PE990855

APPENDIX

PALYNOLOGICAL ANALYSIS
SNAPPER-6, GIPPSLAND BASIN

by

M.K. Macphail

Esso Australia Ltd
Palaeontology Report 1986/4

May 1986

2271L

INTERPRETATIVE DATA

INTRODUCTION

Forty six sidewall cores were processed and the fossil spore-pollen and dinoflagellate extracts analysed. Although most assemblages were diverse, yields were usually low and preservation poor. Consequently many Early Eocene and Palaeocene dates are of low confidence.

Lithological units and palynological zones from the base of the Lakes Entrance Formation to Total Depth are summarized below. Interpretative data are given in Table 1. Basic data are given in Table 2.

SUMMARY

AGE	UNIT/FACIES	ZONE	DEPTH(m)
Oligocene/ Early Miocene	Lakes Entrance Formation	P. tuberculatus	1325.0-1331.0
Log break at 1330.5m			
Late/Middle Eocene	Gurnard Fm. "upper unit"	N. asperus (undiff.)	1337.0
Log break at 1346.0m			
Middle Eocene	Gurnard Fm. "lower unit"	Lower N. asperus & A. diktyoplokus	1348.0
Log break at 1349.0m			
Middle Eocene	Latrobe Group coarse clastics	Lower N. asperus	1407.0 - 1433.0
Early Eocene		P. asperopolus	1516.0 - 1557.0
Early Eocene		Upper M. diversus	1605.0
Early Eocene		Middle M. diversus	1704.0 - 1726.0
Early Eocene		Lower M. diversus	1787.0 - 1915.0
Paleocene		Upper L. balmei	1976.0 - 2211.0
Paleocene		Lower L. balmei	2274.0 - 2517.0
Maastrichtian		Upper T. longus	2744.0 - 2946.0
Maastrichtian		Lower T. longus	2998.0

T.D. 3021m

GEOLOGICAL COMMENTS

1. Snapper-6 contains essentially the same sequence of Late Cretaceous to Tertiary zones as other wells in the Snapper and adjacent Whiting fields. In all wells a substantial time break, probably representing the entire Oligocene Period, occurs between the top of the Latrobe Group and the base of the Lakes Entrance Formation.

2. As in Snapper-4 (Macphail 1984) and Snapper-5 (Partridge 1986), lithological and log data indicate the Gurnard Formation comprises two units: an upper glauconite unit between 1330.5 and 1346.0m (See Hannah 1986) and a siltstone unit with relatively minor amounts of glaucontie between 1346.0 and 1349.0m. The latter is characterized by a particularly strong kick out in the resistivity log. In Snapper-4 and Snapper-5 these subunits are dated as Late Eocene, Middle N. asperus Zone and Middle Eocene, Lower N. asperus Zone ages respectively. In Snapper-6, the lower unit is Lower N. asperus/A. diktyoplokus Zone in age, as in Snapper-4 and Snapper-5. The upper unit, which contains (?bioturbated) P. tuberculatus Zone species at 1331.0m, is undatable.

3. Thick coals at 1465-1474m and 1641.5-1654m form an excellent datum for correlating Snapper-6 with the other Snapper and Whiting wells. The depths of the equivalent coals in Snapper-5 are 1396.5-1405m and 1606-1621.5m respectively [Partridge 1986]. Although these coals fall within unsampled intervals in both wells, the Snapper-4 data indicate the upper one is P. asperopolus Zone. It remains uncertain whether the lower coal is Upper or Middle M. diversus Zone in age

4. A marked thickening of Paleocene and (?) Late Cretaceous sediments occurs between Snapper-5 and Snapper-6, a trend that continues to the southwest across the Whiting Field. The most likely explanation is that the Snapper wells, including Snapper-5 and Snapper-6 and Snapper-1 and Snapper-4 (Macphail 1984), are separated by a series of growth faults which had ceased development by the end of the Paleocene.

