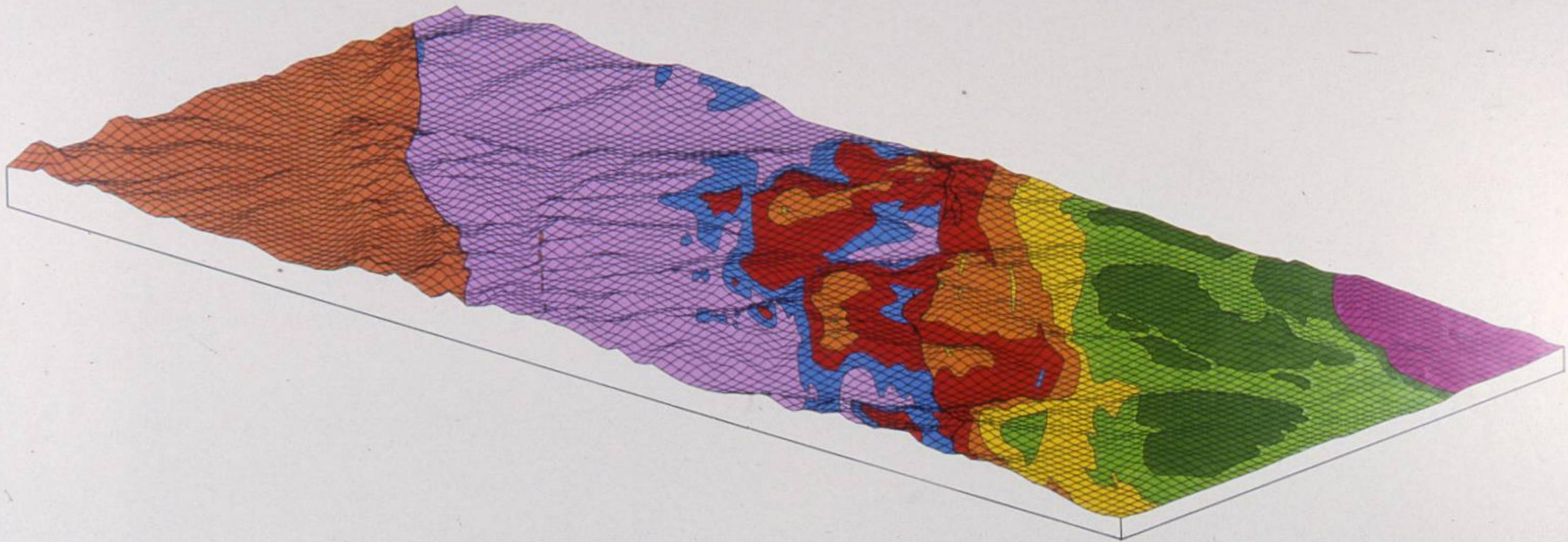


	ST. HELENS	TULAMEEN	N.E.B.C.
	Present	Eocene	Cretaceous

SiO <sub>2</sub>	63.7	69.1	55.
Al <sub>2</sub> O <sub>3</sub>	17.5	24.4	32.5
Fe <sub>2</sub> O <sub>3</sub>	4.7	1.4	3.8
CaO	5.1	.6	3.5
Na <sub>2</sub> O	4.6	.2	.5
K <sub>2</sub> O	1.3	3.4	1.
TiO <sub>2</sub>	.6	.3	1.
MgO	2.	.6	1.7
MnO	.07	.02	.04
P <sub>2</sub> O <sub>5</sub>	.13	--	.23
	n=10	n=10	n=60



# LEGEND

## UPPER CRETACEOUS

uKc

CARDIUM FORMATION: grey sandstone with minor shale

uKk

KASKAPAU FORMATION: dark grey marine rubbly shale with sideritic concretions and sandstone

uKo

DUNVEGAN FORMATION: marine and non-marine sandstone and shale

## FORT ST. JOHN GROUP

uKcr

CRUISER FORMATION: dark grey marine shale with sideritic concretions; some sandstone

## LOWER CRETACEOUS

KGo

GOODRICH FORMATION: fine-grained, crossbedded sandstone; shale and mudstone

KHA

HASLER FORMATION: silty, dark grey marine shale with sideritic concretions; siltstone and sandstone in lower part; minor conglomerate

Kbc

BOULDER CREEK FORMATION: fine-grained, well sorted sandstone; massive conglomerate; non-marine sandstone and mudstone

KH

HULCROSS FORMATION: dark grey marine shale with sideritic concretions

KG

GATES FORMATION: fine-grained, marine and non-marine sandstones; conglomerate; coal; shale and mudstone

Km

MOOSEBAR FORMATION: dark grey marine shale with sideritic concretions; glauconitic sandstone and pebbles at base

