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

NUCLEAR WASTE TECHNICAL REVIEW BOARD
PANEL ON STRUCTURAL GEOLOGY & GEOENGINEERING

SUBJECT: PALEOMAGNETISM STUDIES

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ALEXIS PARK HOTEL
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PALEOMAGNETISM OF YOUNG VOLCANIC ROCKS: UTILITY FOR RELATIVE DATING

- Fundamental Tenets

most geologic materials are capable, with good to high fidelity, of recording the direction of the geomagnetic field at some time in their history

for lava flows, the time of magnetization acquisition (thermal blocking) is generally during initial cooling over a range of temperatures below about 580°C

the past record of the geomagnetic field can be partially deciphered from paleomagnetic data from young volcanic rocks; the record is inherently incomplete (i.e. spotty)

- Geomagnetic Field behavior of Importance for Paleomagnetic Studies

secular variation; changes in direction and intensity of the field at any locality with time. Secular variation of the field is strongly related to non-dipolar components of the geomagnetic field, as well a precessional "wobble" of the dipole field. Therefore, changes in direction and intensity at any location may differ from those at a separate location over the same period of time. Results of some investigations indicate that on average the direction of the field at any locality may change some 4 to 6° per century.

geomagnetic field excursions/polarity episodes are high-amplitude, short-lived field phenomena

field polarity reversals represent a nearly complete breakdown of the main dipole and stabilization of the field in the opposite polarity; the most recent reversal occurred about 780 kyr

averaged over geologically long periods of time, the geomagnetic field is assumed to be represented as an axial geocentric dipole

- Ongoing Studies at Lathrop Wells

sampling conducted in May, 1991; includes ten paleomagnetic sampling sites in Ql_5 (4 sites), Ql_6 (4 sites), and the buried flow (2 sites)

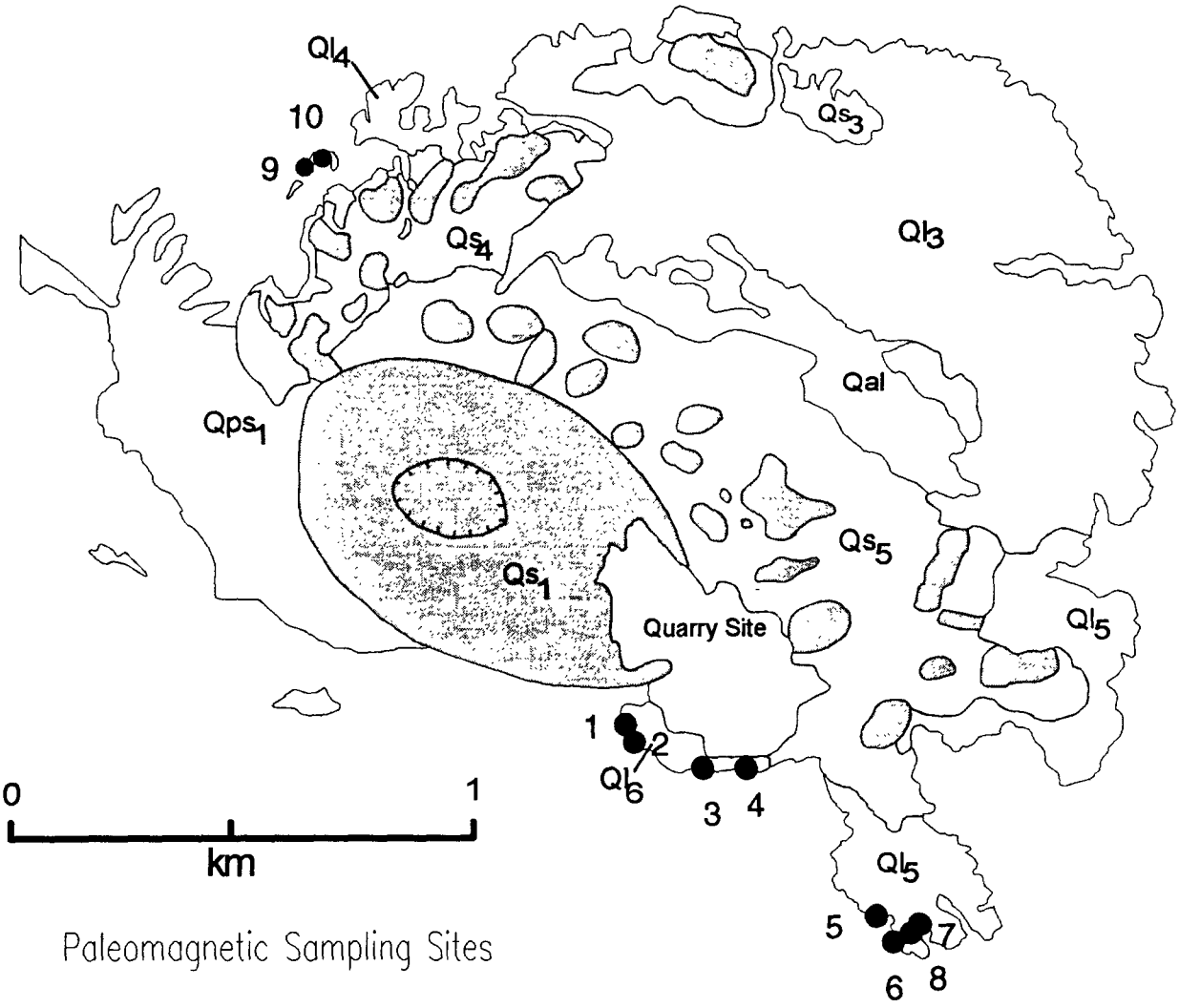
progressive demagnetization carried out on at least one specimen from each of the many (8-12) samples collected per site

anisotropy of magnetic susceptibility measured on at least one specimen from each sample for each site, prior to demagnetization

