

RESTRICTED INVESTIGATION REPORT 1109R

CSIRO

INSTITUTE OF EARTH RESOURCES

Fuel Geoscience Unit

**THE PETROLOGY OF SOME TRIASSIC COALS FROM THE
FINGAL AREA, TASMANIA**

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1. INTRODUCTION

The Department of Mines, Tasmania, has sent samples of Triassic coal to the CSIRO Fuel Geoscience Unit for petrographic analysis. Seams from two boreholes in the Fingal area (Fig. 1) consist of an Unnamed, Duncan and East Fingal sections from bore 42 and the Duncan and East Fingal seams from bore 43. The stratigraphic sequence of the seams is given in Fig. 2.

Five float/sink samples from the Duncan seam have also been supplied for petrographic analysis.

2. ANALYSES

Maceral and microlithotype analyses have been carried out on all of the samples, and the reflectivity of the vitrinite has been measured on selected plies.

3. RESULTS

Results of the maceral analyses are given in Table 1 and plotted in Fig. 3. The types of exinite and inertinite present in the coals are presented in Tables 2 and 3, respectively, and these are plotted in Figs. 4 and 5. Reflectivity values are given in Table 1 for each seam.

The microlithotype compositions of the seams are given in Table 4 and plotted in Fig. 6.

The results of the maceral analyses on the float/sink samples from the Duncan seam are in Table 5 and the microlithotypes in Table 6. The amount of mineral matter in each of the float fractions is plotted in Fig. 7.

4. DISCUSSION

All three seams have extremely high inertinite contents; vitrinite increases upwards from the East Fingal to the Unnamed seam. The exinite content is consistently low at around 6% in the three seams and is predominantly cutinite with some sporinite. The inertinite is composed of more than 50% semifusinite in all subsections, a petrographic feature unique amongst Australian Triassic coals analysed to date.

The seams have extremely high durite plus inertite contents, with approximately equal proportions of vitrite plus clarite and intermediates (includes duroclarite, clarodurite, vitrinertite). There is an increase in the latter two components from the East Fingal to the Unnamed seam.

In the 1.4 sg float fraction there is a great increase in the quantity of vitrinite as expected, compared with the other fractions which are inertinite-rich.

The given ash contents for the three seams are plotted against their mineral contents, maceral and microlithotype, in Fig. 8. Not all the points coincide, that is, the minerals counted as macerals are not equivalent to mineral matter (microlithotypes) plus half the shaly coal, in all cases. Thus, for the Duncan seam, two possible curves have been drawn giving the relationship between ash content and mineral content.

68% of the Duncan seam sample floats at 1.4 plus 1.6 sg, and has less than 6% mineral matter (as macerals), or 11-12% ash: less than 5% using microlithotypes, or 19-20% ash. Thus in the worse case, 68% of the coal can be reduced to less than 20% ash if floated at 1.6 sg.

The rise in the vitrinite content of the 2.0 sg float fraction is due to the fact that any vitrinite which did not float at 1.4 sg, failed to do so because of intimate mixing with mineral matter. This vitrinite therefore forms part of the heaviest fraction.

5. CONCLUSIONS

The Unnamed, Duncan and East Fingal seams from the Fingal area all have high inertinite and high durite plus inertite contents. The quantity of vitrinite increases stratigraphically upwards from the lowest seam, the East Fingal, to the Unnamed seam at the top. This increase is expressed equally as vitrite plus clarite and intermediates.

Floating at 1.4 sg increases the vitrinite content of the coal to 60%, and only 3% mineral matter, but this is a small percentage of the whole (12%). 68% of the coal floats at 1.6 sg with a mineral content of less than 6%.

Ideas on the origins of these seams are to be included in a paper on Triassic coals in the Coal Geology journal of the Geological Society of Australia.

TABLE 1 MACERAL ANALYSES OF THE SUBSECTIONS AND COMPOSITES
(results are given as percentages by volume unless otherwise stated)