## BULLHEAD GROUP

KGE

GETHING FORMATION: fine- to coarse-grained, brown, calcareous, carbonaceous sandstone; coal, carbonaceous shale, and conglomerate

Kco

CADOMIN FORMATION: massive conglomerate containing chert and quartzite pebbles

## MINNES GROUP

JKH

UNDIVIDED thinly-thickly interbedded, shale, sandstone, siltstone and coals

## JURASSIC

JF

FERNIE FORMATION: black marine shale

## TRIASSIC AND PALAEOZOIC

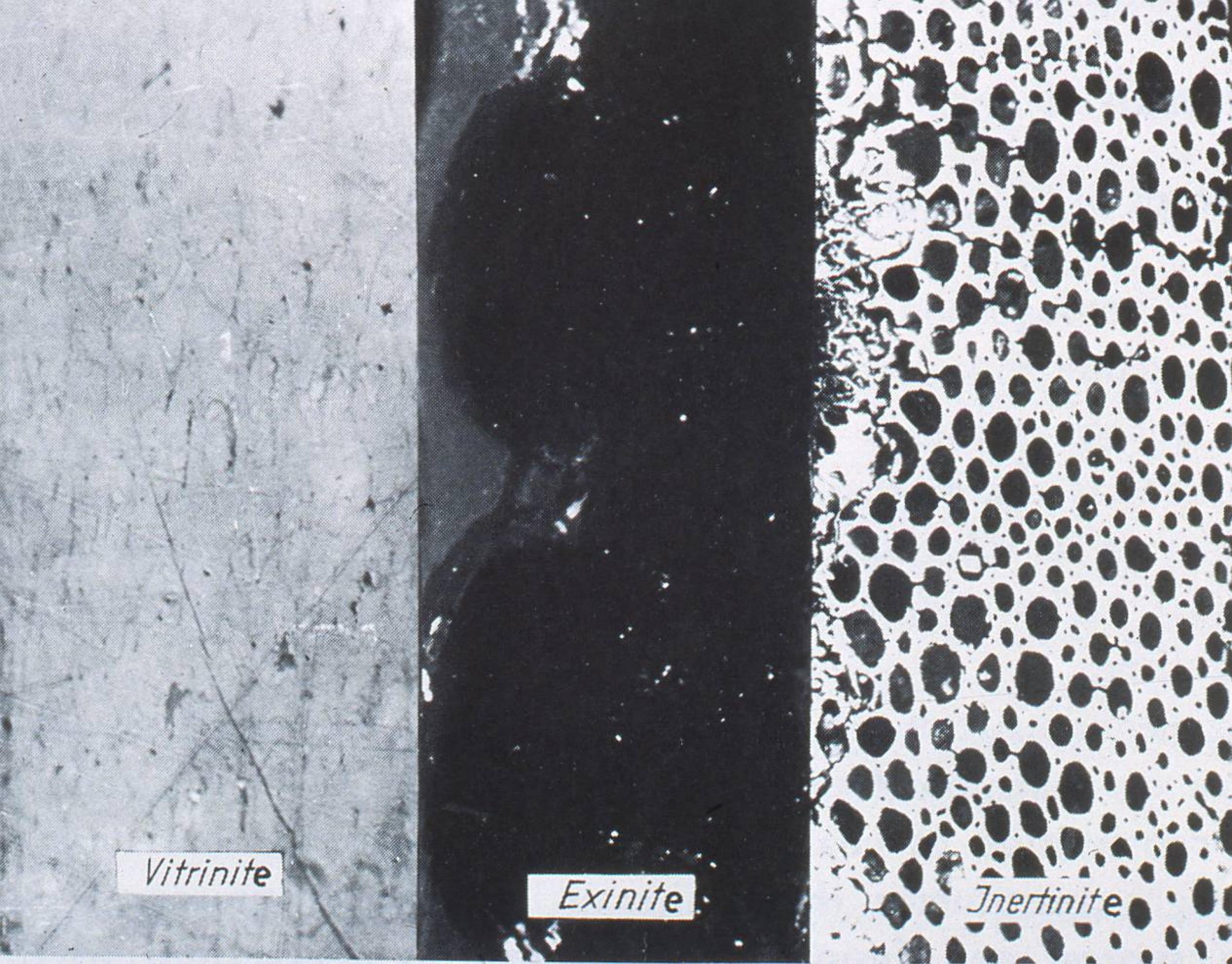
Tp

undifferentiated and unmapped units predominantly carbonate





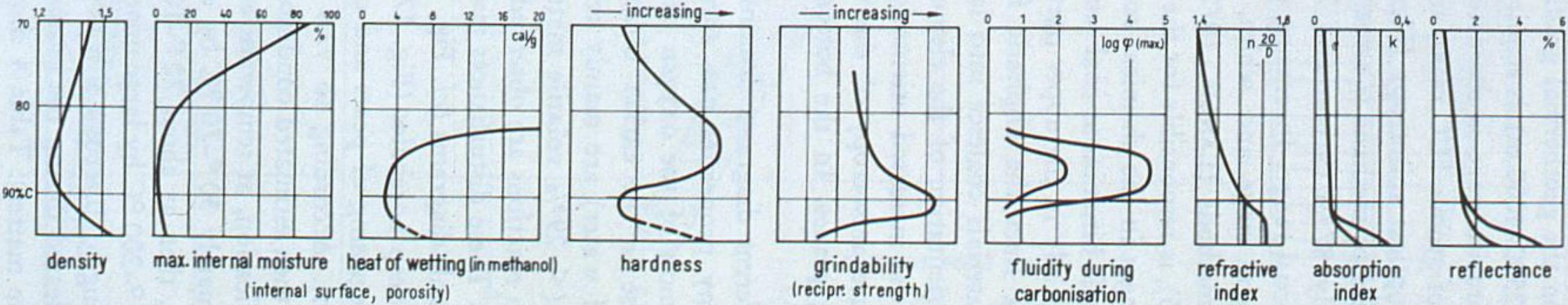
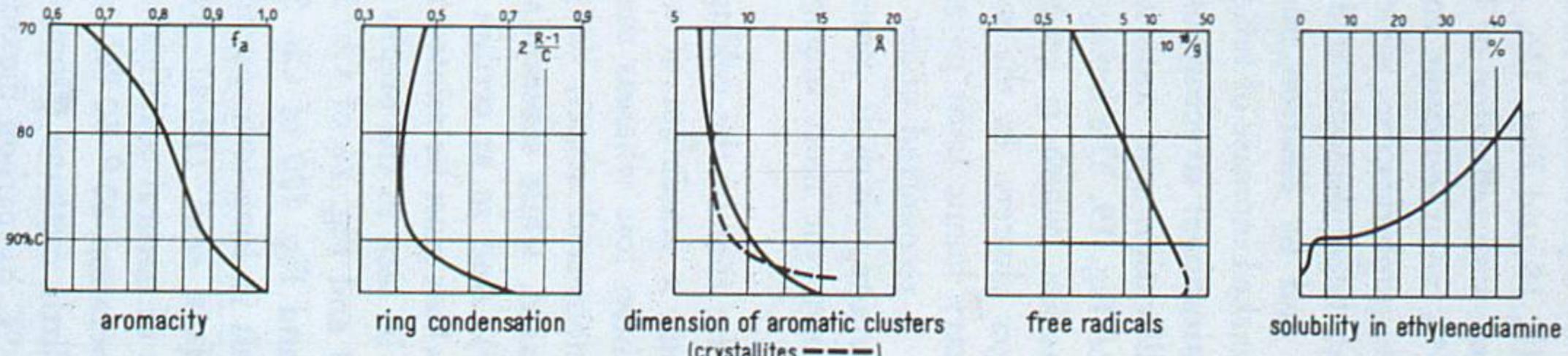
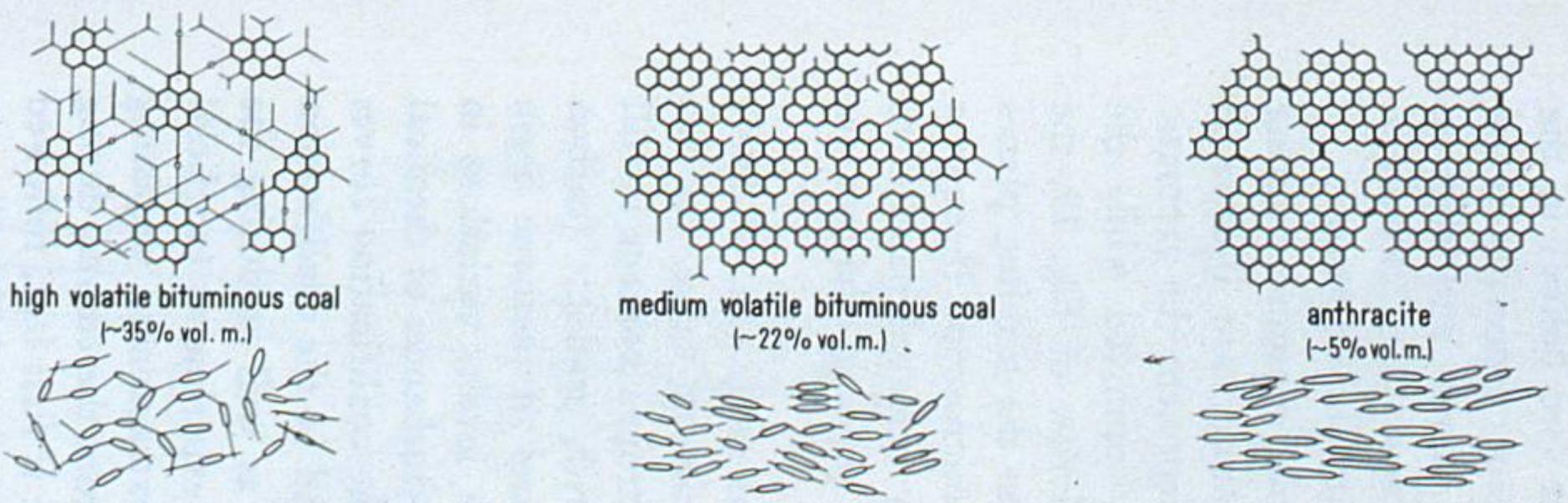