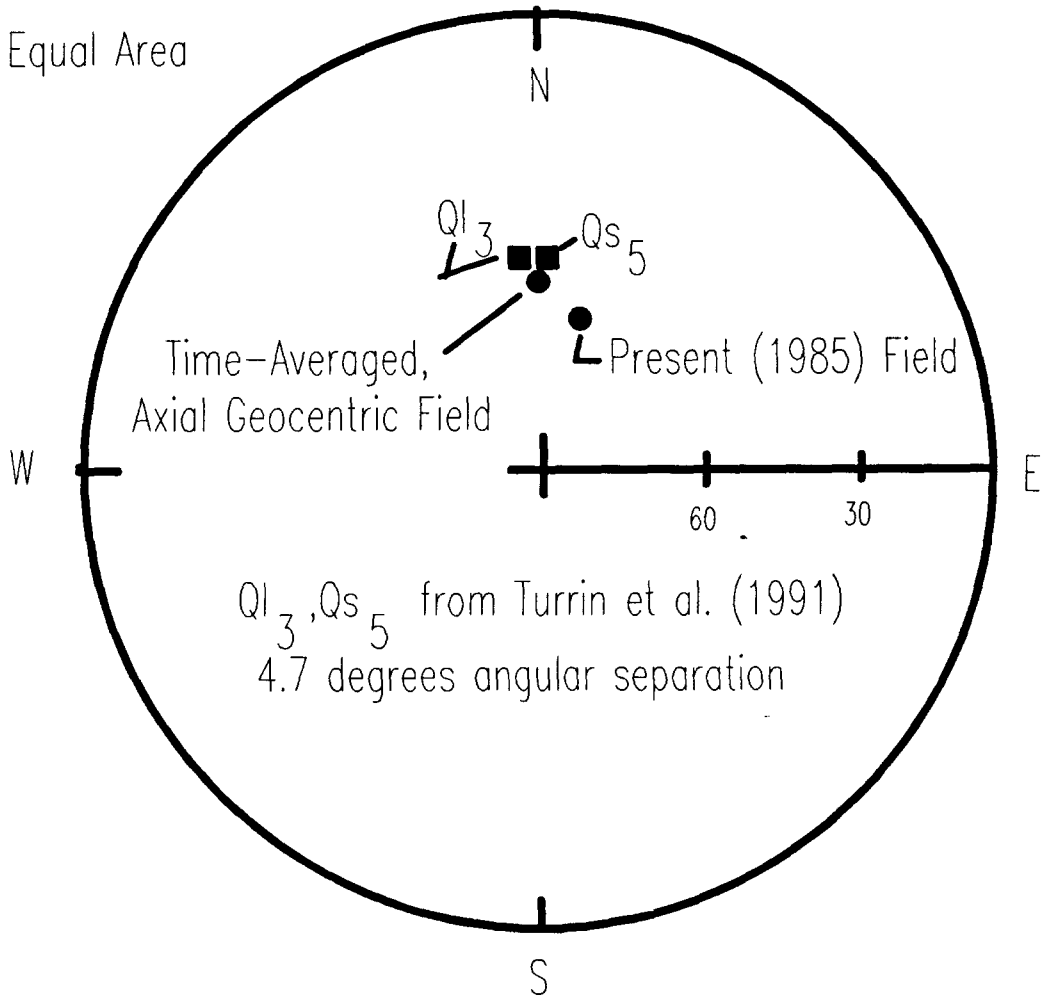
none of the three flows sampled recorded an "unusual" geomagnetic field direction; results are not dissimilar from those reported by Turrin et al. (1991) for Ql_3 and Qs_5.

on the basis of the paleomagnetic data alone, it is difficult to place an estimate on the time duration of volcanic activity at Lathrop Wells

problems encountered include effects of lightning strikes and difficulty in sampling completely intact material

