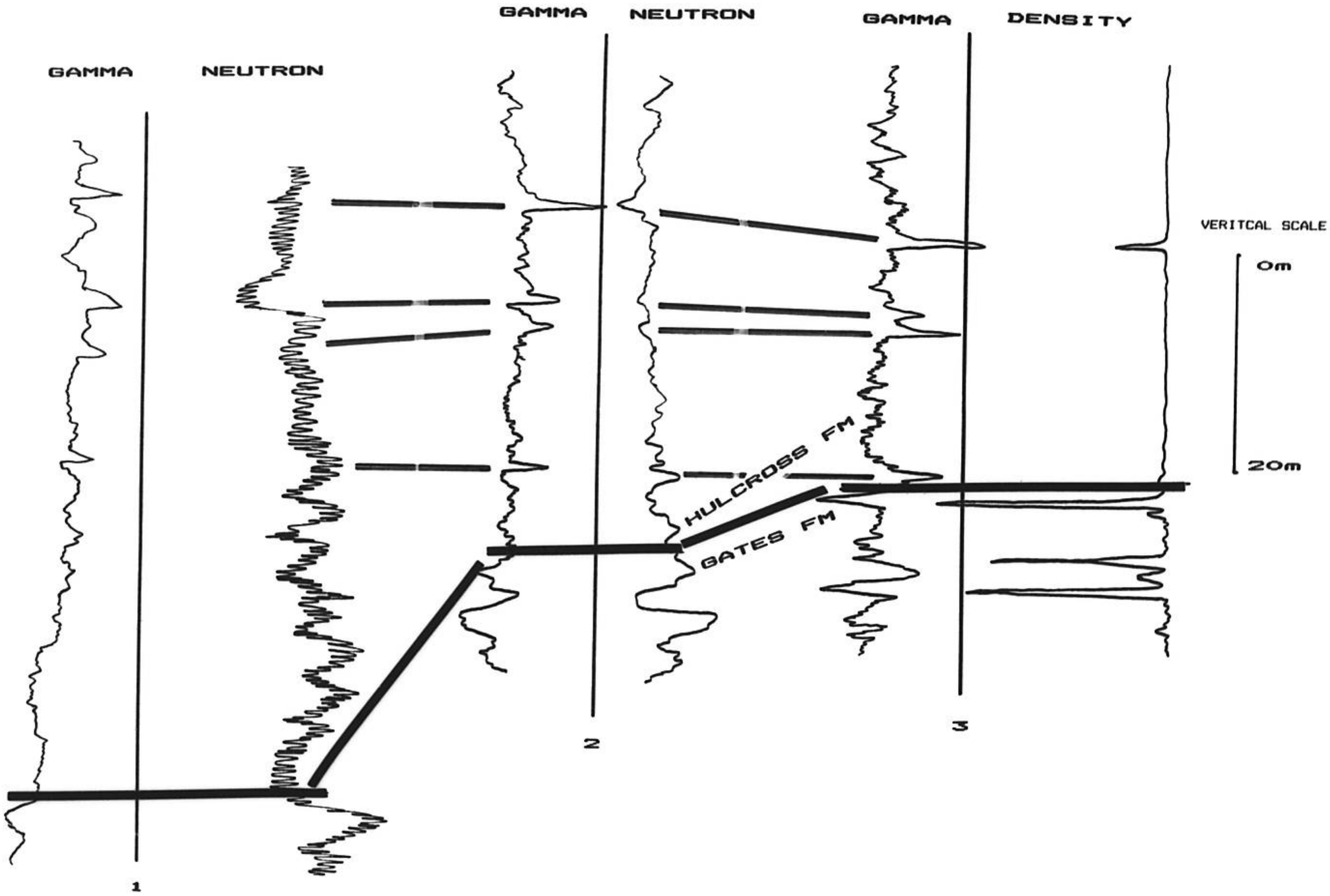
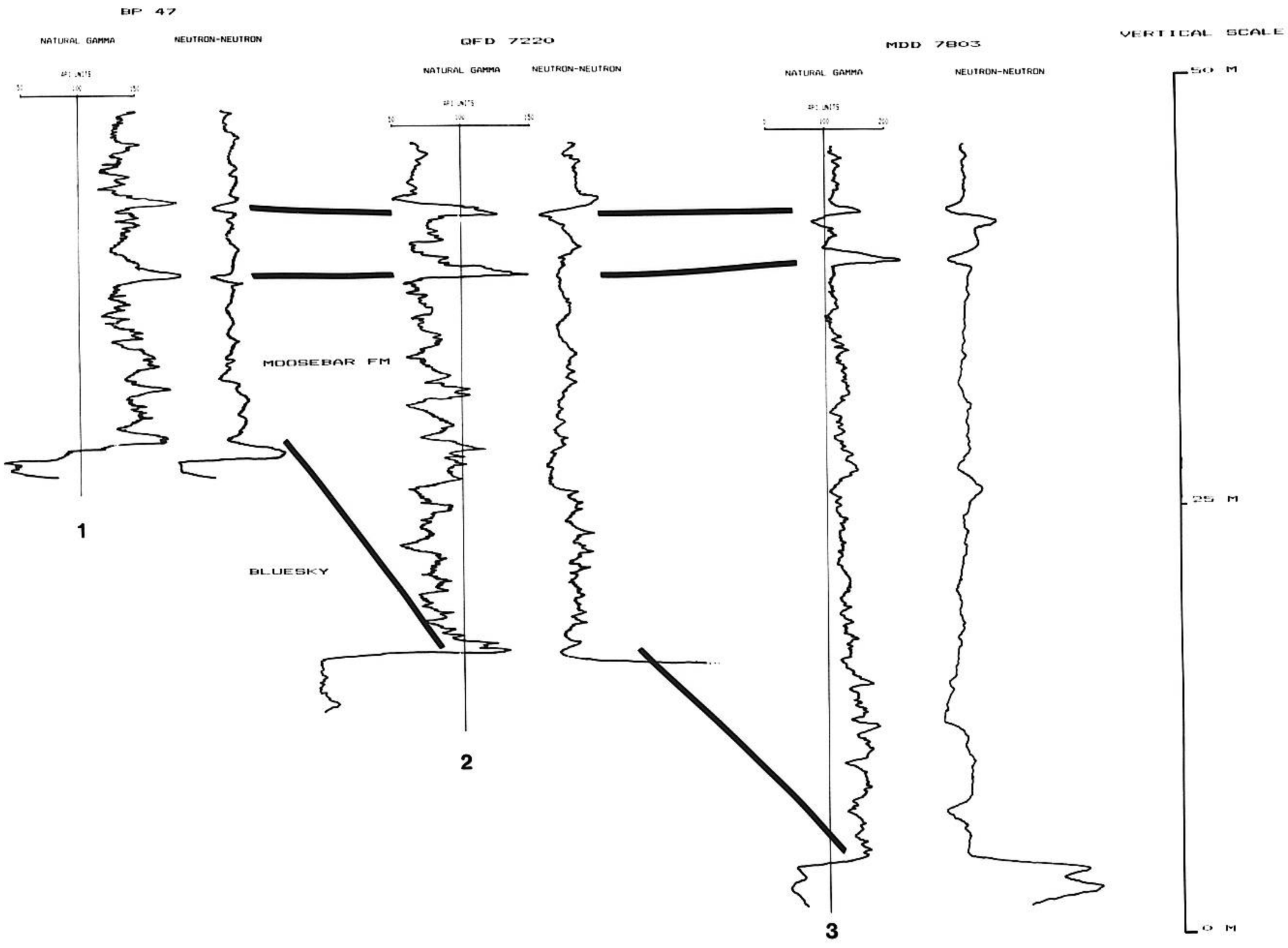
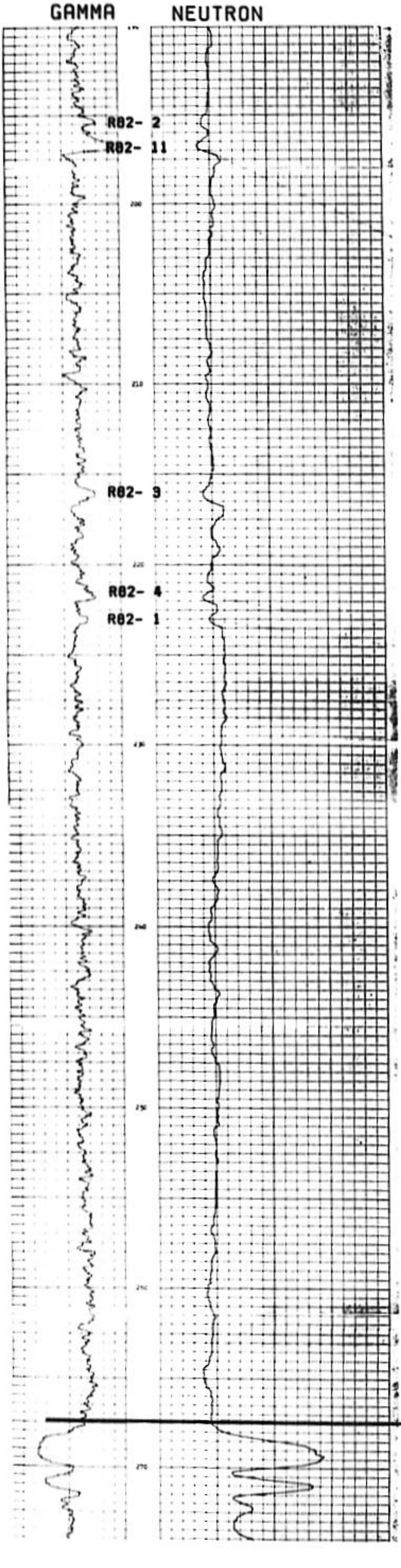
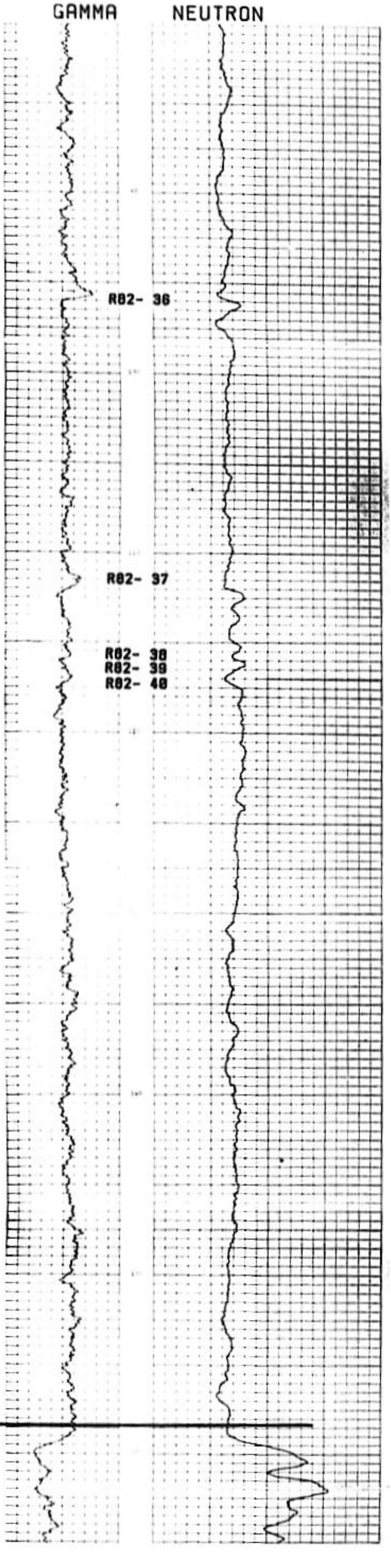