*Vitrinite*

*Exinite*

*Inertinite*



first row: molecular structure  
 - o - = hydrogen bonding  
 - = molecular bonding

second row: orientation of molecules perpendicular to the bedding plane  
 lenses = aromatic clusters  
 lines = non-aromatic elements

third row: development of chemical properties in relation to carbon content (daf)

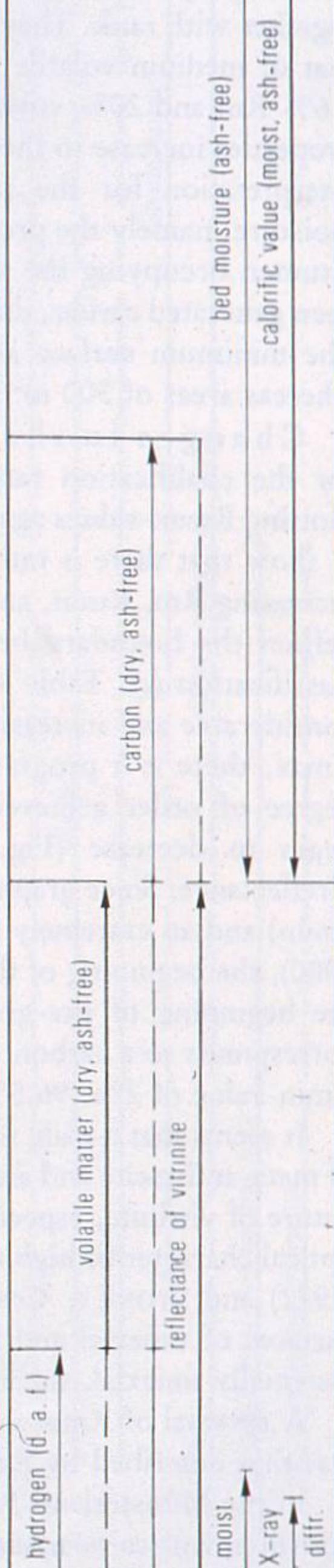
fourth row: development of physical properties in relation to carbon content (daf)

Fig. 19. Physical, chemical and molecular changes of vitrite during the coalification of bituminous coals and anthracites (based on different authors: see M. & R. TEICHMÜLLER, 1954 a, 1968 a).

Rank		Refl. $R_{m_{oil}}$	Vol. M. d. a. f. %	Carbon d. a. f. Vitrite	Bed Moisture	Cal. Value Btu/lb (kcal/kg)	Applicability of Different Rank Parameters		
German	USA								
Torf	Peat	0.2	68						
			64	ca. 60	ca. 75				
Weich-	Lignite	0.3	60						
				56		ca. 35	7200 (4000)		
Matt-	Sub-Bit. C	0.4	52						
		B		48	ca. 71	ca. 25	9900 (5500)		
Glanz-	C	0.5							
		A	0.6	44	ca. 77	ca. 8-10	12600 (7000)		
Flamm-	B	0.7	40						
			0.8						
Gasflamm-	A		36						
			1.0	32					
Gas-	Medium Volatile Bituminous	1.2	28	ca. 87		15500 (8650)			
			1.4	24					
Fett-	Low Volatile Bituminous	1.6	20						
			1.8	16					
Ess-	Semi-Anthracite	2.0	12						
Anthrazit	Anthracite		8	ca. 91		15500 (8650)			
			3.0						
Meta-Anthr.	Meta-A.	4.0	4						