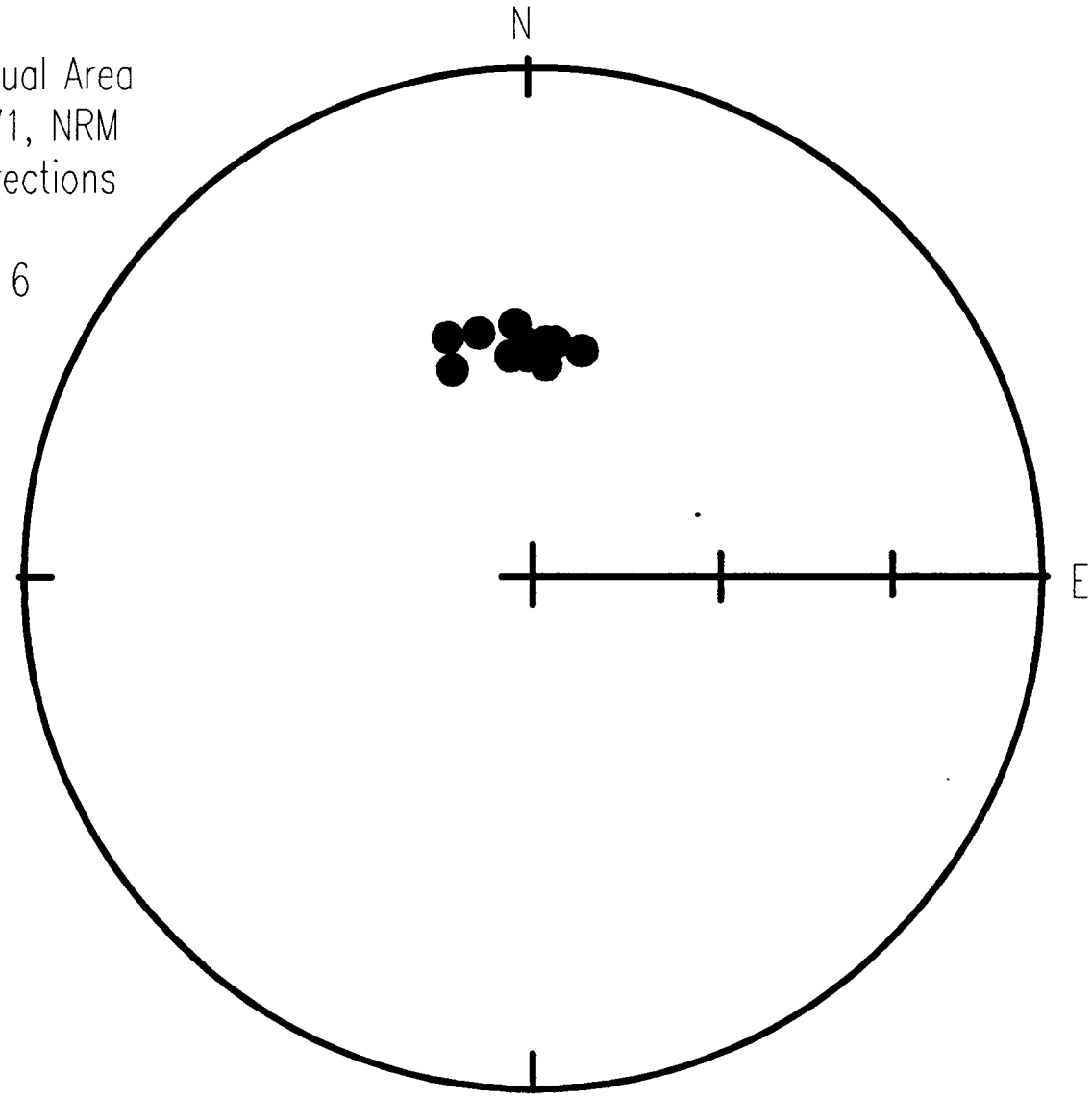


Paleomagnetic Sampling Sites


Equal Area
N
Ql 3
Qs 5
Time-Averaged,
Axial Geocentric Field
Present (1985) Field
W
E
60
30
Ql 3 ,Qs 5 from Turrin et al. (1991)
4.7 degrees angular separation
S