5. Prior to the development of open marine conditions across Snapper-6 during the Middle Eocene, the well was sited within a coastal plain environment that was relatively unaffected by Paleocene-Early Eocene marine transgressions. Marine-influenced sediments occur at 1516.0m, 2099.0 and 2462.0m (A. homomorphum Zone), and 2396.0m (?A. homomorphum Zone). Sediments deposited during the A. hyperacanthum Zone marine transgression occur at 1834.5m in Snapper-5 but have not been identified

in Snapper-6. Log data indicates the most likely equivalent facies in Snapper-6 is the shale unit at 1862-1872m. Sidewall core 33 (1870.0m) shot in this unit contains very rare dinoflagellates, the only marine organisms recorded within the Lower M. diversus Zone in Snapper-6.

6. Because of anomalously young occurrences of the typically Paleocene species Lygistepollenites balmei, it is not clear whether the Upper L. balmei - Lower M. diversus Zone boundary lies between 2099.0 and 1915.0m or between 1915.0 and 1870.0m. If the former, then the "L-1" coal, at approx. 1890m and the L. balmei seismic marker some metres above this coal lie within the Early Eocene, Lower M. diversus Zone interval.

BIOSTRATIGRAPHY

Zone boundaries have been established using the criteria of Stover and Partridge (1973) and subsequent proprietary revisions.

Upper Tricolpites longus Zone: 2744-2946.0m.

Samples within this interval contain Stereisporites punctatus associated with frequent Gambierina and, usually, Proteacidites spp. that typically range no higher than this zone, e.g. P. otwayensis, P. reticuloconcavus. One specimen of Tricolpites longus was recorded, at 2786.0m. The basal sidewall core, at 2998.0m lacks S. punctatus and is tentatively assigned to the Lower T. longus Zone.

Lower Lygistepollenites balmei Zone: 2274.0-2517.0m.

Palynofloras within this interval are dominated by gymnosperm pollen, usually including frequent Lygistepollenites balmei. Most samples include Polycolpites langstonii or Integricorpus antipodus, species first appearing in this zone. The lower boundary is provisionally placed at 2517.0m, based on occurrences of Tetracolporites verrucosus with frequent to common L. balmei. Occurrences of Verrucosisporites kopukuensis and Integricorpus antipodus indicate this sample is relatively high within the Lower L. balmei Zone. The upper boundary is picked at 2274.0m, the highest sample lacking Malvacipollis spp.

Upper Lygistepollenites balmei Zone: 1976.0-2211.0m.

The lower boundary is placed at 2211.0m, the first occurrence of Malvacipollis subtilis. Both Gambierina rudata and Polycolpites langstonii are present at this depth. The sample at 2153.5m contains the first record of Haloragacidites harrisii and that at 2099.0m, the lowest record of Proteacidites annularis. The upper boundary is provisionally placed at 1976.0m, the highest sample containing frequent Lygistepollenites balmei. Malvacipollis subtilis and Gambierina rudata occur in this sample.

Lower Malvacipollis diversus Zone: 1787.0-1915.0m.

All palynofloras in the above interval are dominated by fern spores - species of Cyathidites, Clavifera, Gleicheniidites, Laevigatosporites, Stereisporites and, less commonly, Ischyosporites, Rugulatisporites and Verrucosisporites. The next most common palynomorphs were gymnosperm pollen - Podocarpidites ssp. and Phyllocladidites mawsonii. Although isolated spore-dominated palynofloras occur in the majority of Gippsland wells, the persistence of this dominance over an approx. 130m section is unusual. The evidence indicates a stable floodplain swamp-forest, vegetation that possibly include rare (Eocene) occurrences of Lygistepollenites balmei [1845.0m, 1915.0m]. L. balmei pollen also occurs in time-equivalent sediments in Snapper-5 [see Partridge 1986]. Although the diversity of angiosperm pollen was often high, most species were long-ranging. The base of the zone is placed at 1915.0m, a very sparse assemblage containing single specimens of Crassiretitriletes vanraadshoovenii and Proteacidites obscurus. Since the same flora also contains three specimens of Lygistepollenites balmei, the data is of low confidence. The upper boundary is provisionally placed at 1787.0m, a sample containing a general M. diversus Zone palynoflora which includes a very rare (for Gippsland Basin) Eocene record of Integricorpus antipodus.