B r a u n k o h l e  
S t e i n k o h l e

High Vol. Bituminous



## Fuel Conversion Factors

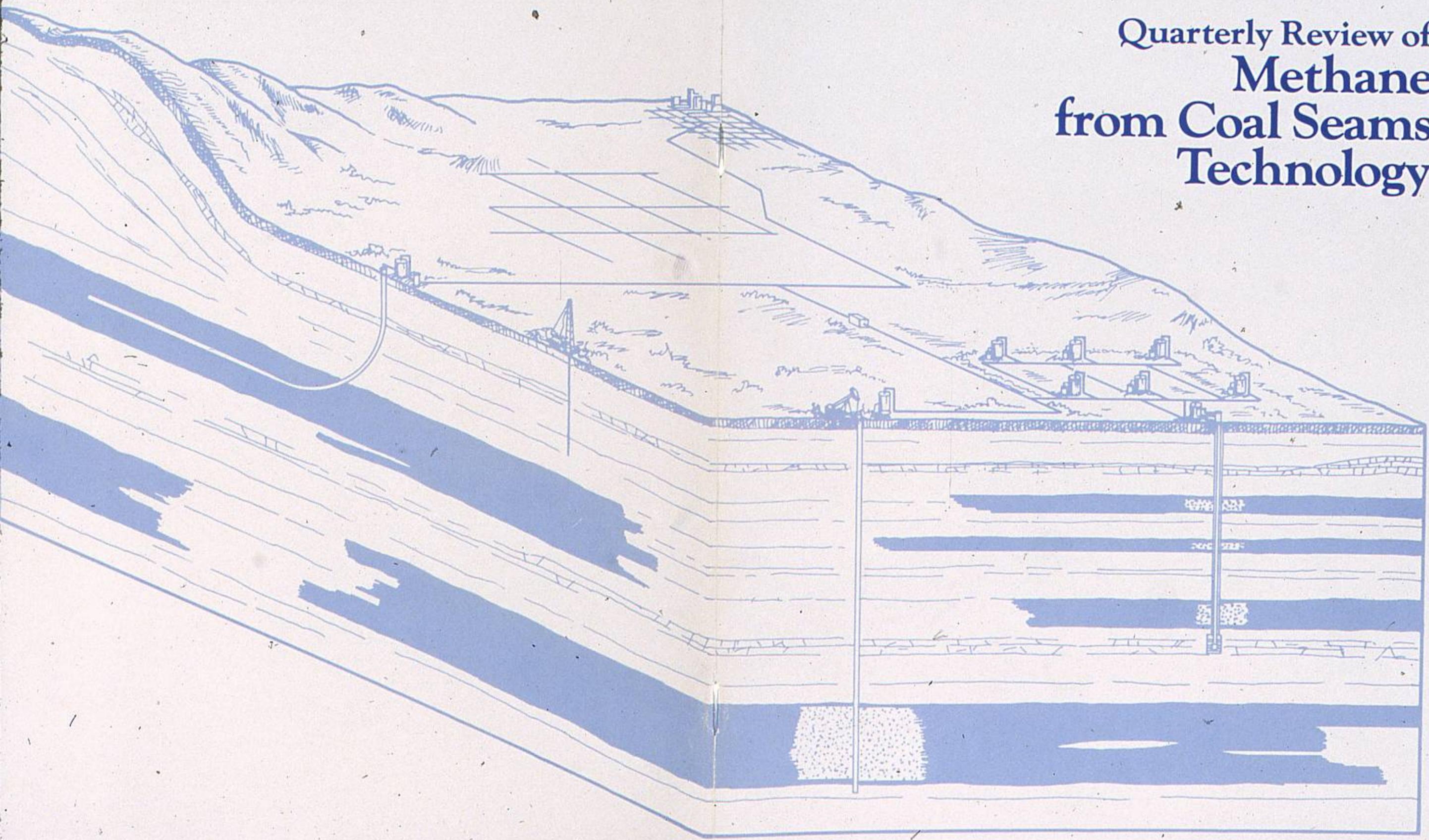
Product	Btu
Bituminous coal and lignite	
Production, average/short ton	24,050,000
Consumption, average/short ton	23,750,000
Electric generation/short ton	22,364,000
Anthracite . . . . . short ton	25,400,000
Petroleum products:	
Natural gasoline . . . . . barrel	4,620,000
Liquefied gases . . . . . barrel	4,011,000
Jet fuel, naphtha-type . . . . . barrel	5,355,000
Jet fuel, kerosine-type . . . . . barrel	5,670,000
Gasoline (including aviation) . . . . . barrel	5,248,000
Special naphtha . . . . . barrel	5,248,000
Kerosine . . . . . barrel	5,670,000
Distillate (including diesel) . . . . . barrel	5,825,000
Residual fuel oil . . . . . barrel	6,287,000
Still gas . . . . . barrel	6,000,000
Lubricants . . . . . barrel	6,065,000
Waxes . . . . . barrel	5,537,000
Petroleum coke . . . . . barrel	6,024,000
Asphalt and road oil . . . . . barrel	6,636,000
Natural gas liquids	
Natural gasoline and cycle products . . . . . gallon	110,000
LP-gases . . . . . gallon	95,500
Ethane . . . . . gallon	73,390
Natural gas, dry . . . . . cubic foot	1,031
Nuclear power <sup>1</sup> . . . . . kilowatt-hour	10,660
Hydropower <sup>1</sup> . . . . . kilowatt-hour	10,379