GAMMA
NEUTRON
GAMMA
NEUTRON
GAMMA
DENSITY
VERITCAL SCALE
0m
20m
HULCROSS FM
GATES FM
1
2
3


BP 47
NATURAL GAMMA
NEUTRON-NEUTRON
API UNITS
50
100
150
1
MOOSEBAR FM
BLUESKY
QFD 7220
NATURAL GAMMA
NEUTRON-NEUTRON
API UNITS
50
100
150
2
MDD 7803
NATURAL GAMMA
NEUTRON-NEUTRON
API UNITS
0
100
200
3
VERTICAL SCALE
50 M
25 M
0 M


GAMMA
NEUTRON
R82- 2
R82- 11
R82- 3
R82- 4
R82- 1
MOOSEBAR
BLUE SKY


GAMMA
NEUTRON
R82- 36
R82- 37
R82- 38
R82- 39
R82- 40

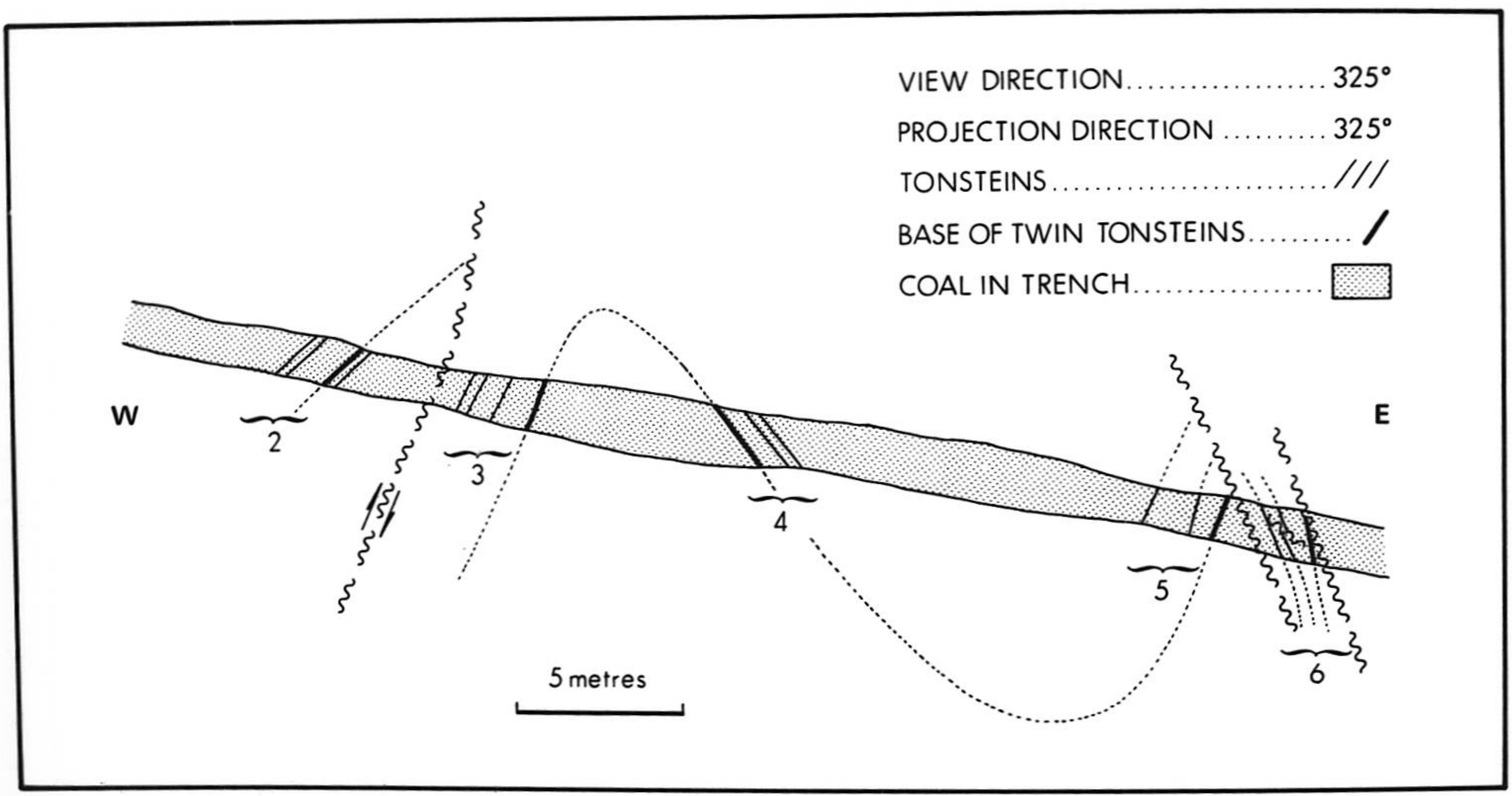
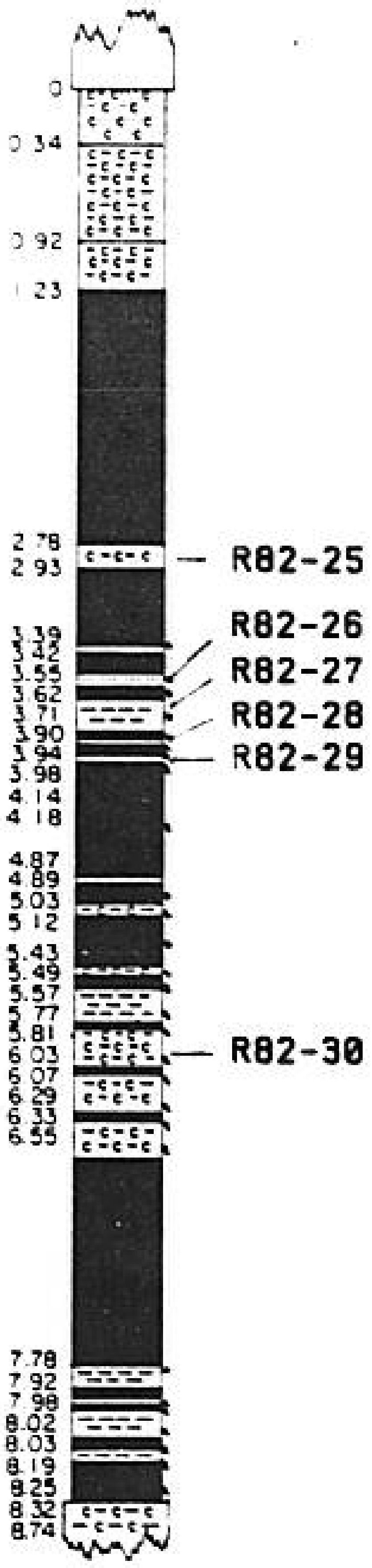


Figure 39. Section view of trench exposure with the deformed sequence containing the Twin Tonsteins. The numbers of the bracketted zones correspond with the detailed sections on Figure 36.