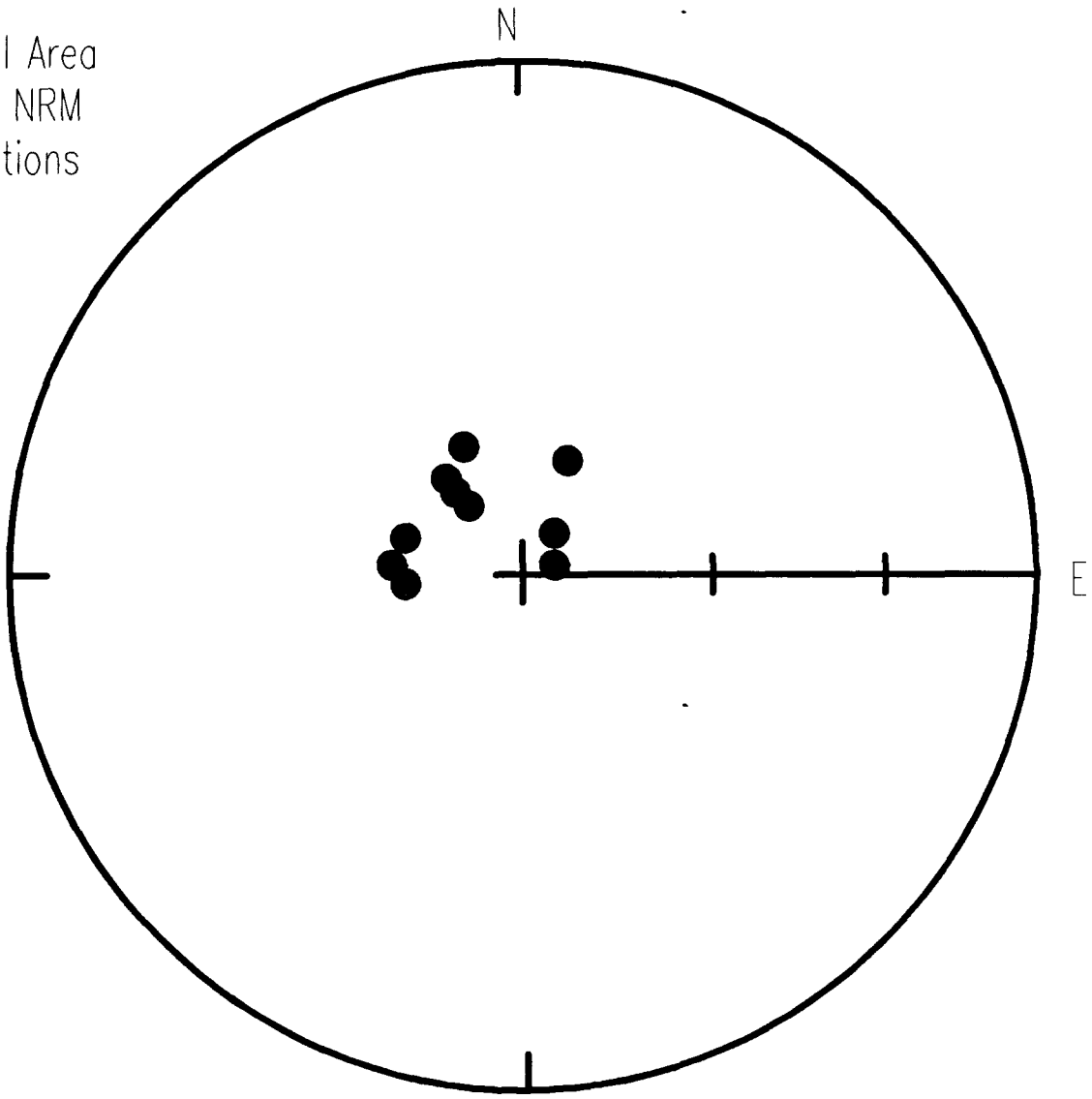
Equal Area
LW1, NRM
directions

QI 6



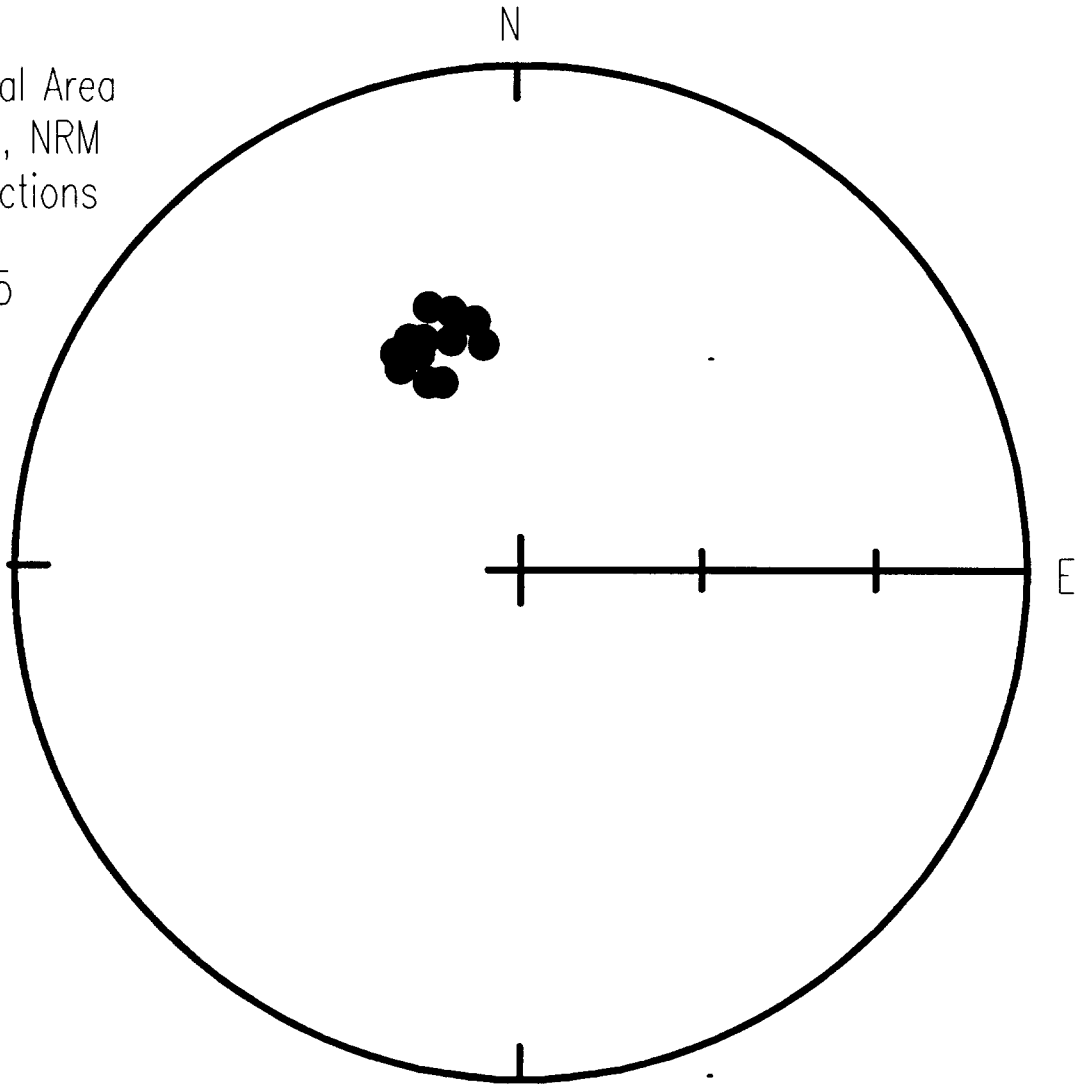
Equal Area
LW2, NRM
directions