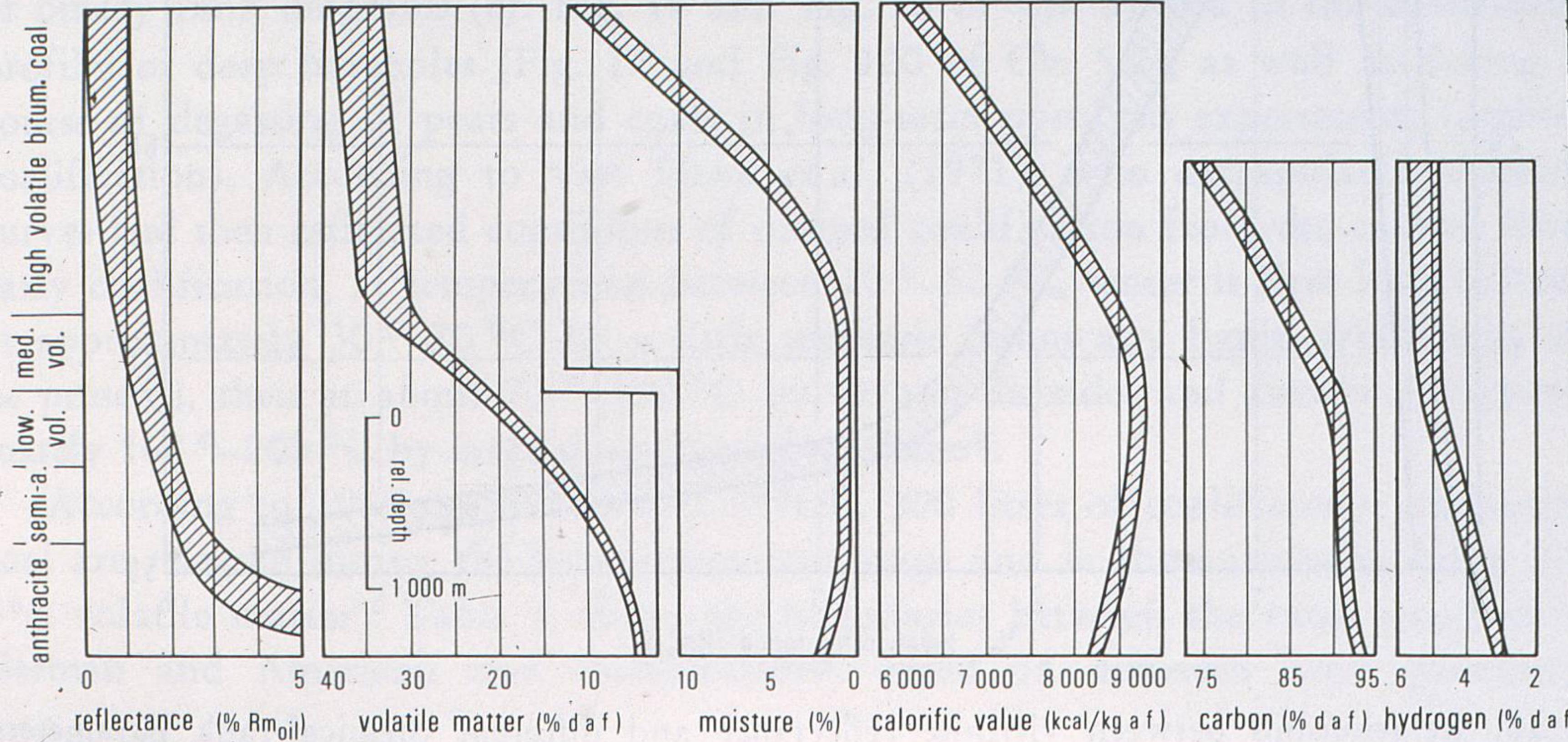
1. Outputs of nuclear and hydropower are converted to theoretical energy inputs calculated from national heat rates for fossil-fueled steam-electric plants.