0
0.34
0.92
1.23
2.78
2.93
3.39
3.42
3.55
3.62
3.71
3.90
3.94
3.98
4.14
4.18
4.87
4.89
5.03
5.12
5.43
5.49
5.57
5.77
5.81
6.03
6.07
6.29
6.33
6.55
7.78
7.92
7.98
8.02
8.03
8.19
8.25
8.32
8.74
R82-25
R82-26
R82-27
R82-28
R82-29
R82-30

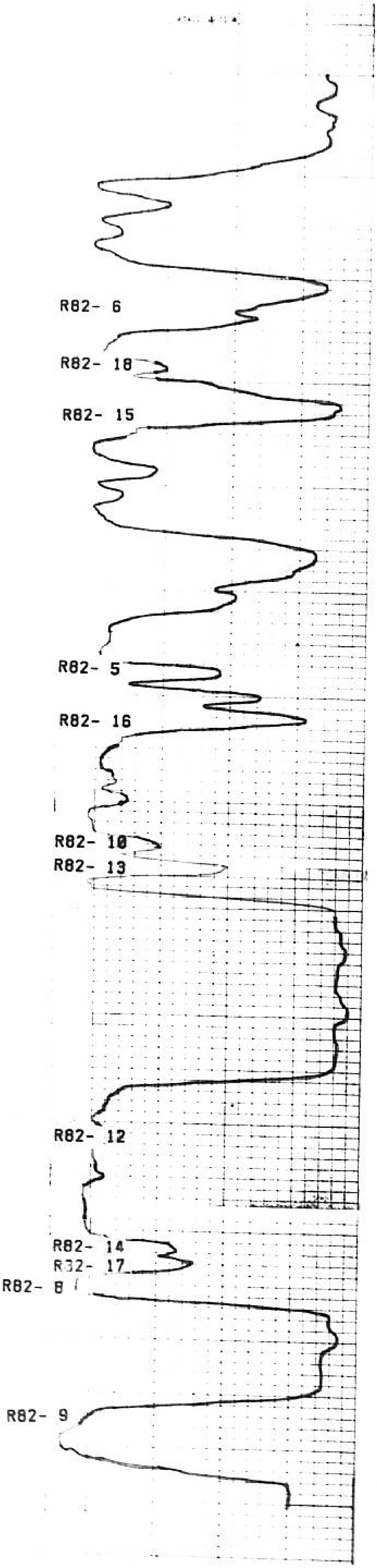

R82- 6
R82- 18
R82- 15
R82- 5
R82- 16
R82- 10
R82- 13
R82- 12
R82- 14
R82- 17
R82- 8
R82- 9

Table 1

A genetic classification of tonsteins
(Based on Bouroz, 1962, pp. 86–89)

Origin	Variety	Character	
Alteration of a primary deposit of tuff and consequently isochronous horizons with very considerable lateral extent. ORTHO-TONSTEIN[1]	Ortho-tonstein a[2]	Conspicuous irregular nodules containing vermicular or crystalline kaolinite	Many contain corroded quartz and sanidine
	Ortho-tonstein B[3]	Numerous small crystals and vermicules of kaolinite	
Redeposition and subsequent alteration of a tuff which may be diachronous and of sometimes restricted lateral distribution STRATO-TONSTEIN [4, 5]	Strato-tonstein a[1]	Ovoid or flattened nodules with sharp margins and crypto or occasionally micro-crystalline kaolinite. Possessing a definite layered texture	May contain abundant detrital quartz and other sedimentary fragments
	Strato-tonstein a[2]	Irregular masses of crypto- or micro-crystalline kaolinite and altered feldspars	
	Strato-tonstein B	Numerous small crystals or vermicules of kaolinite. (Differs from ortho-tonstein B in containing an abundance of detrital quartz and having a less homogeneous texture)	
A colloidal sedimentary deposit. CRYPTO-TONSTEIN		A homogeneous and crypto-crystalline mass of kaolinite	
Probably developed from ortho-tonsteins by metamorphism META-TONSTEIN[6]		Composed predominantly of micaceous minerals having a similar form to kaolinite	

[1] Group B tonsteins (Barnsley *et al.*, 1966)
[2] Graupen tonsteins.
[3] Crystal tonsteins.
[4] Group A tonsteins (Barnsley *et al.*, 1966)
[5] Most Dichte tonsteins.
[6] Although kaolinite may be rare or even absent, and notwithstanding previous comments, the term may be valid for those meta-tonsteins clearly drived from the metamorphism of an original ortho-tonstein. Thus Kisch (1966) demonstrates the transformation of an ortho-tonstein, present within a medium volatile bituminous coal to a chlorite-illite rock

TABLE I

TABLE OF FORMATIONS

Pine River Region

Series	Group	Formation thickness	Description
Upper Cretaceous		Dunvegan 350-1200' (107-300 m)	Fine-to coarse-grained sandstone; conglomerate; carbonaceous shale and coal.
Lower Cretaceous	Fort St. John 2000-5000' (610-1529 m)	Cruiser 350-800' (107-244 m)	Dark grey marine shale with sideritic concretions; some sandstone
		Goodrich 50-1350' (15-411 m)	Fine-grained, crossbedded sandstone; shale and mudstone.
		Hasler 500?-1500' (152-459 m)	Silty, dark grey marine shale with sideritic concretions; siltstone in lower part.
		Boulder Creek 240-560' (73-171 m)	Fine-grained, well sorted sandstone; massive conglomerate; nonmarine sandstone and mudstone.
		Hulcross 0-450' (0-131 m)	Dark grey marine shale with sideritic concretions.
		Gates 220-900' (67-274 m)	Fine-grained, marine and nonmarine sandstones; conglomerate; coal; shale and mudstone.
		Moosebar 100-1000' (30-304 m)	Dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base.
	Bullhead 300-2500' (91-762 m)	Gething 75-1800' (22-549 m)	Fine-to coarse-grained, brown, calcareous, carbonaceous sandstone; coal, carbonaceous shale and conglomerate.
		Cadomin 45-700' (14-213 m)	Massive conglomerate containing chert and quartzite pebbles.
	Regional erosional unconformity; bevels rock of succeedingly older age northward and eastward.		
	Minnes 0-6500' (0-1840 m)	Bickford 0-1400?' (0-427? m)	Sandstone, fine-grained and silty shale; carbonaceous in part.
		Monach 0-1000' (0-304 m)	Sandstone, fine-grained, argillaceous; massive, fine- to coarse-grained quartzose sandstone.
		Beattie Peaks 0-1300' (0-396 m)	Interbedded fine-grained sandstone and silty shales.
		Monteith 0-2000' (0-610 m)	Sandstone, fine-grained; white, quartzose fine- to coarse-grained sandstone.
Jurassic		Fernie 0-1900' (0-579 m)	Calcareous and phosphatic shales; rusty weathering shales; glauconitic siltstone; sideritic shales, thinly interbedded sandstone, shale, and siltstone.

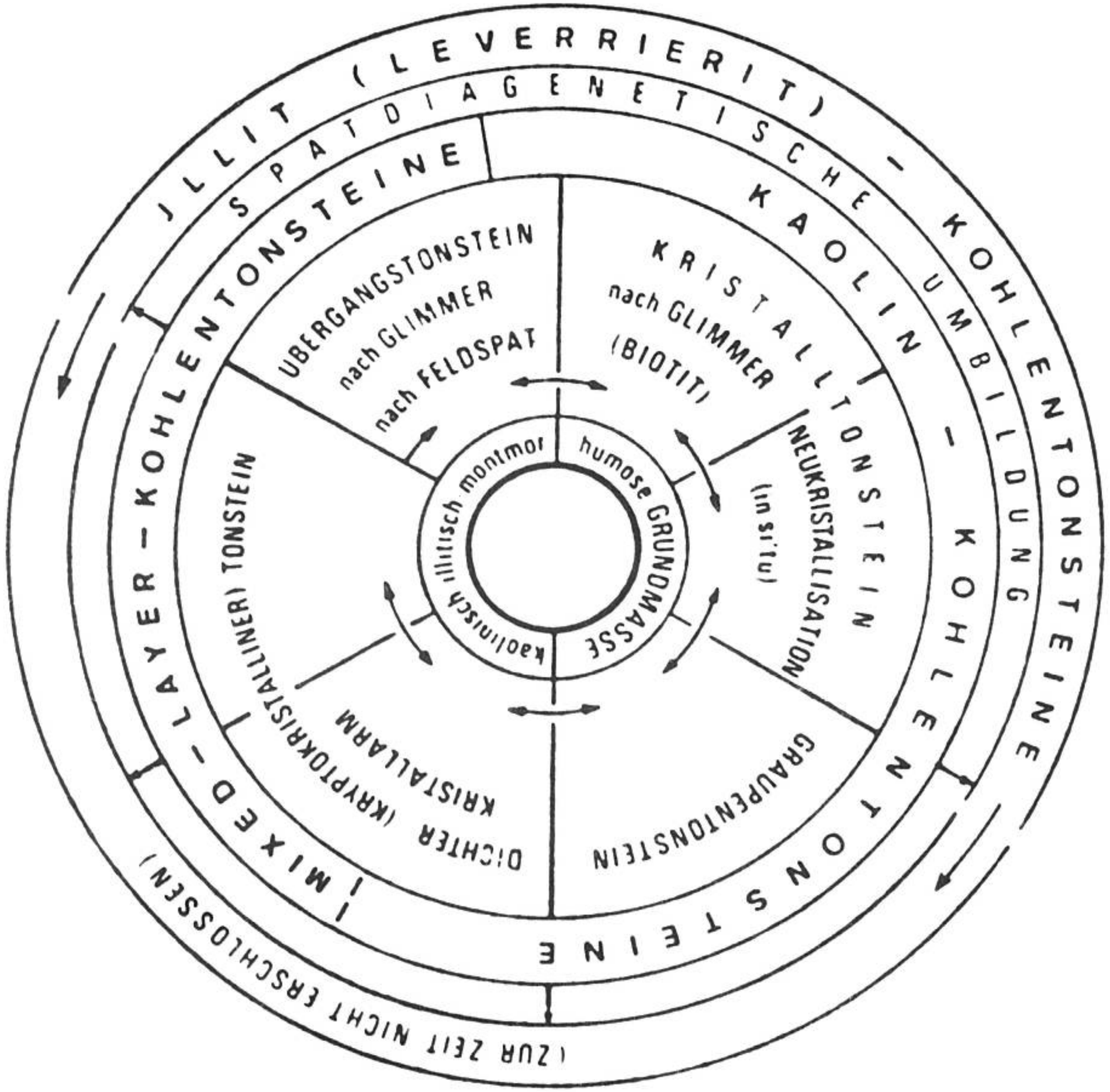


Abb. 2: Klassifikation der Kohlentonsteine.