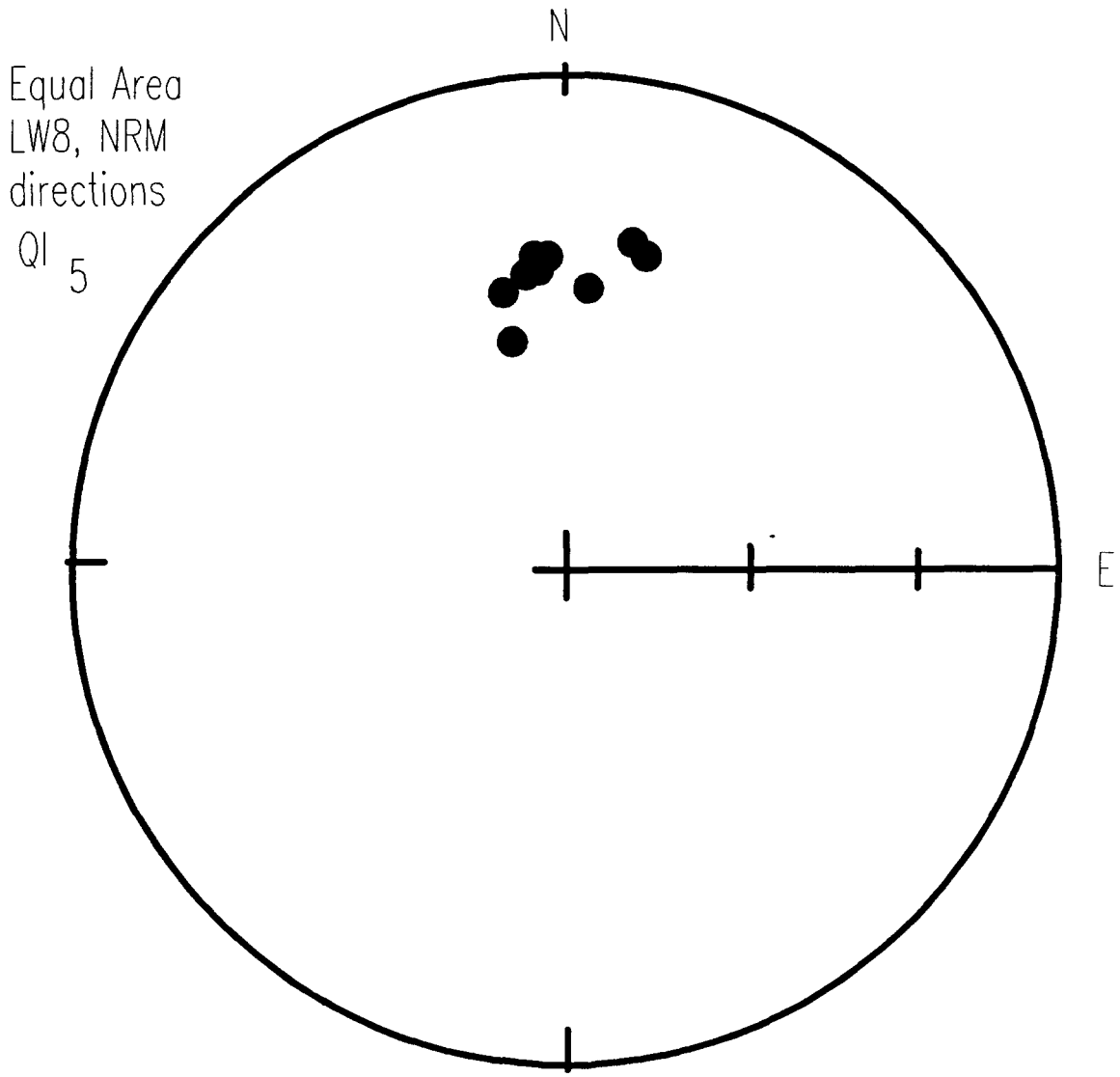
QI 6

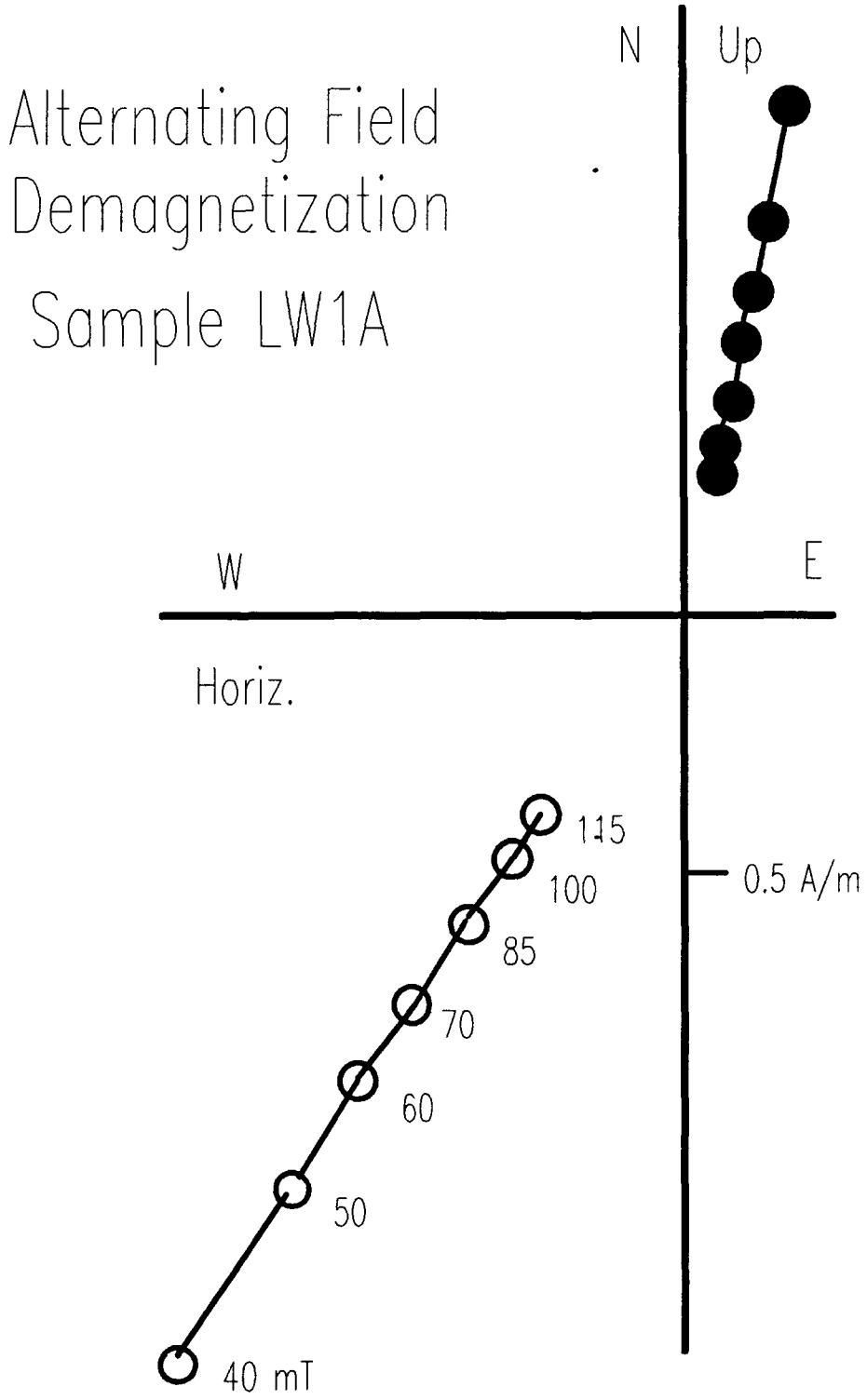


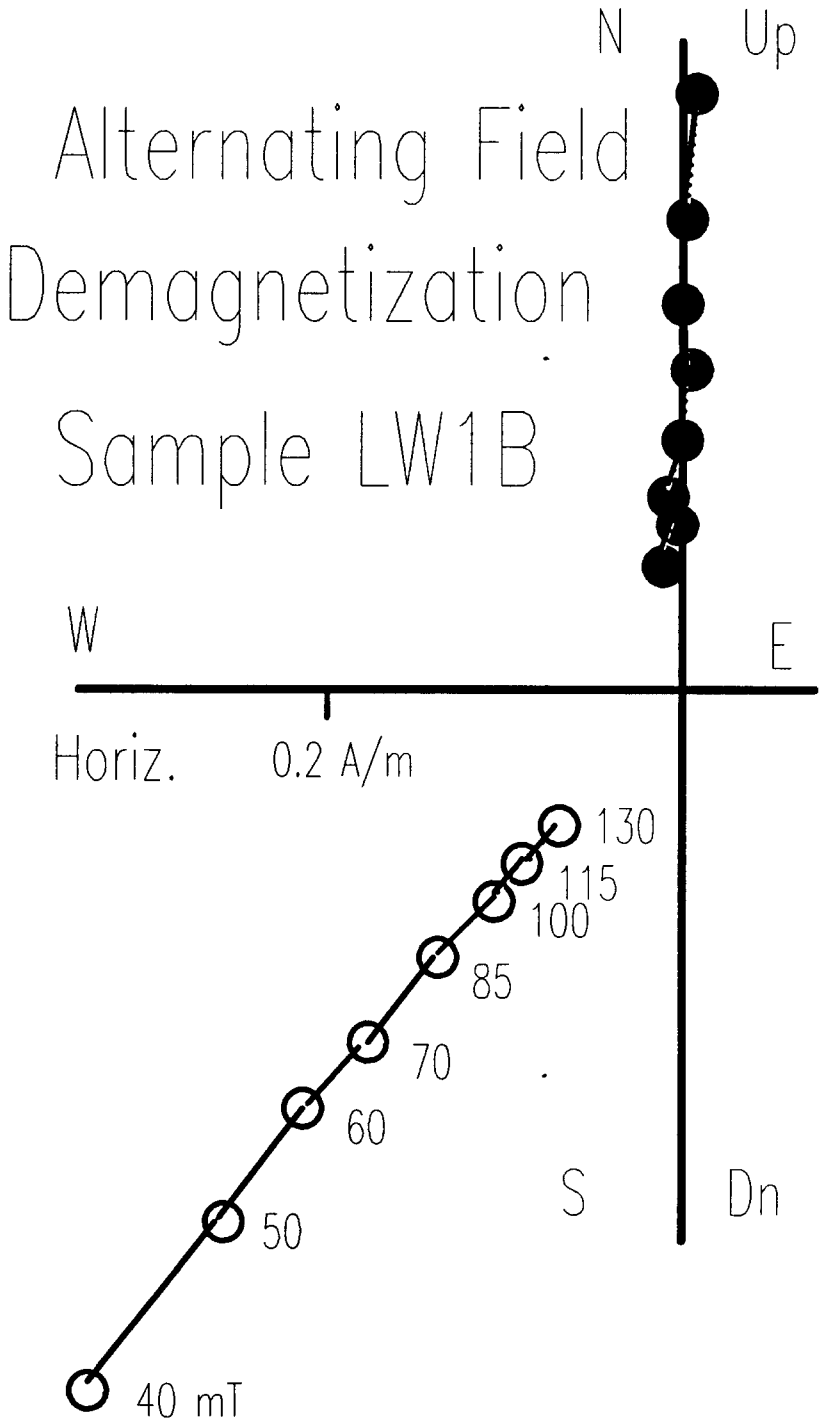
Equal Area
LW7, NRM
directions

QI 5