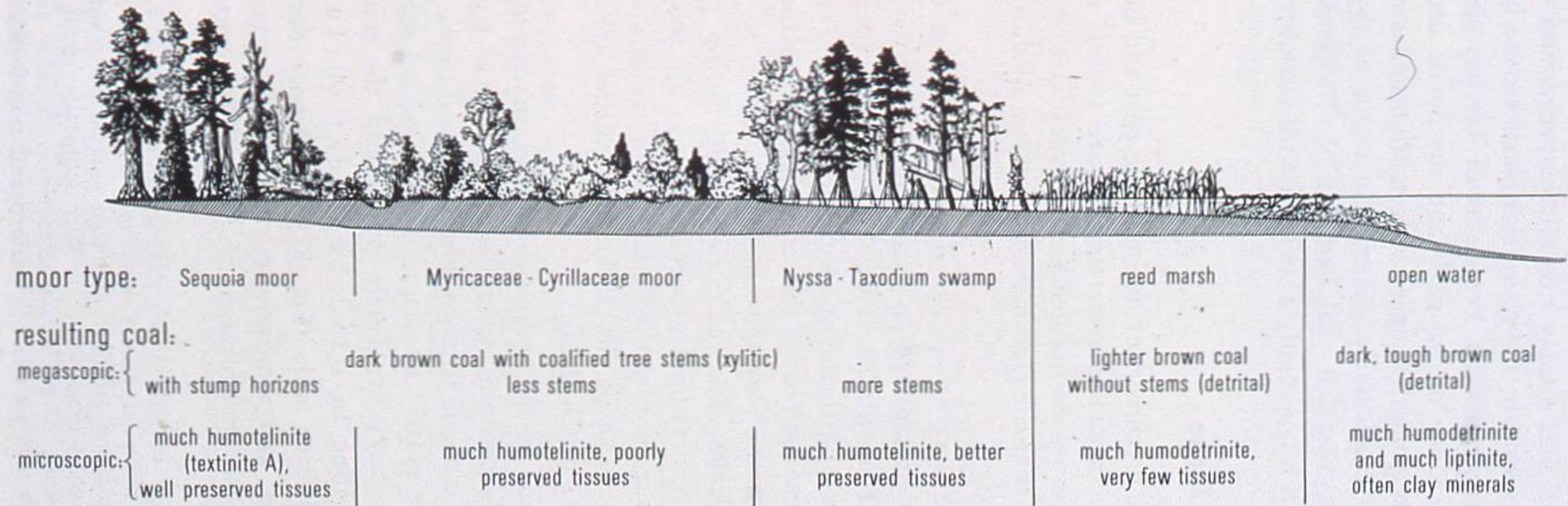
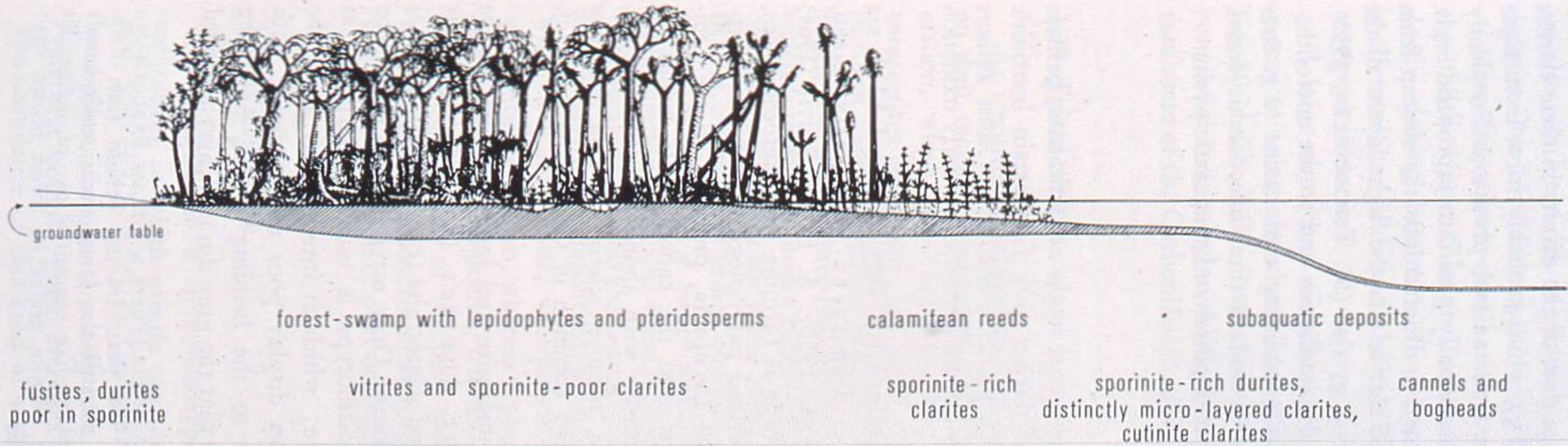
## Fuel Conversion Facts

Product	Approximate heat value
1 ton of bituminous coal	25 Mcf of natural gas 189 gallons of gasoline 4.17 barrels of crude oil
1 Mcf of natural gas	0.04 ton of coal (80 lb of coal) 7.58 gallons of gasoline 0.17 barrel of crude oil (7 gallons of crude oil)
1 gallon of gasoline	0.005 ton of coal (10.56 pounds of coal) 0.132 Mcf of natural gas (132 cubic feet of natural gas) 0.022 barrel of oil 0.917 gallon of oil
1 barrel of oil	0.24 ton of coal (480 pounds of coal) 6 Mcf of natural gas 45.5 gallons of gasoline
1 pound U <sub>3</sub> O <sub>8</sub> in Conc. (for electric power from LWR reactors)	8.9 tons of coal  37.1 barrels of crude oil

