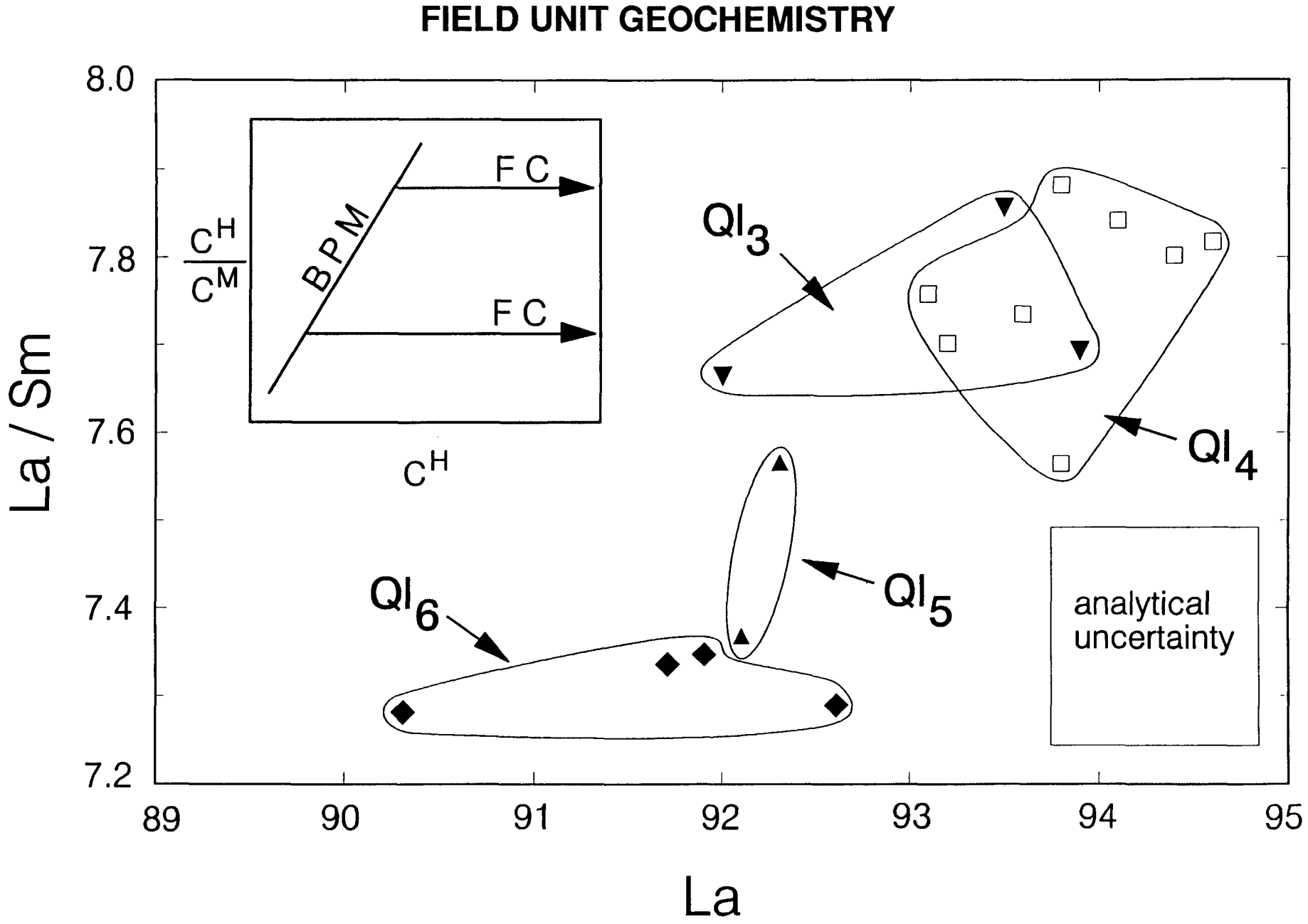
TEMPORALLY DISCRETE PULSES

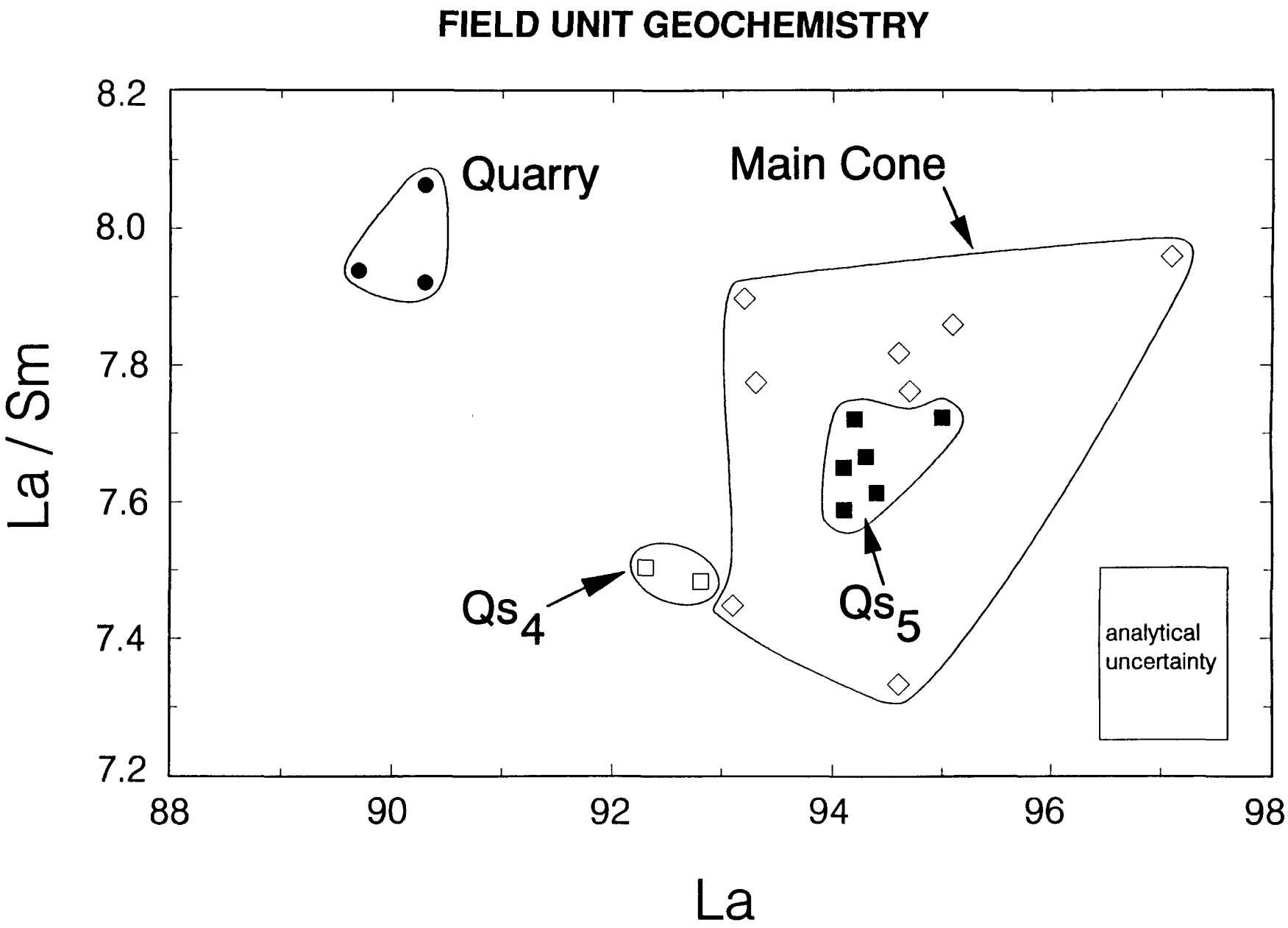
FIELD UNIT GEOCHEMISTRY




n=8
PRIMITIVE BASALT
Eruptive units
0
1
2
3
4
70
68
66
64
62
60
58
56
54
52
50
Mg Number


FIELD UNIT GEOCHEMISTRY
2.2
2.1
2.0
1.9
1.8
TiO2
6.6
6.4
6.2
6.0
5.8
MgO
Ql6
Ql4
Ql5
Ql3


FIELD UNIT GEOCHEMISTRY
8.0
7.8
7.6
7.4
7.2
La / Sm
89
90
91
92
93
94
95
La
C^H / C^M
BPM
FC
FC
C^H
Ql3
Ql4
Ql5
Ql6
analytical uncertainty


FIELD UNIT GEOCHEMISTRY
Quarry
Main Cone
Qs4
Qs5
analytical uncertainty
La / Sm
La
8.2
8.0
7.8
7.6
7.4
7.2
88
90
92
94
96
98

CONCLUSIONS:

1. Eruptive events at Lathrop Wells represent separate partial melts.

2. Apparent lack of melt interactions are consistent with long time intervals between eruptions.

NEEDS:

1. Integration of chemistry with stratigraphy

   -are there systematic variations with time?

2. Analytical capability