Middle Malvacipollis diversus Zone: 1704.0m-1726.0m.

Two samples are assigned to this zone. Both contain species that range no lower than the Middle M. diversus Zone: Proteacidites tuberculiformis at 1726.0m and Anacolosidites rotundus at 1704.0m. Species ranging no higher than this zone were not recorded.

Upper Malvacipollis diversus Zone: 1605.0m.

One sample is assigned to this zone, based on occurrences of Myrtaceidites tenuis, Santalumidites cainozoicus and frequent Malvacipollis subtilis and Proteacidites pachypolus. No species diagnostic of the P. asperopolus Zone were recorded.

Proteacidites asperopolus Zone: 1516.0-1557.0m.

The two samples within this interval contain species which first appear in the zone, e.g. Proteacidites asperopolus, Tricolpites incisus and Sapotaceoidaepollenites rotundus, as well as species which range no higher than this zone, e.g. Intratriporopollenites notabilis, Myrtaceidites tenuis, Proteacidites ornatus, P. plemmelus and P. tuberculiformis. Clavastephanocolporites meleosus occurs at 1516.0m. Both age-determinations are of high confidence.

Lower Nothofagidites asperus Zone: 1348.0-1433.5m.

The base of this zone is defined by the occurrence of Proteacidites asperopolus in an assemblage dominated by Nothofagidites pollen. Nothofagidites falcatus pollen first occurs at 1412.5m and Triporopollenites delicatus at 1348.0m. The latter sample, which contains Tritonites pandus and T. tricornus associated with Areosphaeridium diktyoplokus, is picked as the upper boundary. This sample represents the first evidence for an overlap in the ranges of Tritonites pandus and T. tricornus.

Proteacidites tuberculatus Zone: 1325-1331.0m.

Occurrences of Cyatheacidites annulatus confirm a P. tuberculatus Zone age for the samples at 1325.0m and if in situ, at 1331.0m.

REFERENCES

MACPHAIL, M.K. 1984. Palynological analysis, Snapper-4, Gippsland Basin. Esso Australia Ltd. Palaeontological Report 1984/8.

PARTRIDGE, A.D. 1986. Palynological analysis, Snapper-5, Gippsland Basin. Esso Australia Ltd. Palaeontological Report 1986/9.

STOVER, L.E. & PARTRIDGE, A.D. (1973). Tertiary and Late Cretaceous spores and pollen from the Gippsland Basin, Southeastern Australia. Proc. R. Soc. Vict., 85: 237-286.

PALYNOLOGY DATA SHEET

BASIN: GIPPSLAND ELEVATION: KB: +21.0m GL: -55.0m

WELL NAME: SNAPPER-6 TOTAL DEPTH: 3021m

AGE	PALYNOLOGICAL ZONES	HIGHEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time	LOWEST DATA Preferred Depth	Rtg	Alternate Depth	Rtg	Two Way Time
NEOGENE	*T. pleistocenicus*										
	M. lipsis										
	C. bifurcatus										
	T. bellus										
	P. tuberculatus	1325.0	0				1331.0	0			
PALEOGENE	Upper *N. asperus*										
	Mid *N. asperus*										
	Lower *N. asperus*	1348.0	0				1433.5	1			
	P. asperopolus	1516.0	0				1557.0	0			
	Upper *M. diversus*	1605.0	2				1605.0	2			
	Mid *M. diversus*	1704.0	2				1726.0	1			
	Lower *M. diversus*	1787.0	2				1915.0	2	1870.0	1	
	Upper *L. balmei*	1976.0	2				2211.0	2			
	Lower *L. balmei*	2274.0	2				2517.0	1			
LATE CRETACEOUS	Upper *T. longus*	2744.0	1				2946.0	2	2905.0	1	
	Lower *T. longus*	2998.0	2				2998.0	2			
	T. lilliei										
	N. senectus										
	T. apoxyexinus										
	P. mawsonii										
	A. distocarinatus										
EARLY CRET.	*P. pannosus*										
	C. paradoxa										
	C. striatus										
	C. hughesi										
	F. wonthaggiensis										
	C. australiensis										

COMMENTS: Dinoflagellate Zones:
A. diktyoplokus 1348.0m
A. homomorphum: 2099.0, 2462.0m
Sample or fossils at 1331.0m may not be in situ.