# Quarterly Review of Methane from Coal Seams Technology







Figs. 87 and 88. The presumed depositional sites for microlithotypes of 87) Carboniferous coals of the northern hemisphere, and 88) the corresponding sites for Miocene lignite types in the Lower Rhine bay, W. Germany (after M. TEICHMÜLLER, 1962 a).

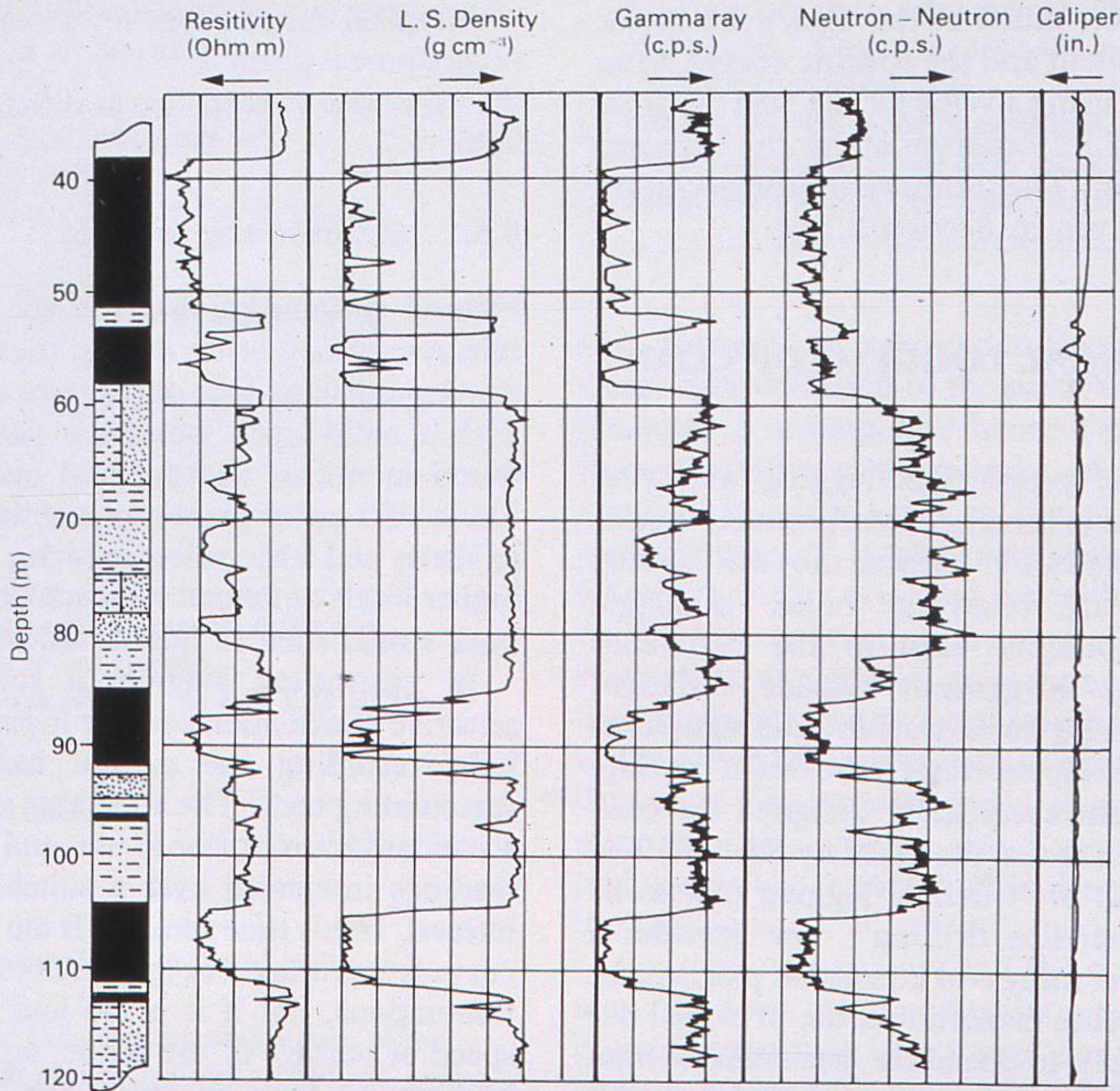


Fig. 6.18 Geophysical logs in a typical borehole through coal-bearing strata. □ Sandstone, ■ Coal