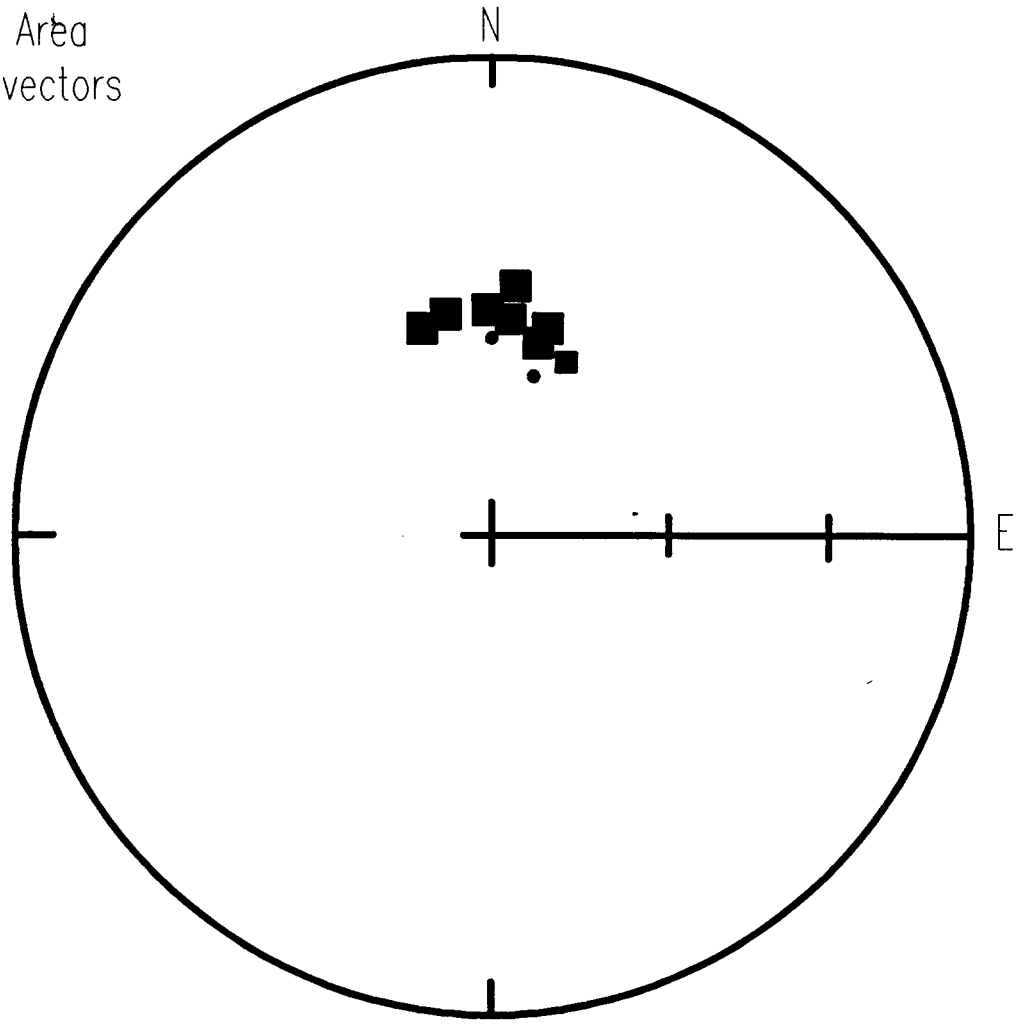



Equal Area
LW8, NRM
directions
QI 5
N
E


Alternating Field
Demagnetization
Sample LW1A
N
Up
W
E
Horiz.
115
100
85
70
60
50
40 mT
0.5 A/m