Lab No. Sub ⁿ	Estimated thickness (m)	Vitrinite	Exinite	Inertinite	Mineral Matter				
					Cy.	Cb.	Py.	Q.	Ash (by weight)
<u>UNNAMED SEAM: BORE 42 Reflectance = 0.59%</u>					$(\bar{R}_O$ average)				
79719	1.29	21	5	51	21	1	-	1	41.1
3a									
mmf	1.29	27	6	67					
<u>DUNCAN SEAM: BORE 42 Reflectance = 0.58%</u>					$(\bar{R}_O$ average)				
79720	0.49	14	6	53	17	8	-	2	40.6
4a									
79721	1.28	8	6	72	10	3	-	1	24.4
4b									
79722	0.54	24	4	53	19	-	-	-	31.9
4c									
4a+4b+4c	2.31	13	5	64	14	3	-	1	
composite									
mmf	2.31	16	6	78	-	-	-	-	
<u>DUNCAN SEAM: BORE 43</u>									
79725	1.37	19	3	65	12	1	-	-	Predicted 23-24
3a									
79726	1.20	16	5	66	12	1	-	-	23-24
3b									
3a+3b	2.57	18	4	65	12	1	-	-	
composite									
mmf	2.57	20	5	75	-	-	-	-	
<u>EAST FINGAL SEAM: BORE 42</u>									
79723	1.30	6	6	63	25	-	-	-	47.1
5a									
79724	1.17	7	2	51	40	-	-	-	59.7
5b									
5a+5b	2.47	7	4	57	32	-	-	-	
composite									
mmf	2.47	10	6	84	-	-	-	-	
<u>EAST FINGAL SEAM: BORE 43 Reflectance 0.58%</u>					$(\bar{R}_O$ average)				
79727	1.79	13	3	58	25	1	-	-	
4									
79728	0.60	4	3	52	41	tr	-	-	
5a									
79729	1.08	Dirt Band							
5b									
79730	2.05	Dirt Band							
6a									
79731	0.35	Dirt Band							
6b									
4+5a	2.39	11	3	56	29	1	-	-	
composite									
mmf	2.39	6	4	80	-	-	-	-	

Cy. - clay
Cb. - carbonate
Py. - pyrite

Q. - quartz
tr - trace

TABLE 2 MACERAL ANALYSES OF THE EXINITE GROUP

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ⁿ	Estimated Thickness	Sporinite	Cutinite	Liptodetrinite	No. of Counts
<u>UNNAMED SEAM: BORE 42</u>					
79719 3a	1.29	20	69	11	35
<u>DUNCAN SEAM: BORE 42</u>					
79720 4a	0.49	11	78	11	19
79721 4b	1.28	4	83	13	23
79722 4c	0.54	31	69	-	13
<u>DUNCAN SEAM: BORE 43</u>					
79725 3a	1.37	43	57	-	7
79726 3b	1.20	25	75	-	12
<u>EAST FINGAL SEAM: BORE 42</u>					
79723 5a	1.30	26	70	4	23
79724 5b	1.17	40	50	10	10
<u>EAST FINGAL SEAM: BORE 43</u>					
79727 4	1.79	50	50	-	4
79728 5a	0.60	39	46	15	13
79729 5b	1.08	Dirt Band			
79730 6a	2.05	Dirt Band			
79731 6b	0.35	Dirt Band			

TABLE 3 MACERAL ANALYSES OF THE INERTINITE GROUP

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ^{II}	Estimated Thickness (m)	Micrinite	Macrinite	Inerto- detrinite	Semi- fus- inite	Fusinite	No. of Counts
<u>UNNAMED SEAM: BORE 42</u>							
79719 3a	1.29	1	3	13	83	-	377
<u>DUNCAN SEAM: BORE 42</u>							
79720 4a	0.49	2	-	32	65	1	173
79721 4b	1.28	tr	4	38	56	2	279
79722 4c	0.54	1	1	25	72	1	172
<u>DUNCAN SEAM: BORE 43</u>							
79725 3a	1.37	1	3	18	77	1	171
79726 3b	1.20	-	4	21	75	-	170
<u>EAST FINGAL SEAM: BORE 42</u>							
79723 5a	1.30	-	3	27	70	-	268
79724 5b	1.17	-	2	35	62	1	169
<u>EAST FINGAL SEAM: BORE 43</u>							
79727 4	1.79	1	-	31	67	1	156
79728 5a	0.60	-	3	36	61	-	218
79729 5b	1.08	Dirt Band					
79730 6a	2.05	Dirt Band					
79731 6b	0.35	Dirt Band					

