15. AN INERTINITE-RICH COAL LENTICLE IN TRIASSIC SEDIMENT OF SAMPLE 547B-35,CC, DEEP SEA DRILLING PROJECT LEG 79[1]

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ABSTRACT

A lenticle of organic matter in a piece of dolomite rock embedded in Triassic sandy mudstone of Core 547B-35 (DSDP Leg 79) was identified as inertinite-rich coal by organic petrography and analytical pyrolysis. About 95% of the organic matter recognized under the microscope consists of pyrofusinite, degradofusinite, and inertodetrinite. Gaseous hydrocarbons evolved during pyrolysis are rich in methane and are characteristic of inertinitic material. The organic matter is suggested to be a piece of redeposited Permian Gondwana coal.

INTRODUCTION

A dolomite pebble embedded in a sequence of probable Triassic (site chapter, this volume) gray and red sandy mudstone in DSDP Sample 547B-35,CC (1027.5 m depth) of the continental rise of the Mazagan Escarpment, about 150 km west of Casablanca, contains a lenticle of coaly organic matter. The lenticle is 8 mm in diameter and appears black, dull, and friable. Fractures within the coaly material are filled with dolomite, whereas the dolomite pebble itself does not contain any of this coaly material. This somewhat unusual association of coaly organic matter contained in a dolomite pebble embedded in a sandy mudstone is interesting with respect to sedimentary processes in the nearshore environment at an early stage of the Atlantic Ocean opening.

RESULTS

The coaly material removed from the lenticle contains only 39.6% organic carbon (because of dilution by dolomite in the small-scale fractures), whereas the dolomite as well as a sample of the gray sandy mudstone from Core 547B-30 (Rullkötter et al., this volume) contain only 0.28% C_{org} (Table 1). The mudstone sequence based on shipboard observation (cf. site chapter, this volume) appeared to be fairly homogeneous so that the organic geochemistry results obtained for Core 547B-30 are assumed to also represent the situation in Core 547B-35 about 40 m deeper in the hole. Rock-Eval pyrolysis (Espitalié et al., 1977) yields low hydrogen index values in all three samples (Table 1). Microscopic examination (see Mukhopadhyay et al., 1983, for analytical details) of the polished surface of particles removed from the lenticle revealed that the coaly organic matter predominantly (about 95%) consists of inertinitic macerals like pyrofusinite, degradofusinite, and inertodetrinite (Plate 1, Figs. 1 and 2; cf. Stach et al., 1982, for terminology).

Table 1. Organic petrography and Rock-Eval pyrolysis data for three DSDP samples.

	547B-30-3, 59–75	547B-35,CC (0-2)	547B-35,CC (0-2)
Depth (m)	981.2	1027.5	1027.5
Lithology	Sandy mudstone	Dolomite	Coal
Corg (%)	0.28	0.28	39.6
Hydrogen index (mg HC/g C_{org})	20	22	14
Oxygen index (mg CO_2/g C_{org})	27	94	3
Mean vitrinite reflectance (%)	0.54	No vitrinite	0.85 (bimacerite)
Maceral composition (%)		No macerals identified	
Liptinite	31 (mostly exinite and resinite)		4
Vitrinite and biodegraded humic matter	50		1
Inertinite			
Inertodetrinite	19		49
Pyrofusinite	—		38
Degradofusinite	—		8

Note: Dash indicates "not detected."

No pyrobitumen was detected. Cell lumens of several fusinite particles are filled with brownish yellow resinite. Vitrinite is scarce and occurs in bimacerite grains. Vitrinite reflectance within the bimacerites is 0.85%, whereas the mudstone matrix contains vitrinite with 0.54% mean reflectance (Table 1). In the dolomite, no vitrinite particles or other macerals could be detected; the low amount of organic matter present rather appears bituminous. The organic matter in the sandy mudstone mainly consists of vitrinite, exinite, and biodegraded humic matter of terrigenous origin (Rullkötter et al., this volume) but it does not resemble the coaly material in the lenticle.