Alternating Field
Demagnetization
Sample LW1B
N
Up
W
E
S
Dn
Horiz.
0.2 A/m
130
115
100
85
70
60
50
40 mT

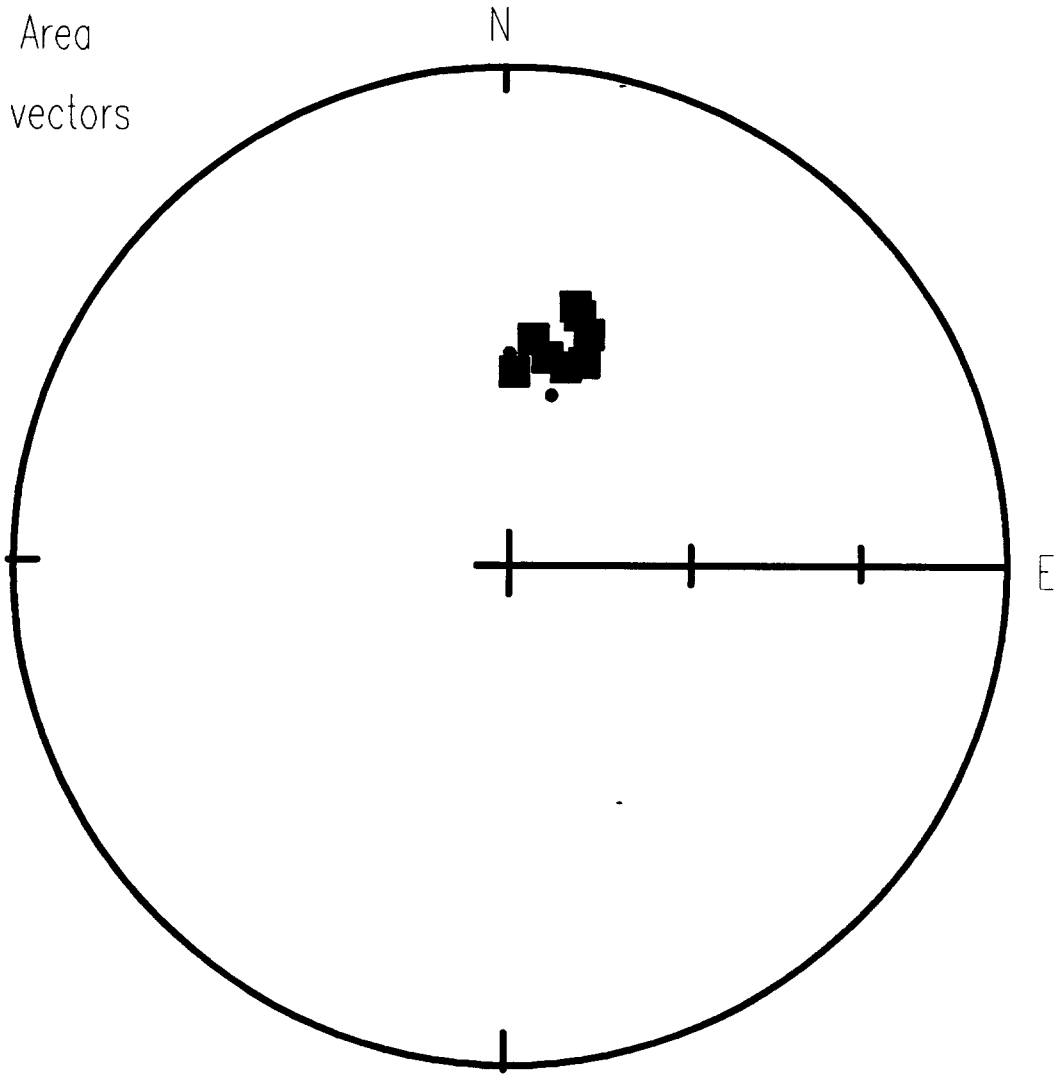
Equal Area
LW1, vectors
QI 6