TABLE 4 MICROLITHOTYPE ANALYSES OF THE SUBSECTIONS AND COMPOSITES
(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ⁿ	Estimated Thickness (m)	Vitrite	Clarite	Intermediates	Microite + Durite	Semifusite + fusite	Shaly Coal	Mineral Matter					
								Cy.	Cb.	Py.	Q.	Ash (by weight)	
<u>UNNAMED SEAM: BOREHOLE 42</u>													
79719	1.29	11	2	9	29	23	8	17	tr	-	1	41.1	
3a													
mmf	1.29	15	3	13	39	39	-	-	-	-	-		
<u>DUNCAN SEAM: BOREHOLE 42</u>													
79720	0.49	5	tr	9	11	36	12	20	5	-	2	40.6	
4a													
79721	1.28	5	tr	4	41	38	5	3	4	-	tr	24.4	
4b													
79722	0.54	12	6	11	21	28	7	15	-	-	tr	31.9	
4c													
4b+4c	1.82	7	2	6	35	35	5	7	3	-	tr		
composite													
mmf	1.82	8	3	7	41	41	-	-	-	-	-		
<u>DUNCAN SEAM: BOREHOLE 43</u>													
79725	1.37	9	1	9	28	40	4	6	3	-	tr	Predicted as 25-26	
3a													
79726	1.20	11	3	10	27	31	8	8	2	-	tr	27-28	
3b													
3a+3b	2.57	10	2	9	27	36	6	7	3	-	tr		
composite													
mmf	2.57	12	2	11	32	43	-	-	-	-	-		
<u>EAST FINGAL SEAM ; BOREHOLE 42</u>													
79723	0.60	2	2	2	43	19	12	20	-	-	tr		
5a													
79724	1.08	2	-	3	36	14	10	31	3	-	1		
5b													
5a+5b	1.68	2	1	2	40	17	11	25	1	-	1		
composite													
mmf	1.68	3	2	3	65	27	-	-	-	-	-		
<u>EAST FINGAL SEAM: BOREHOLE 43</u>													
79727	1.79	3	3	4	40	21	8	17	2	-	2		
4													
mmf	1.79	4	4	6	56	30	-	-	-	-	-		
79728	0.60	2	tr	1	31	15	9	42	-	-	tr		
5a													
79729	1.08	14% coal						15	64	1	-	6	
5b													
5a	0.60	4	tr	2	63	31	-	-	-	-	-		
mmf													
79730	2.05	2% coal						9	87	-	-	2	
6a													
79731	0.35	12% coal						7	74	-	-	7	
6b													

Cy. - clay
Cb. - carbonate
Py. - pyrite
Q. - quartz
tr - trace

TABLE 5 MACERAL ANALYSES OF THE FLOAT/SINK FRACTIONS

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ⁿ	% of whole	Vitrinite	Exinite	Inertinite	Mineral Matter			
					Cy.	Cb.	Py.	Q
80009 1.4 F/T	12	58	4	35	3	-	-	-
80010 1.6 F/T	56	14	5	75	6	tr	-	-
80011 1.8 F/T	12	11	4	63	21	1	-	-
80012 2.0 F/T	4	13	3	34	48	2	-	-
80013 2.0 S/K	16	----- 20% coal -----			79	-	-	1
Mineral-matter-free								
80009 1.4 F/T		60	4	36				
80010 1.6 F/T		15	5	80				
80011 1.8 F/T		14	5	81				
80012 2.0 F/T		26	6	68				

Cy. - clay
Cb. - carbonate
Py. - pyrite

Q. - quartz
tr - trace

TABLE 5 (continued)

MACERAL ANALYSES OF THE EXINITE GROUP

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ⁿ	% of whole	Sporinite	Cutinite	Resinite	Liptodetrinite	No. of Counts
80009 1.4 F/T	12	13	80	-	7	15
80010 1.6 F/T	56	6	61	6	27	18
80011 1.8 F/T	12	17	66	-	17	12
80012 2.0 F/T	4	33	67	-	-	9

MACERAL ANALYSES OF THE INERTINITE GROUP

Lab. No. Sub ⁿ	% of whole	Micrinite	Macrinite	Inerto- detrinite	Semi- fusinite	Fusinite	No. of Counts
80009 1.4 F/T	12	2	-	21	77	-	126
80010 1.6 F/T	56	-	3	15	81	1	259
80011 1.8 F/T	12	1	2	21	76	-	242
80012 2.0 F/T	4	-	2	24	73	1	139

TABLE 6 DUNCAM SEAM, DUNCAN COLLIERY
MICROLITHOTYPE ANALYSES OF THE FLOAT/SINK FRACTIONS

(Results are given as percentages by volume unless otherwise stated)

Lab. No. Sub ⁿ	Vitrite	Clarite	Inter- mediates	Durite + Microite	Semi- fusite + Fusite	Shaly Coal	Mineral Matter				% of whole sample
							Cy.	Cb.	Py.	Q.	
80009 1.4 F/T	56	5	10	9	18	1	1	-	-		12
80010 1.6 F/T	5	1	6	40	41	4	1	1	-	1	56
80011 1.8 F/T	3	1	3	31	31	22	8	1	-	tr	12
80012 2.0 F/T	5	1	1	12	13	25	39	3	-	1	4
2.0 S/K				N O T C O U N T E D							16