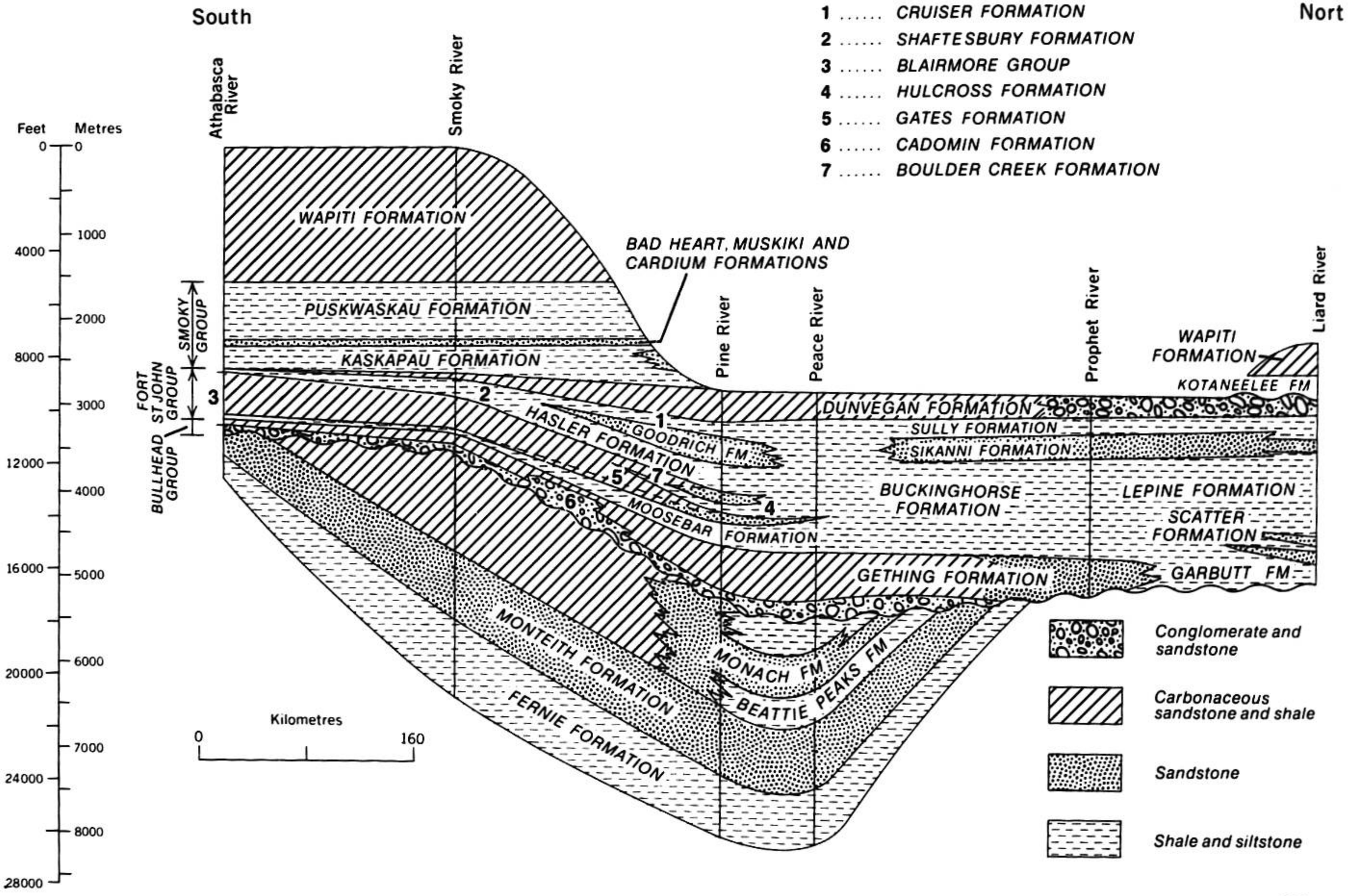


FIGURE 6. *Schematic diagram of major sequences in Jurassic and Cretaceous rocks of northeastern British Columbia.*

BAD HEART, MUSKIKI AND
CARDIUM FORMATIONS

ION

TION

Pine River

Peace River

DUNVEGAN FORMA

SULLY FO

SIKANNI F

HASLER FORMATION

1

GOODRICH

FM

5

7

4

6

MOOSEBAR

FORMATION

BUCKINGHO

FORMATIO

GETHING FORM

MONTEITH FORMATION

MONACH FM

BEATTIE PEAKS FM

FERNIE FORMATION

1

2

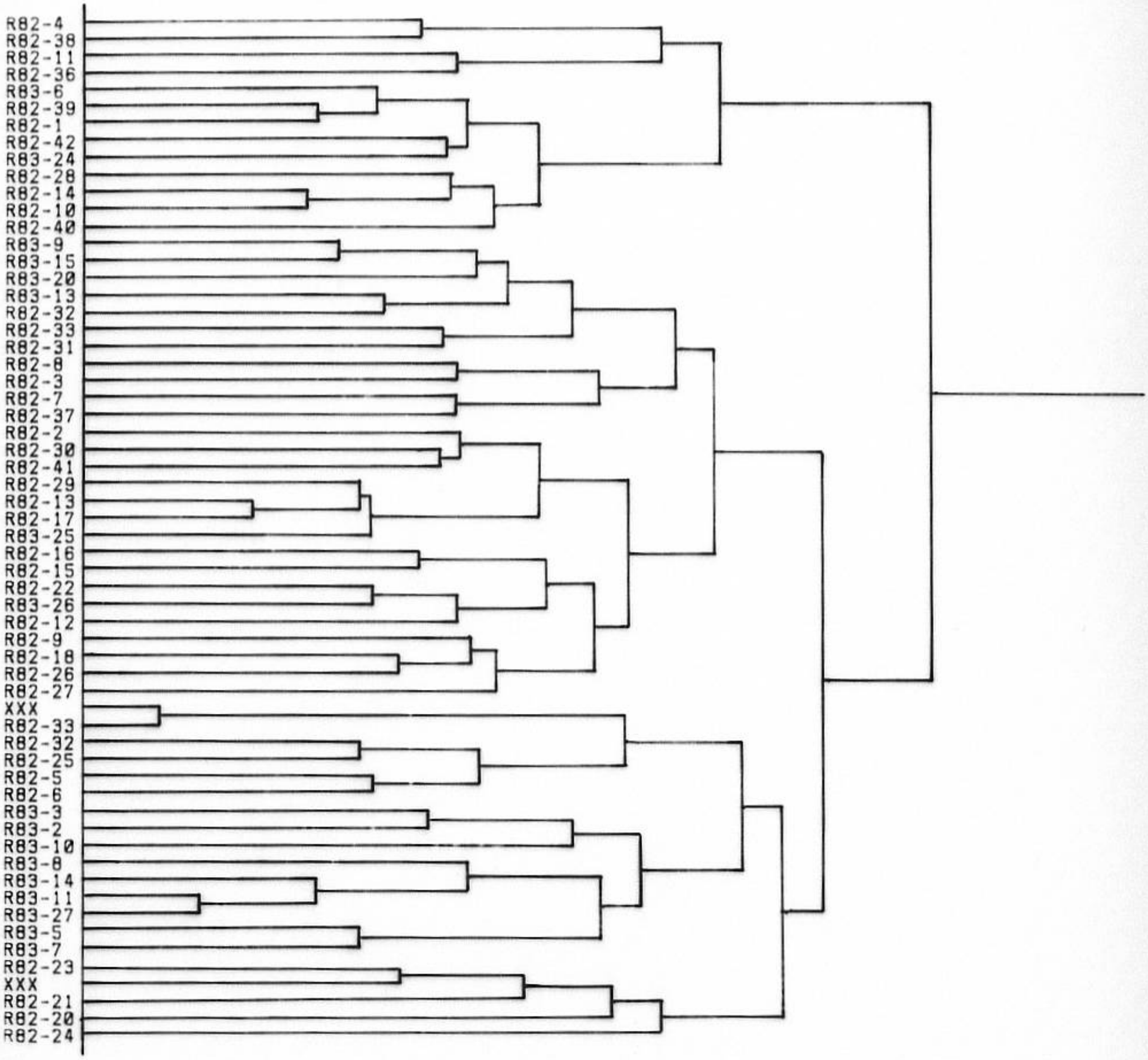
3

N

0 20 km

HULCROSS BENTONITES

WEIGHTED PAIR-GROUP AVERAGE CLUSTERING



Based on SiO2, Al2O3, Fe2O3, NaO, Ca/(Ca+K+Ti), K/(Ca+K+Ti), Ti/(Ca+K+Ti), Sr ppm, Zr ppm