CONFIDENCE RATING:
- O: SWC or Core, Excellent Confidence, assemblage with zone species of spores, pollen and microplankton.
- 1: SWC or Core, Good Confidence, assemblage with zone species of spores and pollen or microplankton.
- 2: SWC or Core, Poor Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.
- 3: Cuttings, Fair Confidence, assemblage with zone species of either spores and pollen or microplankton, or both.
- 4: Cuttings, No Confidence, assemblage with non-diagnostic spores, pollen and/or microplankton.

NOTE: If an entry is given a 3 or 4 confidence rating, an alternative depth with a better confidence rating should be entered, if possible. If a sample cannot be assigned to one particular zone, then no entry should be made, unless a range of zones is given where the highest possible limit will appear in one zone and the lowest possible limit in another.

DATA RECORDED BY: M.K. Macphail DATE: 23 May 1986

DATA REVISED BY: DATE:

TABLE I: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SNAPPER-6

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 60	1325.0	*P. tuberculatus*	-	Early-Middle Miocene	0	*F. crater*, *C. annulatus*, *P. simplex*
SWC 59	1331.0	*P. tuberculatus*	-	Oligocene-Miocene	0	*C. annulatus*, *F. lacunosus*, *P. simplex*
SWC 58	1337.0	*N. asperus*	-	?Middle Eocene	-	*N. falcatus*. No older than Lower *N. asperus* Zone
SWC 57	1342.0	Indeterminate	-	-	-	Negligible yield
SWC 56	1348.0	Lower *N. asperus*	*A. diktoplokus*	Middle Eocene	0	*P. asperopolus*, abund. *Nothofagidites*, *T. delicatus* *A. diktyoplokus*, *T. pandus*, *T. tricornus*
SWC 55	1351.5	Indeterminate	-	-	-	Barren
SWC 54	1357.5	Indeterminate	-	-	-	Negligible yield
SWC 52	1407.7	Lower *N. asperus*	-	Middle Eocene	1	*P. asperopolus*, freq. *Nothofagidites*
SWC 51	1410.0	Lower *N. asperus*	-	Middle Eocene	1	*P. asperopolus*, abund. *Nothofagidites*
SWC 50	1410.5	Lower *N. asperus*	-	Middle Eocene	1	*P. asperopolus*, abund. *Nothofagidites*
SWC 49	1411.5	Lower *N. asperus*	-	Middle Eocene	1	Freq. *P. asperopolus*, abund. *Nothofagidites*
SWC 48	1412.5	Lower *N. asperus*	-	Middle Eocene	1	*P. asperopolus*, common *Nothofagidites*
SWC 46	1433.5	Lower *N. asperus*	-	Middle Eocene	1	*P. asperopolus*, abund. *Nothofagidites*
SWC 45	1475.0	Indeterminate	-	-	-	Barren
SWC 44	1516.0	*P. asperopolus*	-	Early Eocene	0	*P. asperopolus*, *M. tenuis*, *C. meleosus*, *S. rotundus*