Cy. - clay
Cb. - carbonate
Py. - pyrite

Q. - quartz
tr - trace

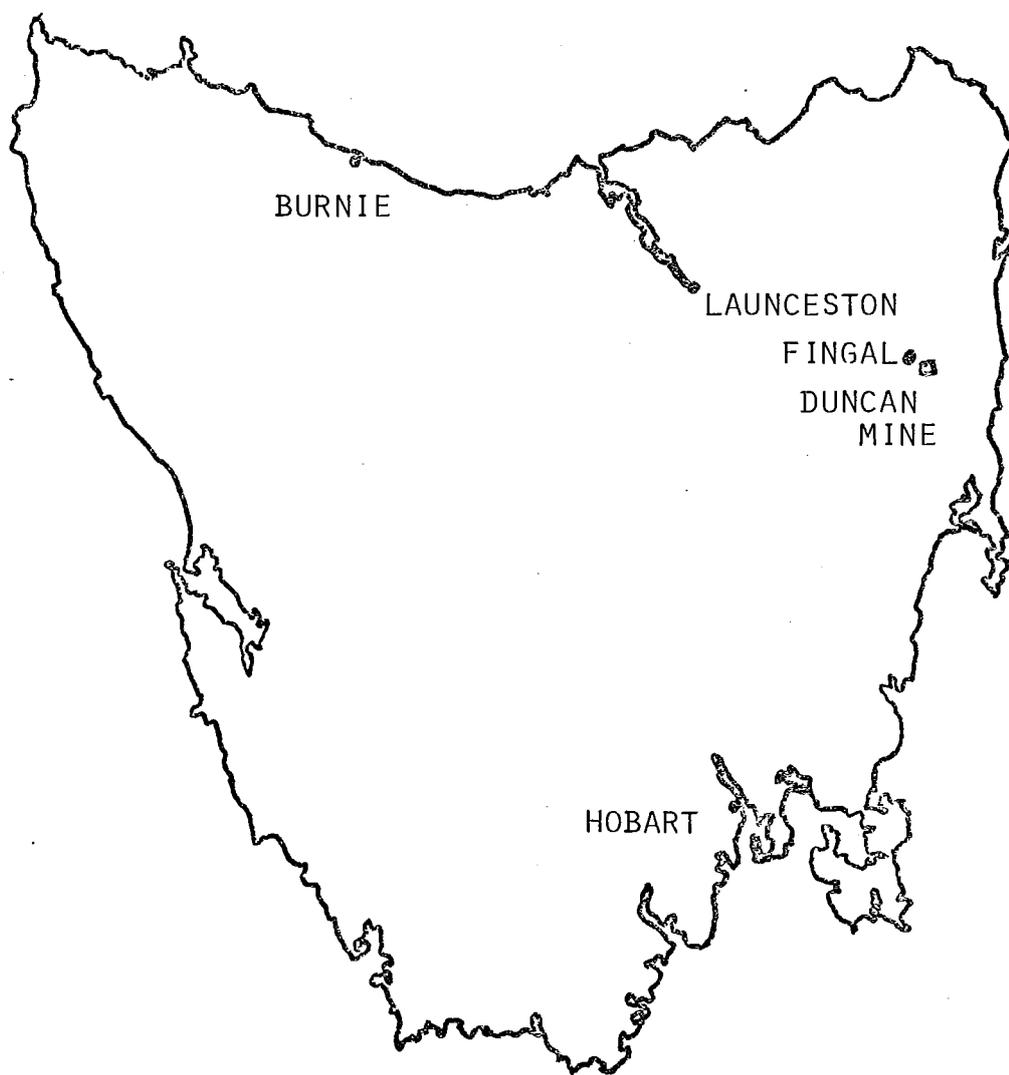


FIG. 1 LOCATION OF FINGAL, TASMANIA

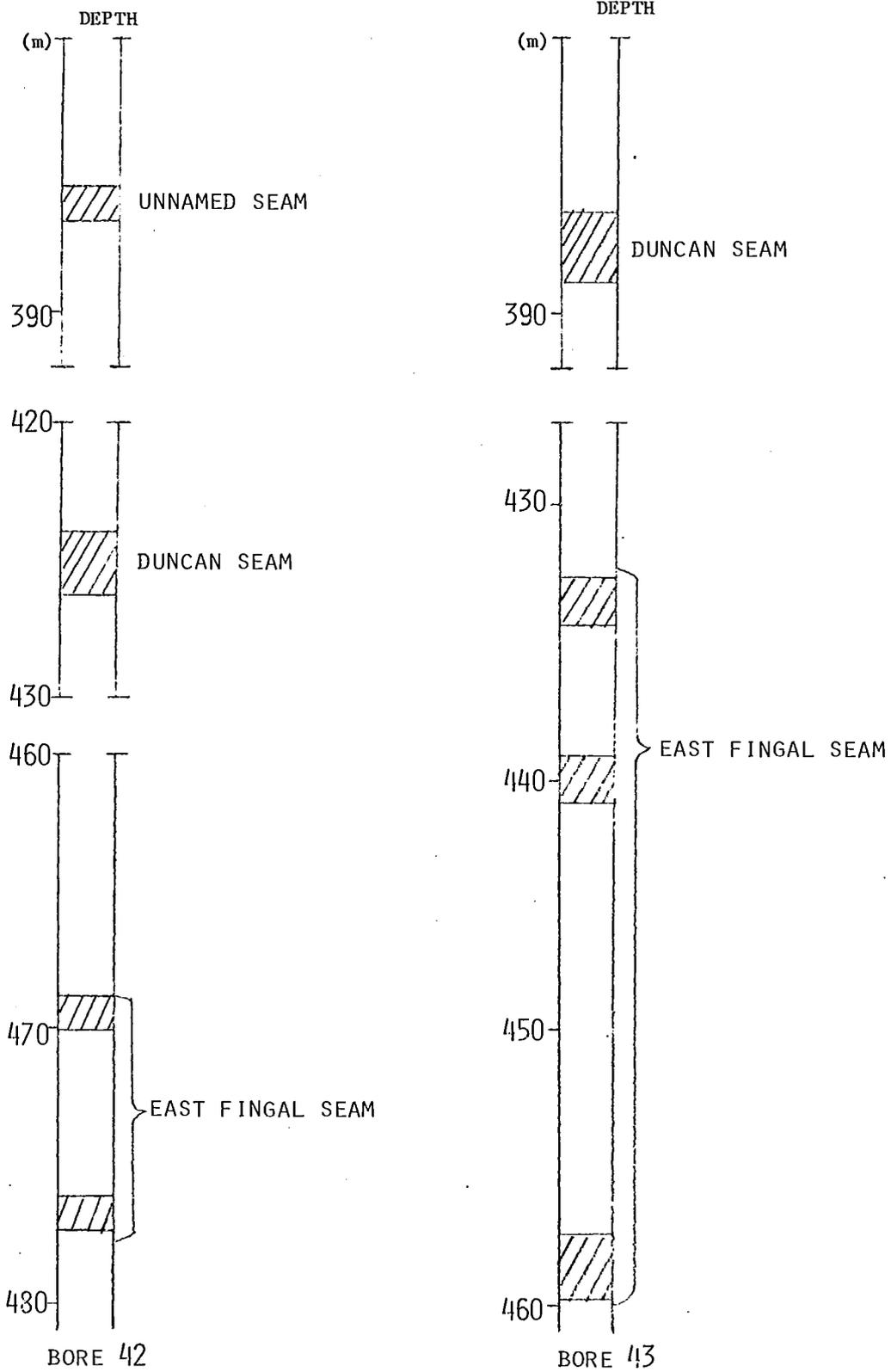