$$d_{(A,B)} = \frac{\sum_{i=1}^{n} R_i}{n},$$

where

$d_{(A,B)} = d_{(B,A)}$ = similarity coefficient for comparison between sample A and sample B

i = element number,

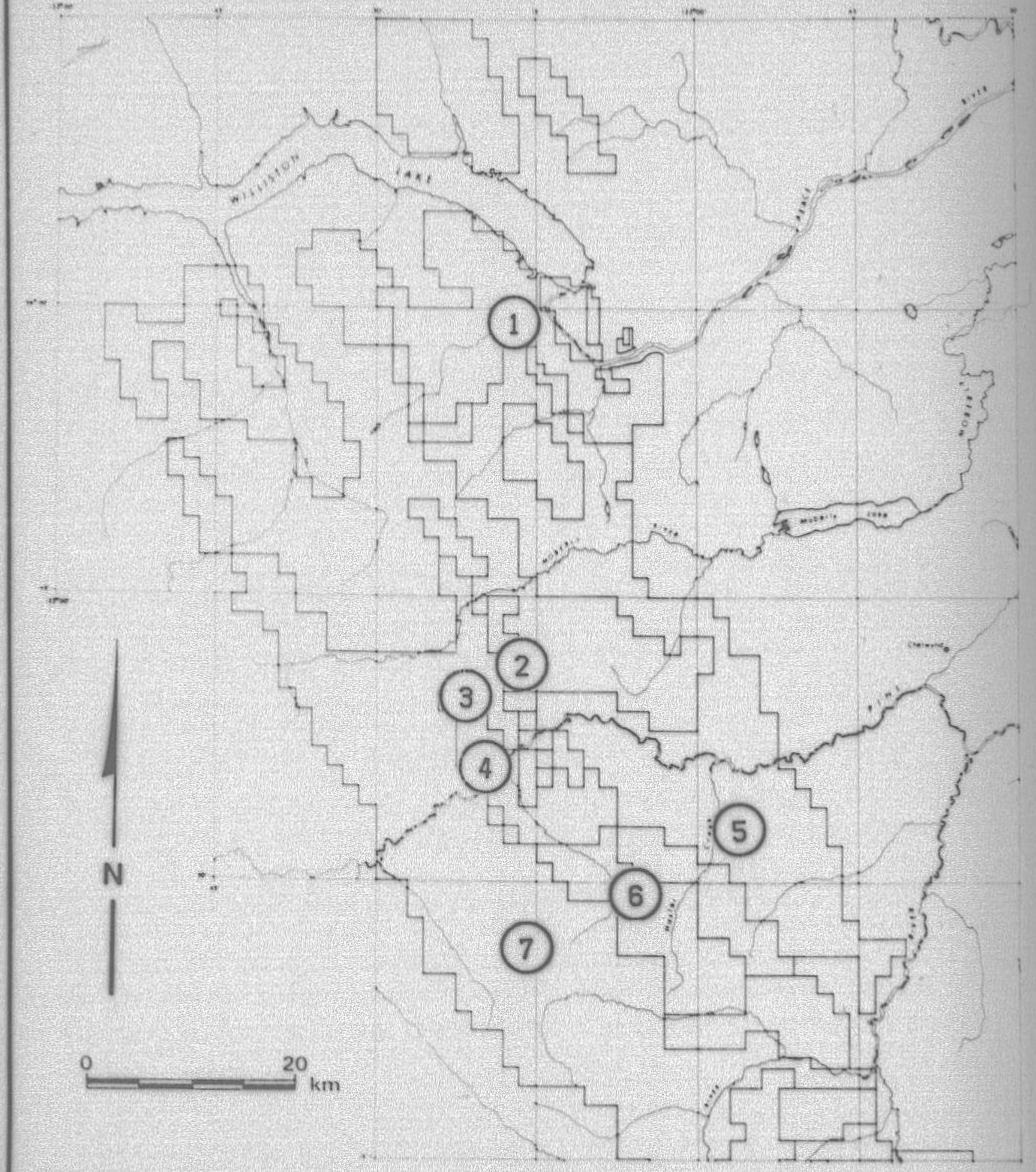
n = number of elements,

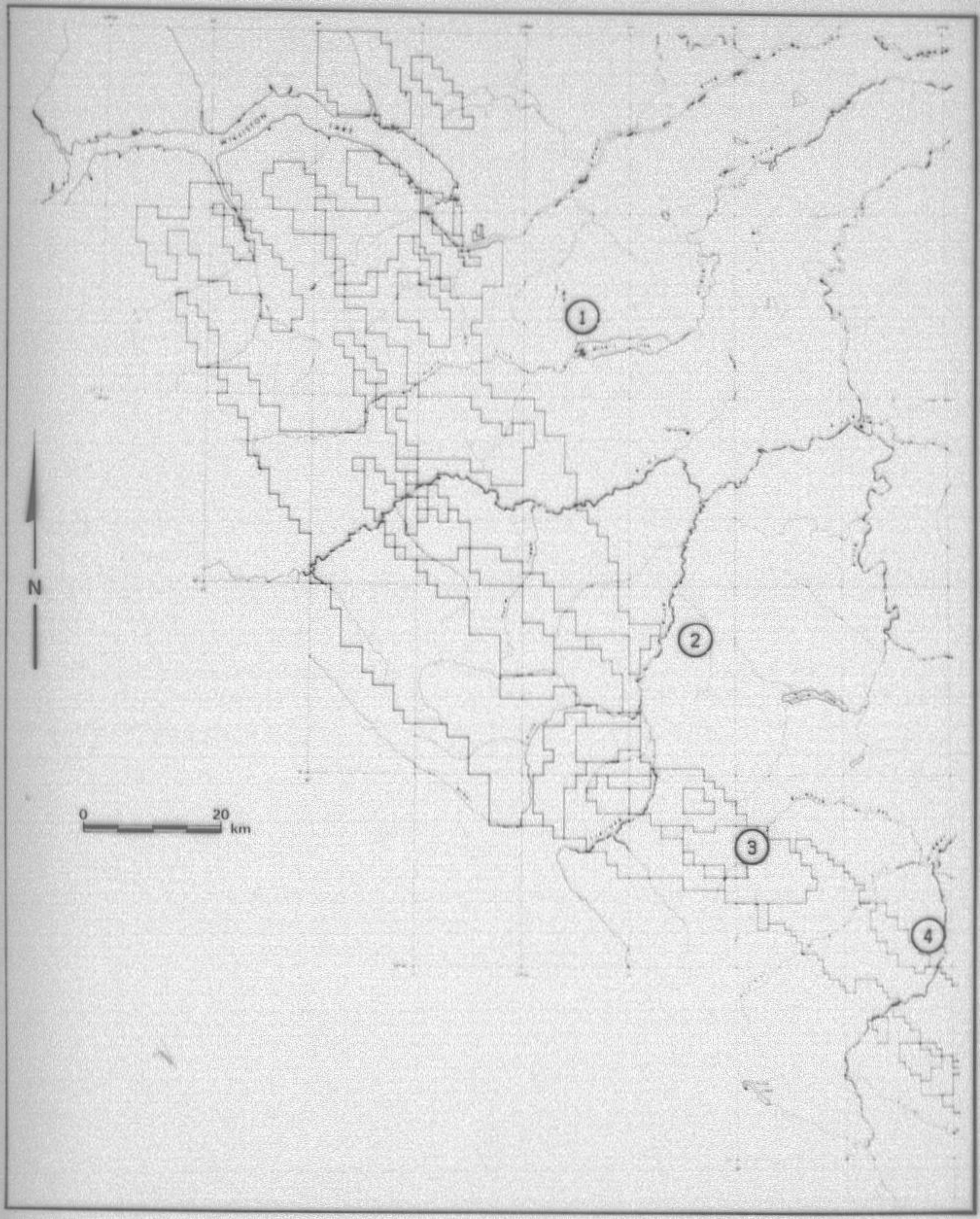
$R_i = X_iA/X_iB$ if $X_iB \geq X_iA$; otherwise X_iB/X_iA,