TABLE 1: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SNAPPER-6

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 43	1557.0	P. asperopolus	-	Early Eocene	0	I. notabilis, P. tuberculiformis, T. incisus, P. ornatus, P. plemmelus, freq. P. asperopolus
SWC 42	1605.0	Upper M. diversus	-	Early Eocene	2	M. tenuis, freq. P. pachypolus & M. subtilis
SWC 41	1656.0	Indeterminate	-	-	-	Barren
SWC 39	1704.0	Middle M. diversus	-	Early Eocene	2	A. rotundus, M. diversus
SWC 38	1726.0	Middle M. diversus	-	Early Eocene	1	P. tuberculiformis, freq. P. grandis
SWC 37	1759.0	Indeterminate	-	Early Eocene	-	Negligible yield
SWC 36	1787.0	Lower M. diversus	-	Early Eocene	2	I. antipodus; spore-dominated flora.
SWC 35	1818.5	Lower M. diversus	-	Early Eocene	1	P. varus; spore-dominated flora.
SWC 34	1845.0	Lower M. diversus	-	Early Eocene	2	Spore-dominated flora.
SWC 33	1870.0	Lower M. diversus	-	Early Eocene	1	Spore-dominated P. obscurus.
SWC 32	1915.0	Lower M. diversus	-	Early Eocene	2	P. obscurus, C. vanraadshoovenii, spore-dominated flora.
SWC 31	1976.0	Upper L. balmei	-	Paleocene	2	M. subtilis, G. rudata, L. balmei.
SWC 30	2037.3	Upper L. balmei	-	Paleocene	1	P. annularis, Freq. L. balmei.
SWC 29	2099.0	Upper L. balmei	A. homomorphum	Paleocene	1	as above plus M. subtilis, P. langstonii
SWC 28	2153.5	Upper L. balmei	-	Paleocene	2	M. ornamentalis, freq. L. balmei.
SWC 27	2211.0	Upper L. balmei	-	Paleocene	2	M. subtilis, P. langstonii.

TABLE I: SUMMARY OF INTERPRETATIVE PALYNOLOGICAL DATA

SNAPPER-6

SAMPLE NO.	DEPTH (m)	SPORE-POLLEN ZONE	DINOFLAGELLATE ZONE	AGE	CONFIDENCE RATING	COMMENTS
SWC 26	2274.0	Lower L. balmei	-	Paleocene	2	L. balmei, common. P. langstonii.
SWC 25	2337.0	Lower L. balmei	-	Paleocene	2	T. verrucosus, freq. L. balmei.
SWC 23	2396.0	Lower L. balmei	-	Paleocene	2	L. balmei freq. marginal marine.
SWC 22	2435.2	Indeterminate	-	Paleocene	-	Barren.
SWC 21	2462.0	Lower L. balmei	A. homomorphum	Paleocene	1	L. balmei, P. langstonii, freq. A. homomorphum.
SWC 20	2484.8	Lower L. balmei	-	Paleocene	2	L. balmei, freq. A. obscurus.
SWC 19	2517.0	Lower L. balmei	-	Paleocene	1	T. verrucosus, I. antipodus, freq. L. balmei, freq. H. elliottii.
SWC 18	2580.0	Indeterminate	-	-	-	Negligible yield.
SWC 17	2636.0	Indeterminate	-	-	-	Barren.
SWC 12	2744.0	Upper T. longus	-	Maastrichtian	1	S. punctatus, P. wahooensis, freq. G. rudata.
SWC 10	2786.0	Upper T. longus	-	Maastrichtian	0	S. punctatus, T. longus, freq. G. rudata.
SWC 7	2865.3	Indeterminate	-	-	-	Assemblage resembles Lower L. balmei flora.
SWC 5	2905.0	Upper T. longus	-	Maastrichtian	1	S. punctatus, P. reticuloconcavus.
SWC 4	2946.0	Upper T. longus	-	Maastrichtian	2	S. punctatus in coal flora.
SWC 2	2988.0	Lower T. longus	-	Maastrichtian	2	G. rudata.

2271L:8-10

(G1:2181L:1)