FIG. 2 STRATIGRAPHIC SEQUENCE OF THE SEAMS IN THE FINGAL BORES 42 AND 43

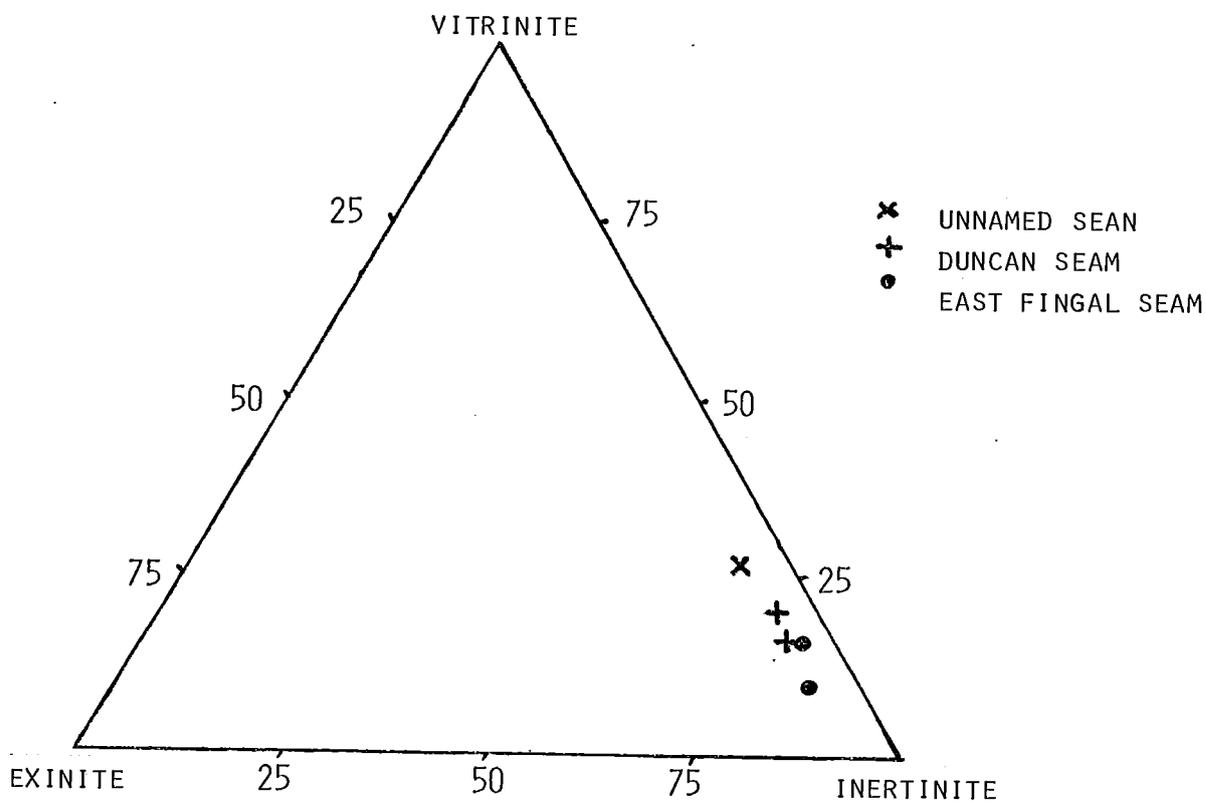


FIG. 3 MACERAL COMPOSITIONS OF THE SEAMS FROM BORES 42 AND 43 (MINERAL-MATTER-FREE)