X_iA = concentration of element i in sample A, and

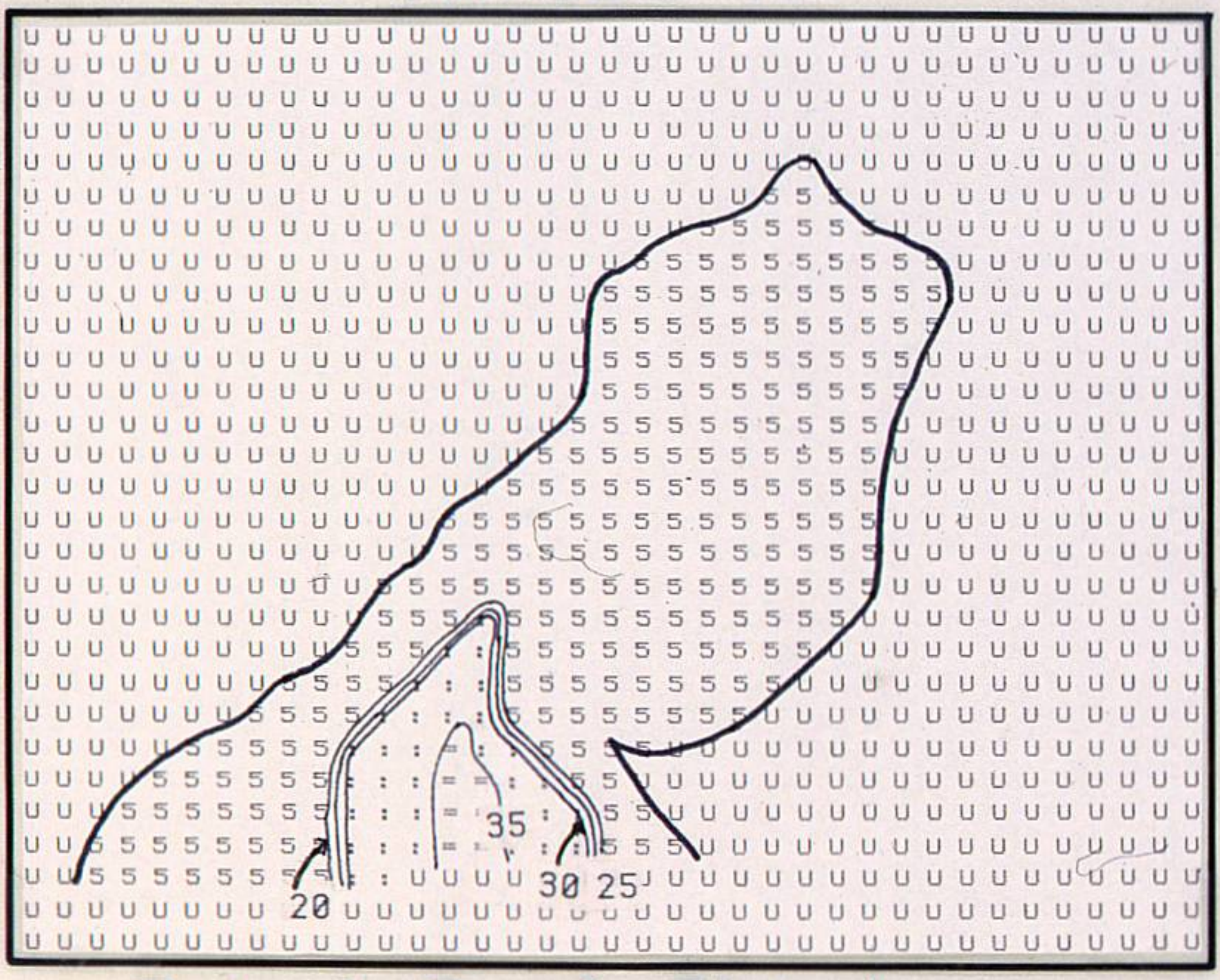
X_iB = concentration of element i in sample B.