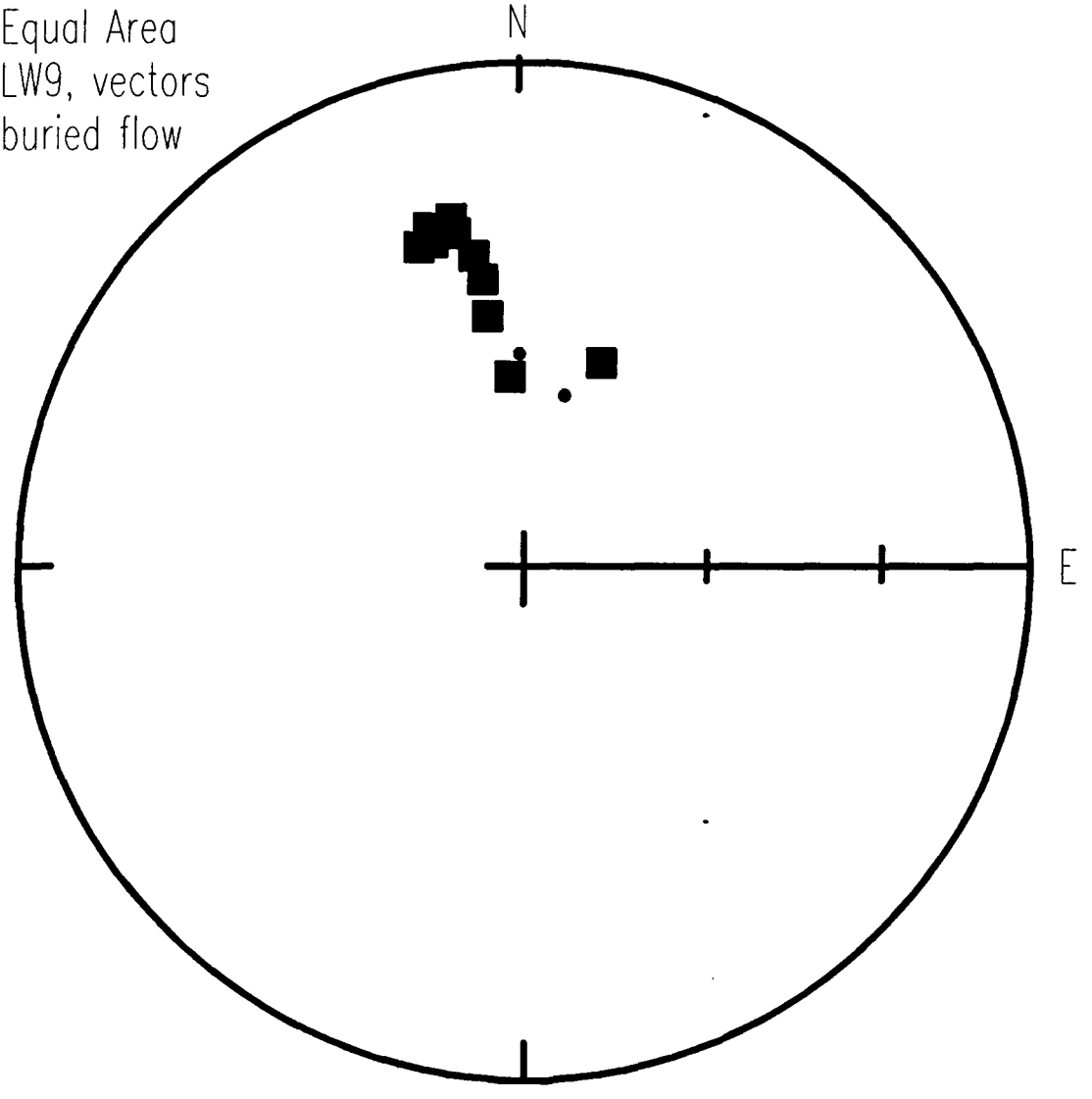
Equal Area

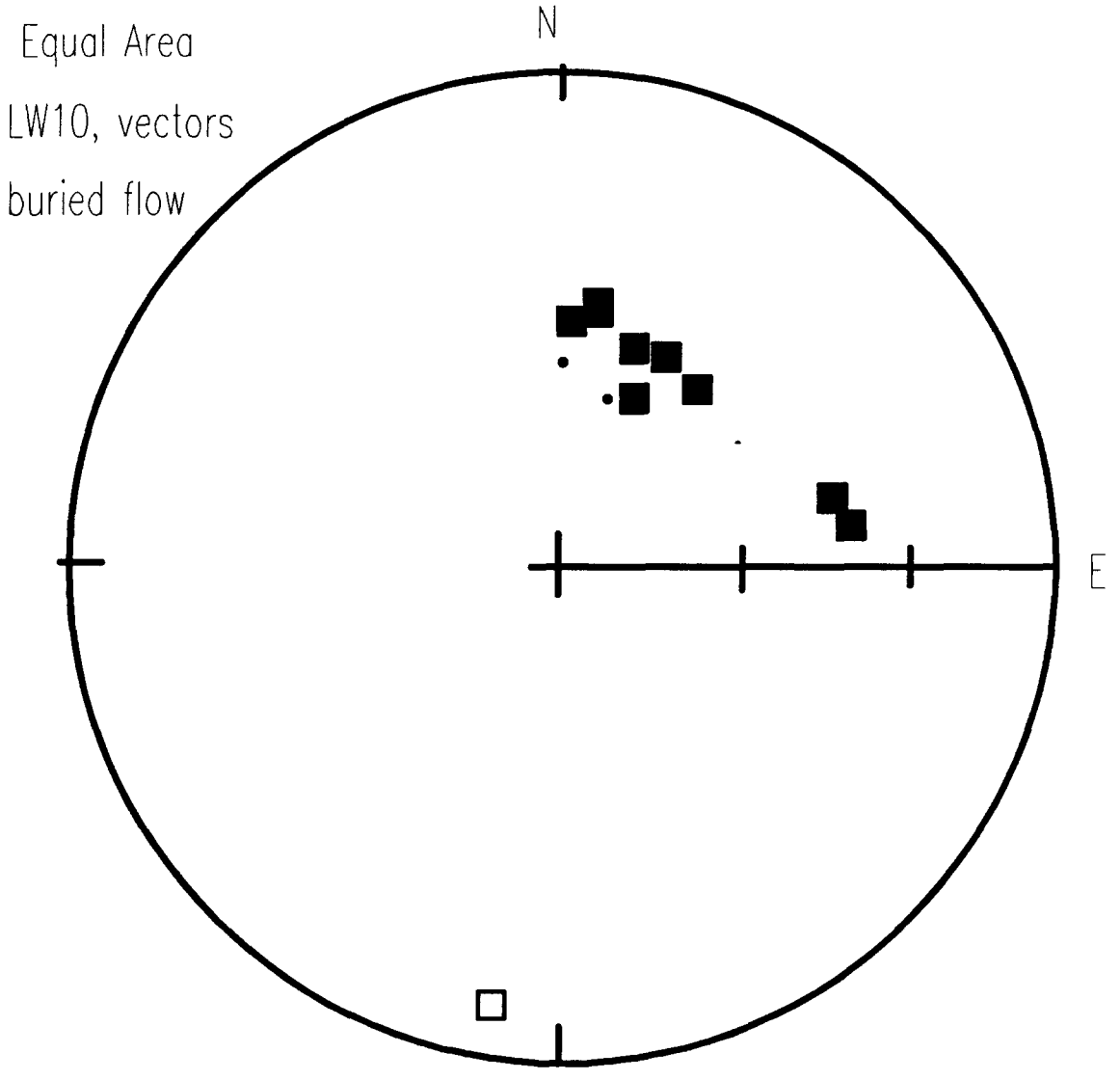
LW2, vectors

QI_6



Equal Area
LW9, vectors
buried flow




Equal Area
LW10, vectors
buried flow
N
E