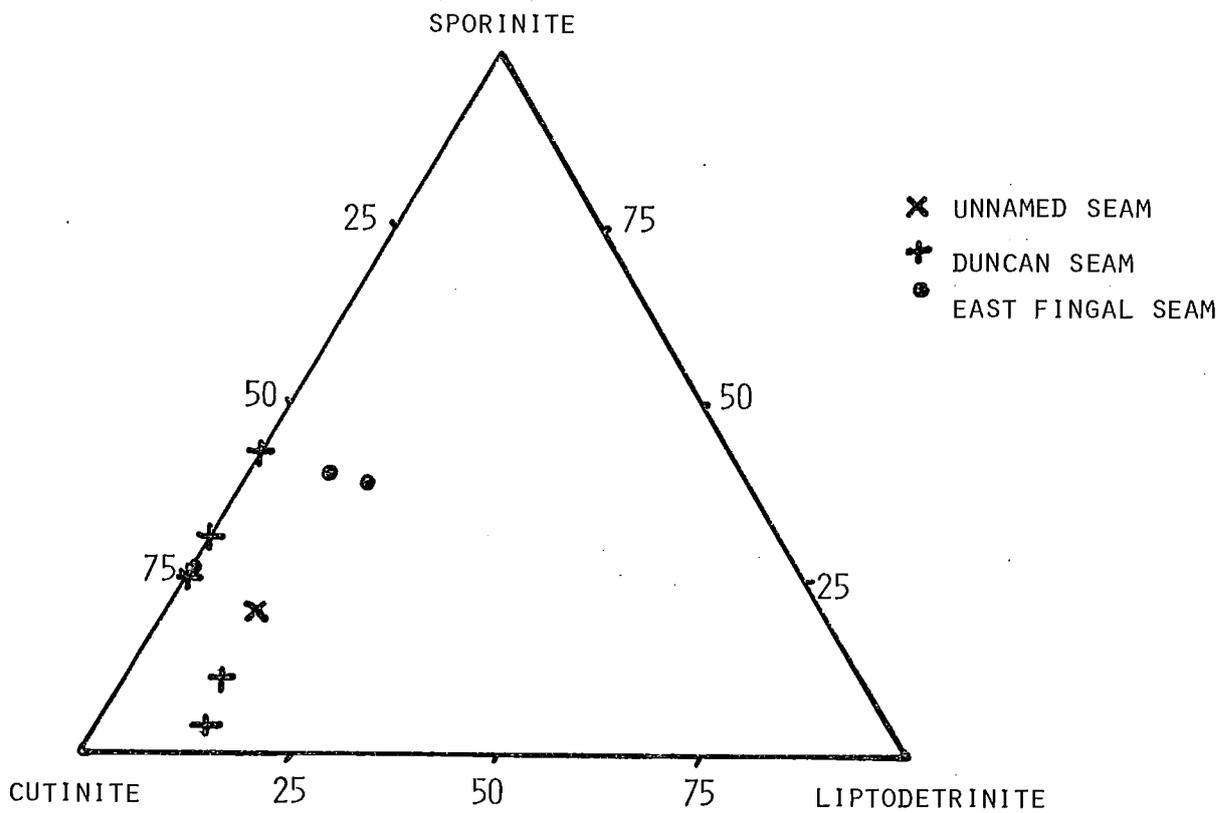


FIG. 4 COMPONENTS OF THE EXINITE GROUP IN THE SUBSECTIONS OF THE SEAMS FROM BORES 42 AND 43