In practice, the values of the coefficient for repli-

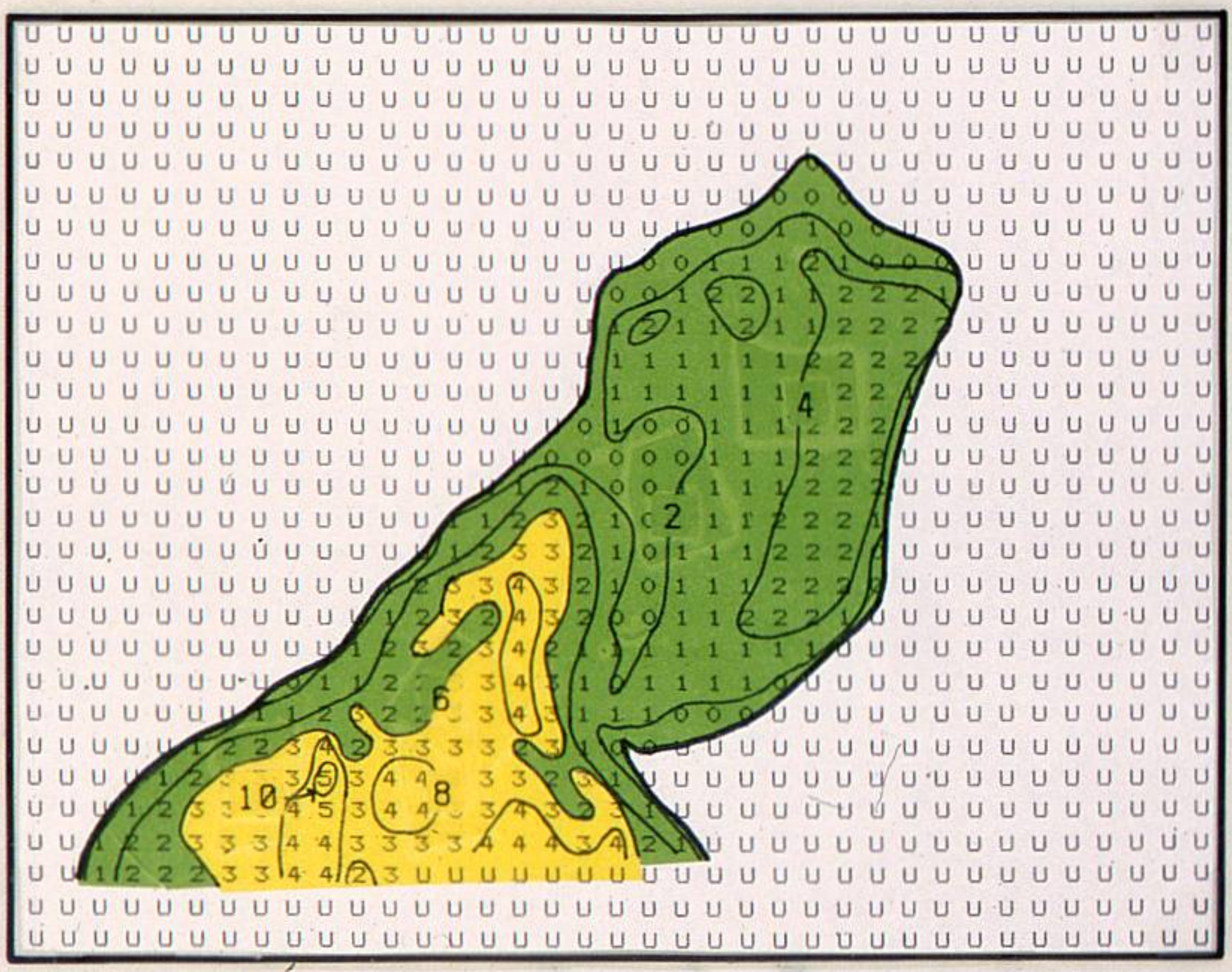

1
2
3
4
5
6
7
N
0
20
km


1
2
3
4
N
0
20
km

PARCEL 73

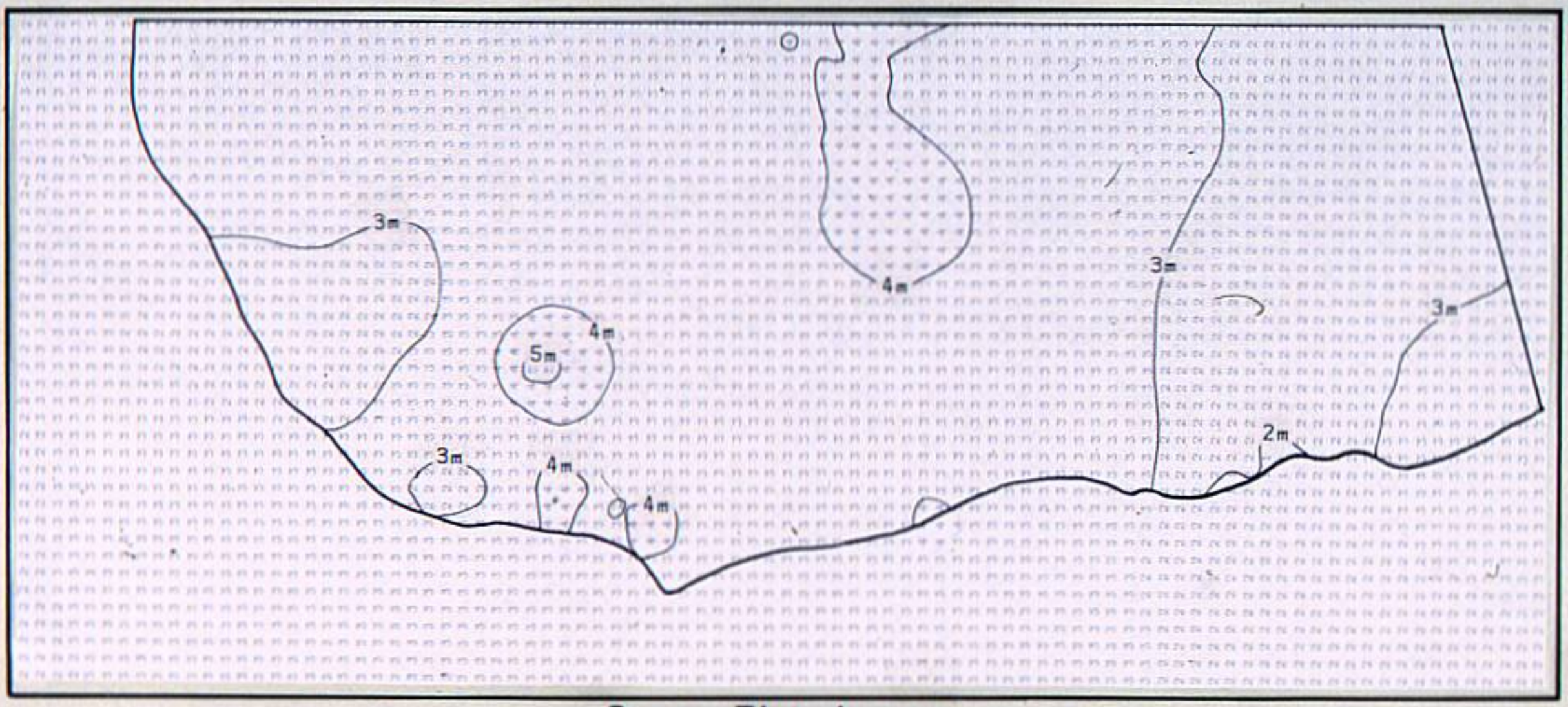


Total Coal Thickness

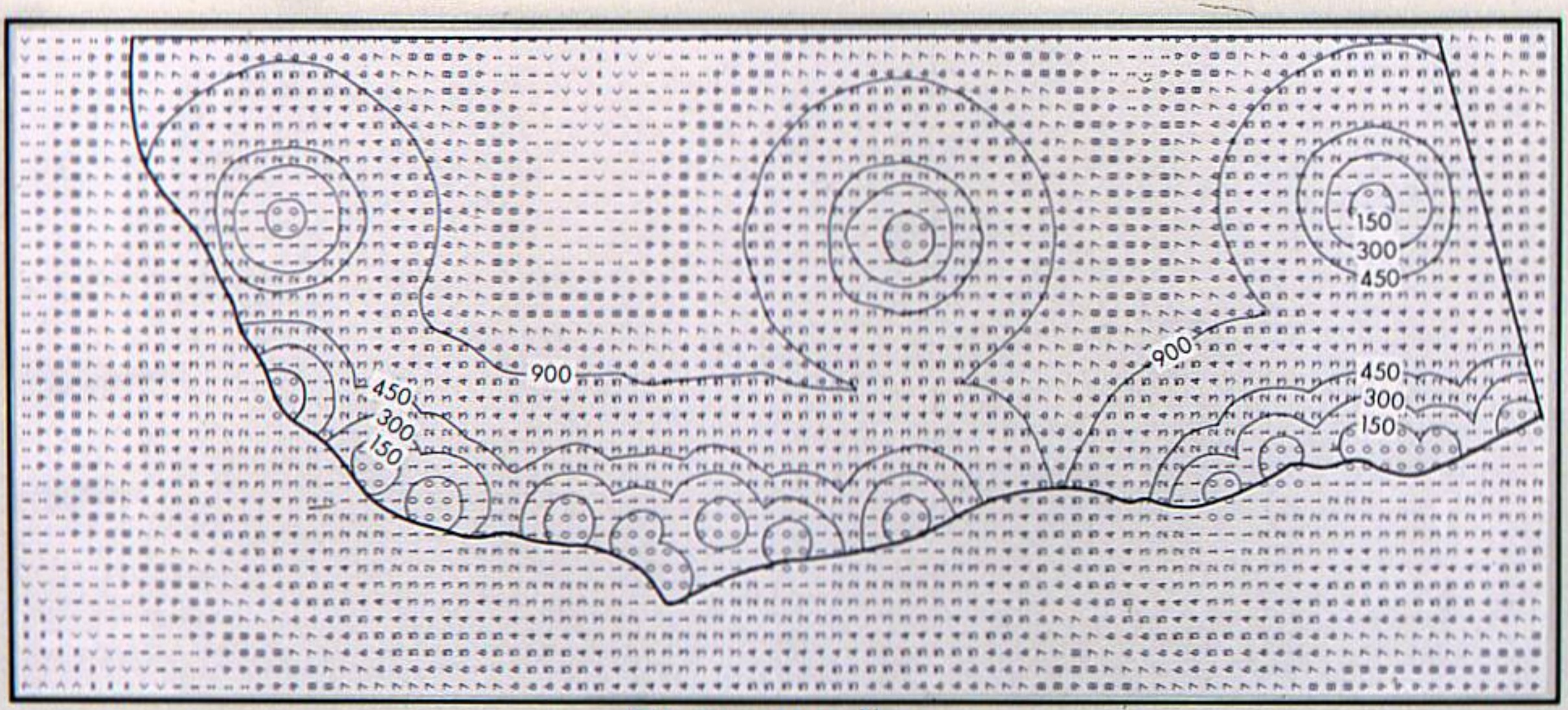


Waste-Coal Ratio

FLATHEAD RIDGE