Pyrolysis of the finely powdered coal sample, using a Chemical Data Systems 820 GS instrument (50–600°C/min.; Gormly and Mukhopadhyay, 1983), yields 14 mg hydrocarbons per gram organic carbon. The pyrolyzed residue differs from the original sample. It contains the same types of inertinitic components, but with a higher

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proportion of inertrodetrinite due to disintegration of fusinite particles during pyrolysis. Resinite is no longer detectable in the pyrolysis residue, and the reflectance of the vitrinite particles has increased to 2.3%. No coke structure was observed, but vitrinite grains showed a pitted surface. The gaseous hydrocarbons (saturated and olefinic) evolved during pyrolysis are in the range of C_1 to C_4 and have the following relative carbon number distribution: $C_1 = 55\%$, $C_2 = 28\%$, $C_3 = 16\%$, $C_4 < 1\%$. This hydrocarbon composition, with its slight predominance of methane, is characteristic of inertinite and differs significantly from the pyrolysis products of other maceral types (Spiro et al., 1982). This also suggests that the inertinite particles still have a noticeable gas potential since the small amount of resinite in the coal apparently does not significantly influence the pyrolytic hydrocarbon distribution.

DISCUSSION

The inertinite-rich coal from DSDP Core 547B-35 has a maceral composition similar to some of the Gondwana coals of India, South Africa, and Australia that were deposited in oxic swamp environments (Stach et al., 1982). The petrographic similarity suggests that the coaly fragment was eroded from a Permian coal-bearing sediment and at first redeposited in an environment of carbonate deposition. This is indicated by the fact that carbonate fills small fractures in the coal. At a later stage, following dolomitization of the carbonate, the coaly material was again redeposited as part of a dolomite pebble and embedded in the Triassic sandy mudstone during the early phase of the opening of the Atlantic Ocean. The association of coal with dolomite is unusual but in this case can be explained by the sequence of redeposition steps outlined previously. The difference in vitrinite reflectance between the coaly lenticle and the sandy mudstone supports this suggestion.

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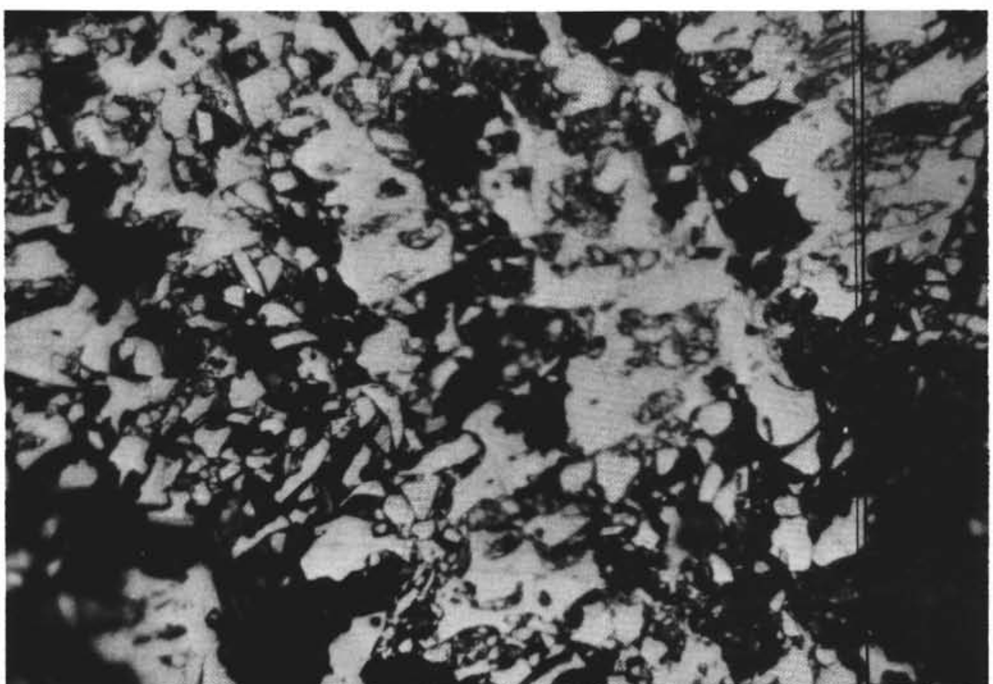
1

50 μm



2

50 μm

Plate 1. Pyrofusinite (1) and inertodetrinite (2) in a coal sample from Sample 547B-35,CC; normal reflected light.