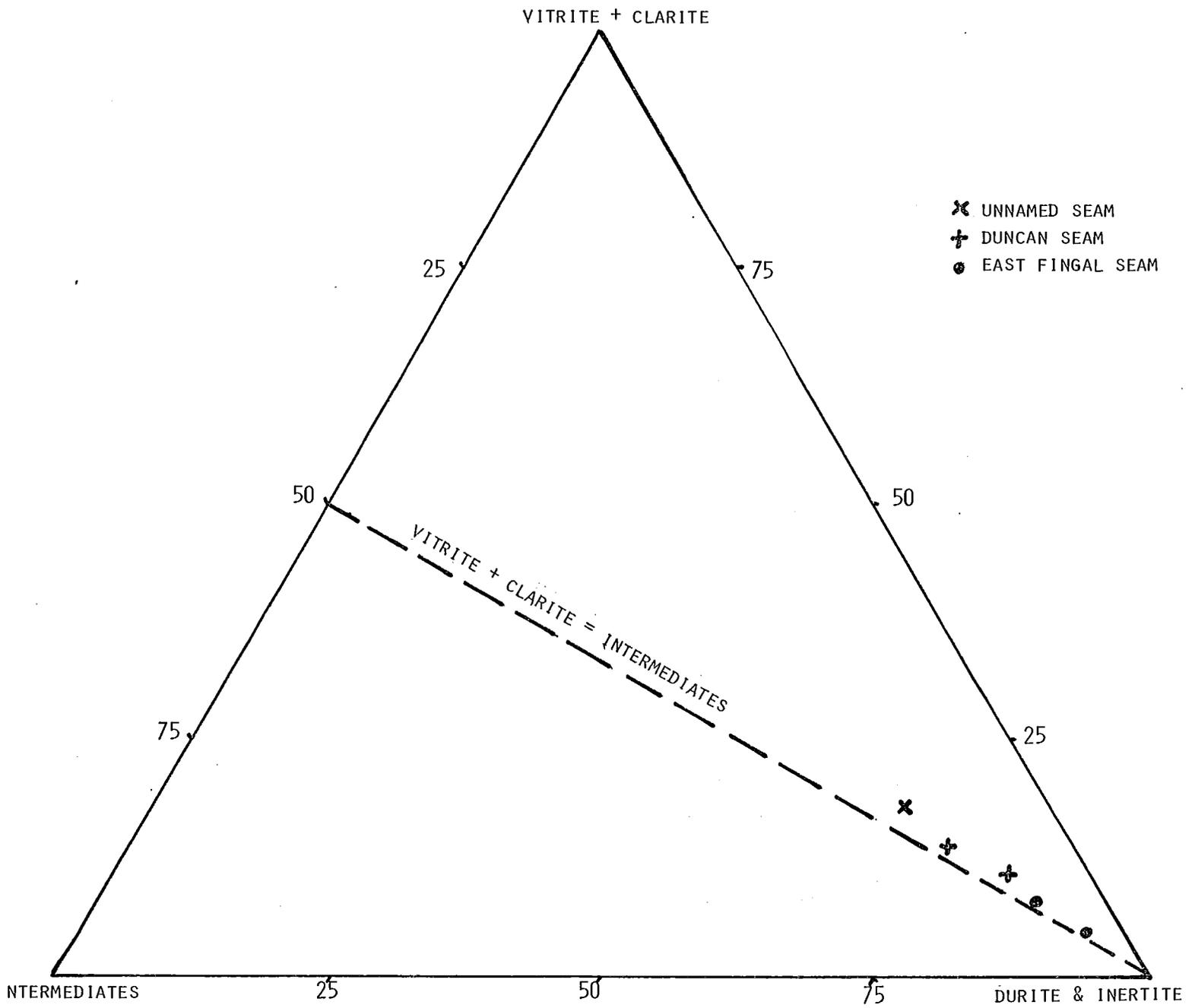


FIG. 6 MICROLITHOTYPE COMPOSITIONS OF THE SEAMS FROM BORES 42 AND 43.