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SNAPPER-6

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
SWC 60	1325.0	Low	Fair	Low	Medium	Good	Calcilutite	-	
SWC 59	1331.0	Low	Fair	Medium	Medium	V. good	Slst.,calc, glauc.	-	
SWC 58	1337.0	V. low	Low	Medium	Low	Fair	Slst.	-	
SWC 57	1342.0	Negl.	-	Low	-	Fair	Slst.	-	
SWC 56	1348.0	Fair	Low	High	Medium	Good	Sst.	-	
SWC 55	1351.5	-	-	-	-	-	Sst.	-	
SWC 54	1357.5	Negl.	-	Low	-	Fair	Sst.	-	
SWC 52	1407.7	V. low	Neg.	Medium	Low	Good	Sst.	-	
SWC 51	1410.0	Low	V. low	Medium	Low	Fair	Sst.	-	Hydrocarbon-affected?
SWC 50	1410.5	Low	V. low	Medium	Low	Fair	Sst.	-	
SWC 49	1411.5	Low	-	Medium	-	Fair	Sst.	-	
SWC 48	1412.5	Low	-	Medium	-	Fair	Sst.	minor	
SWC 46	1433.5	Good	-	Medium	-	Fair	Sst.	-	Hydrocarbon-affected?
SWC 45	1475.0	Good	-	-	-	-	Sst.	-	
SWC 44	1516.0	Good	Fair	High	Medium	Fair	Sst.	minor	

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SNAPPER-6

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
SWC 43	1557.0	Good	V. low	High	Low	Good	Slst.	-	
SWC 42	1605.0	V. low	-	Medium	-	Fair	Slst.	-	
SWC 41	1656.0	-	-	-	-	-	Slst.	-	
SWC 39	1704.0	V. low	V. low	Medium	Low	Fair	Slst.	-	
SWC 38	1726.0	Good	Fair	High	Medium	Good	Slst.	-	
SWC 37	1759.5	Negl.	-	Low	-	Fair	Slst.	-	
SWC 36	1787.0	V. good	-	Medium	-	Good	Slst.	-	
SWC 35	1818.5	Good	-	High	-	Fair	Slst.	-	
SWC 34	1845.0	Low	-	Medium	-	Poor	Slst.	-	
SWC 33	1870.0	V. good	Negl.	High	Low	Good	Sh.	-	
SWC 32	1915.0	V. low	-	Medium	-	Fair	Sh.	-	
SWC 31	1976.0	Fair	-	Medium	-	Poor	Sh.	-	
SWC 30	2037.5	Low	-	Medium	-	Fair	Clyst.	-	
SWC 29	2099.0	Good	Good	High	Low	Poor	Slst.	Minor	
SWC 28	2153.5	V. good	Low	High	Low	Poor	Slst.	Strong	

TABLE 2: SUMMARY OF BASIC PALYNOLOGICAL DATA

SNAPPER-6

DIVERSITY -	low	medium	high
S & P	less than 10	10-30	greater than 30
D	1-3	3-10	10

SAMPLE NO.	DEPTH (m)	YIELD SPORE-POLLEN	YIELD DINOS	DIVERSITY SPORE-POLLEN	DIVERSITY DINOS	PRESERVATION	LITHOLOGY	PYRIZATION	COMMENTS
SWC 27	2211.0	Fair	V. low	Medium	Low	V. poor	Ss.	Strong	
SWC 26	2274.0	Low	-	Medium	-	Poor	Clyst, carbon.	-	
SWC 25	2337.0	Fair	-	Medium	-	Poor	Clyst.	-	
SWC 24	2396.0	V. good	Good	Medium	Medium	V. poor	Slst., carb.	Strong	
SWC 22	2435.2	-	-	-	-	-	Sst.	-	
SWC 21	2462.0	Low	Low	Medium	Medium	Poor	Slst.	Minor	
SWC 20	2484.8	V. low	-	Medium	-	Poor	Sst.	-	
SWC 19	2517.0	Fair	-	Medium	-	Poor	Slst., carb.	-	
SWC 18	2580.0	Negl.	-	Low	-	Good	Clyst.	-	
SWC 17	2636.0	-	-	-	-	-	Slst., carb.	-	
SWC 12	2744.0	Low	-	Medium	-	Poor	Slst., carb.	-	
SWC 10	2786.0	Low	-	Medium	-	Poor	Slst., carb.	-	
SWC 7	2865.3	V. low	-	Low	-	Poor	Sst.	-	
SWC 5	2905.0	Fair	-	Medium	-	V. poor	Sst. carb.	-	
SWC 4	2946.0	Negl.	-	Low	-	Poor	Coal	-	
SWC 2	2988.0	V. low	-	Low	-	Poor	Coal	-	