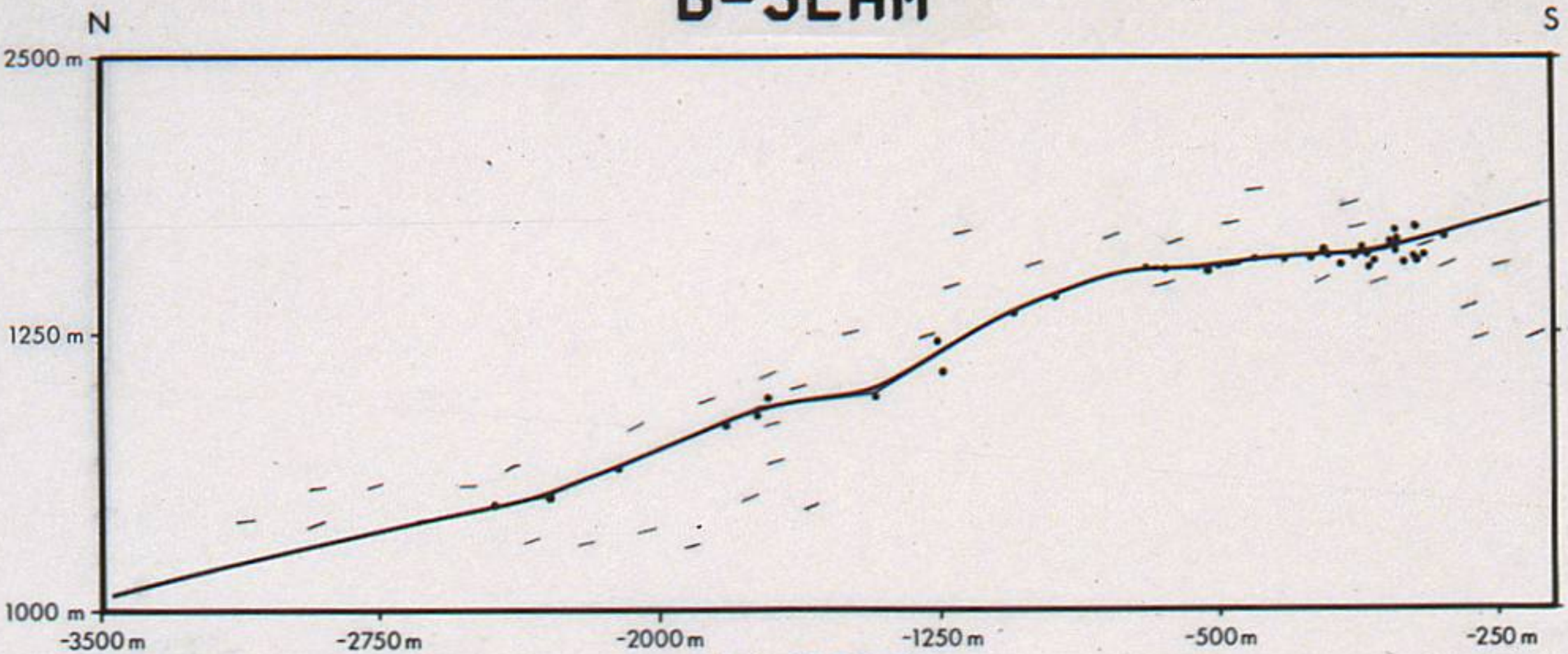


Seam Thickness

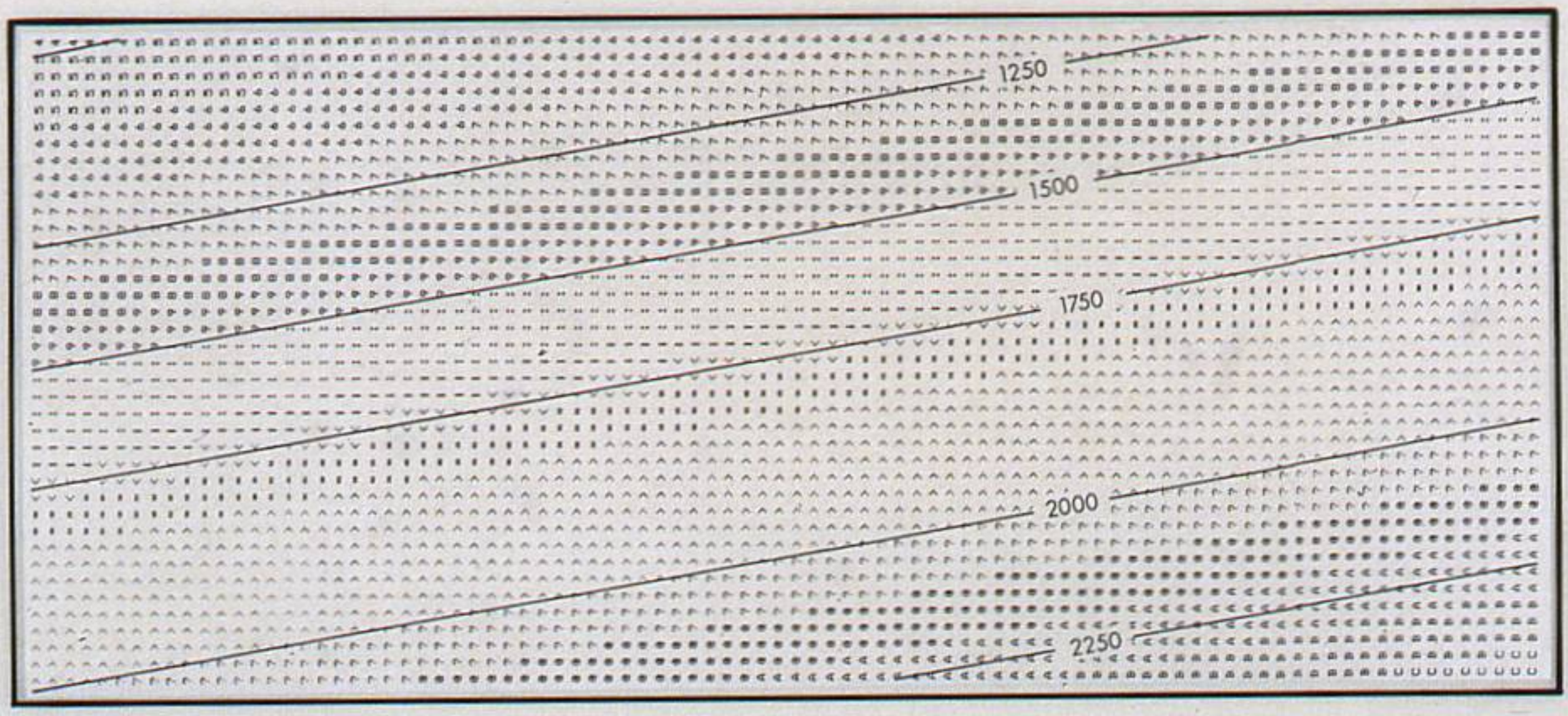


Distance Map

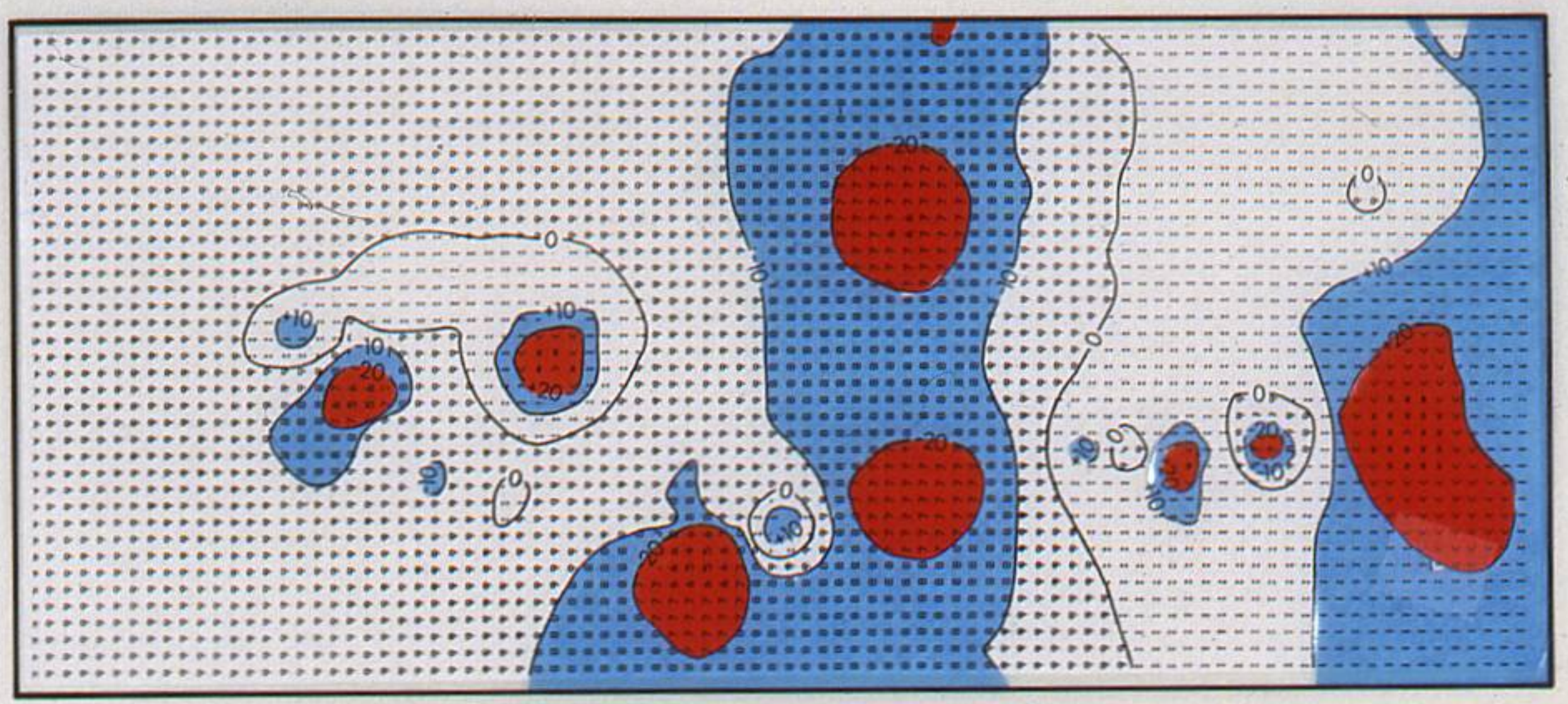
B-SEAM



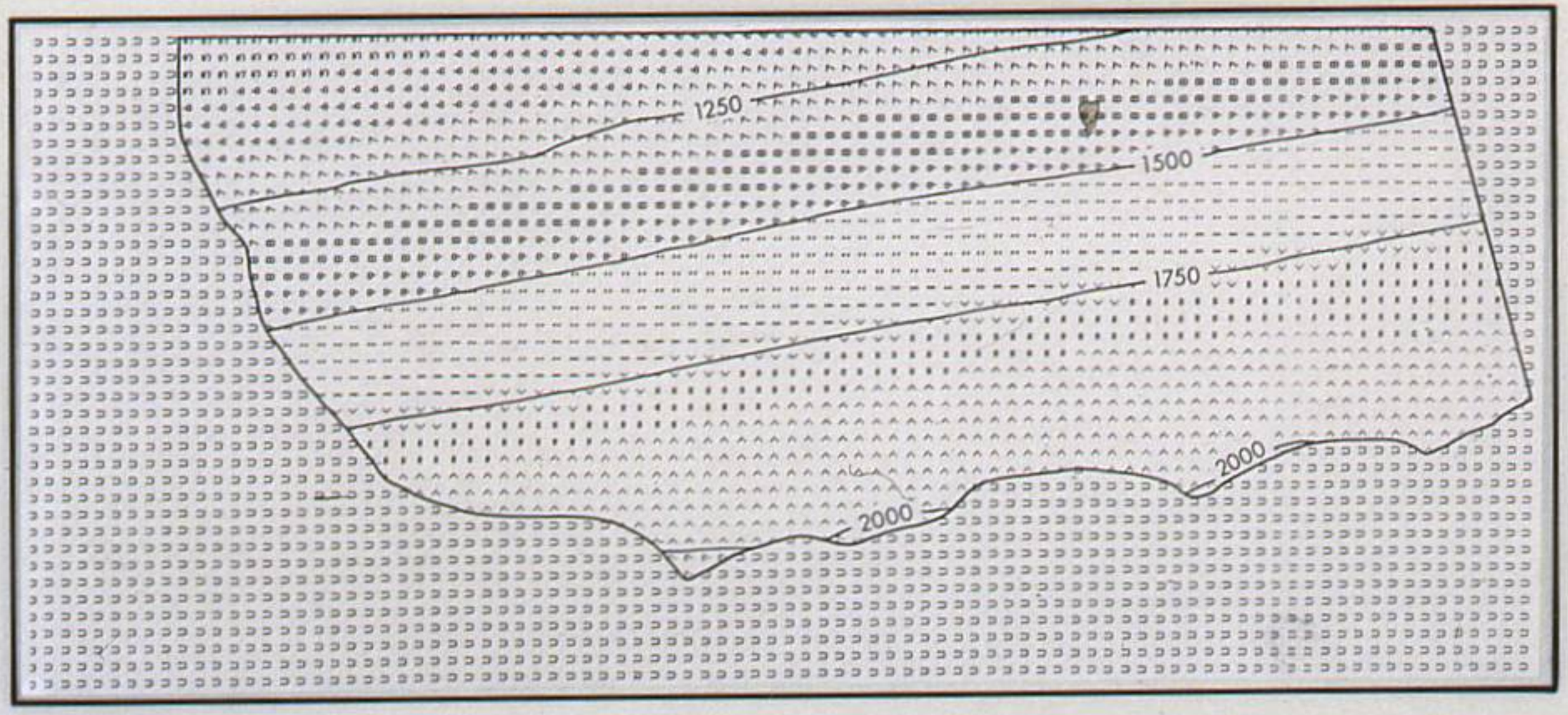
(A) PROFILE



(B) PROJECTED STRUCTURAL CONTOUR GRID



(C) RESIDUAL CONTOUR GRID



(D) FINAL ELEVATION GRID