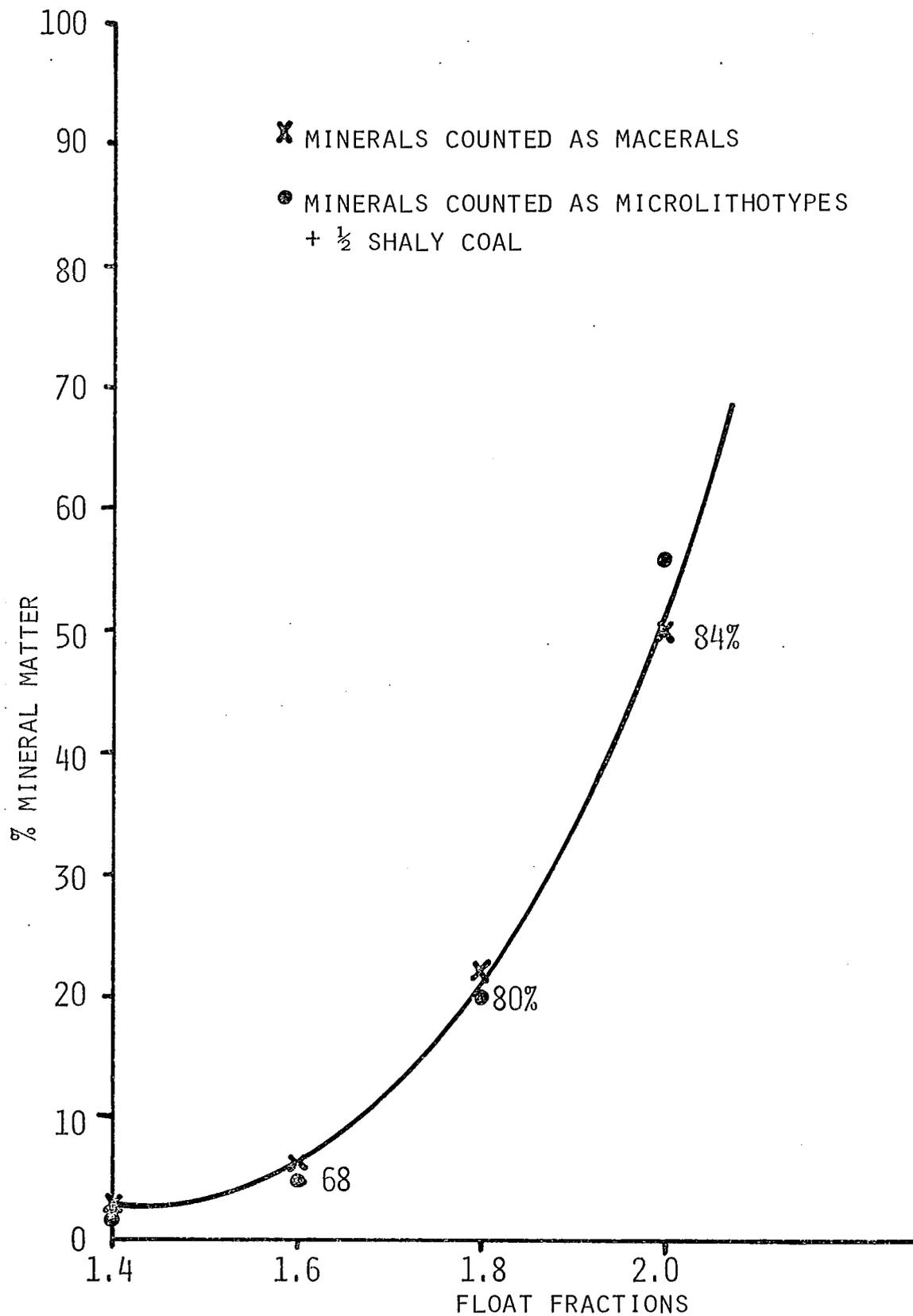


FIG. 7 MINERAL MATTER CONTENT OF THE FLOAT FRACTIONS

MINERALS COUNTED AS MACERALS

X UNNAMED SEAM

+ DUNCAN SEAM

• EAST FINGAL SEAM

MINERALS COUNTED AS

MICROLITHOTYPES + $\frac{1}{2}$ SHALY COAL

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FIG. 3. RELATIONSHIP BETWEEN MINERALS AND ASH CONTENT

