# REFLECTANCE STUDY OF THE ANTARCTIC COAL FROM OHIO RANGE, MOUNT SCHOPF, TERRACE RIDGE

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ABSTRACT

The reflectance studies of the coal from the coal block-column specimen from Terrace Ridge, Antarctica has been described in this paper. The maximum reflectance in oil ranges from 3.1—4.7, while the minimum reflectance in oil ranges from 0.8—1.4. The maximum reflectance values of these coals are very closely akin to the coals from the other beds of the Ohio Range, Horlick mountains reported by SCHAPIRO and GRAY (1965). The bireflectance values correspond to those of normal anthracites and semianthracites. Further, the petrographic and reflectance studies indicate that the high reflectance of the macerals is indicative of high rank. The abundance of semi-fusinoids and the presence of massive micrinoids is consistent with the Permian coals of Gondwana age as contrasted with the coals of Northern Hemisphere (SCHOPF, 1961).

## INTRODUCTION

This paper deals with the reflectance studies of coal from slices of a coal block-column specimen from Terrace Ridge, Ohio Range, Antarctica, taken by W. E. Long of the Ohio State University Institute of Polar Studies, during the 1961-62 Antarctic field season. The coal was studied to ascertain the nature and stage of alteration of the coal on the basis of its reflectance. The rank or degree of metamorphism of the coal is largely due to the effects of a thick sill (diabase). The sill occurs at a distance of 958 feet above the level of the coal bed.

The samples H2-206 to H2-214 were sampled by use of a microsplit to get a proportional representation. The coal was crushed to pass through a 20 mesh sieve mixed with an epoxy resin and pellets were prepared. These pellets were polished with a Buehler AB Automat and the reflectance read with the help of a photovolt multiplier at 600 magnification using an oil immersion objective. Table 1 shows the maximum and minimum reflectance and bireflectance values together with the reflectance values for anthracites from other areas.

## RESULTS AND DISCUSSIONS

The maximum reflectance in oil of these coals ranges from 3.1-4.7, while the minimum reflectance in oil ranges from 0.8-1.4. The maximum reflectance values are very close to the values of anthracites from Wales, Mittagong (New South Wales), and Pennsylvania reported by BROWN and TAYLOR (1961), except for minor differences in the minimum values. The maximum reflectance values of these coals are very closely akin to the coals from other beds of the Ohio Range, Horlick Mountains (samples 91[a], 94[b], 100[b]) reported by SCHAPIRO and GRAY (1965). The maximum reflectance is considerably lower than coals from Mount Faraway of the Theron Mountains reported by BROWN and TAYLOR (1961).

The distribution of the various reflectance types of vitrinoids and anthrinoids is shown in Figure-1. The terms "vitrinoid" and "anthrinoid" are used in accordance with the terms proposed by Spackman (1963) on the basis of reflectance values <2.4%=vitrinoid, >2.4%=anthrinoid). Samples H2-206 and H2-207 are characterised by the higher reflectance types of anthrinoids, which are absent or less abundant as we proceed towards sample H2-214. The average reflectance plotted in text-Figure 1 shows highest reflectance near the top of the bed (H2-206—H2-207) and then a decrease (H2-208 to H2-210) followed by higher reflectance near the bottom.

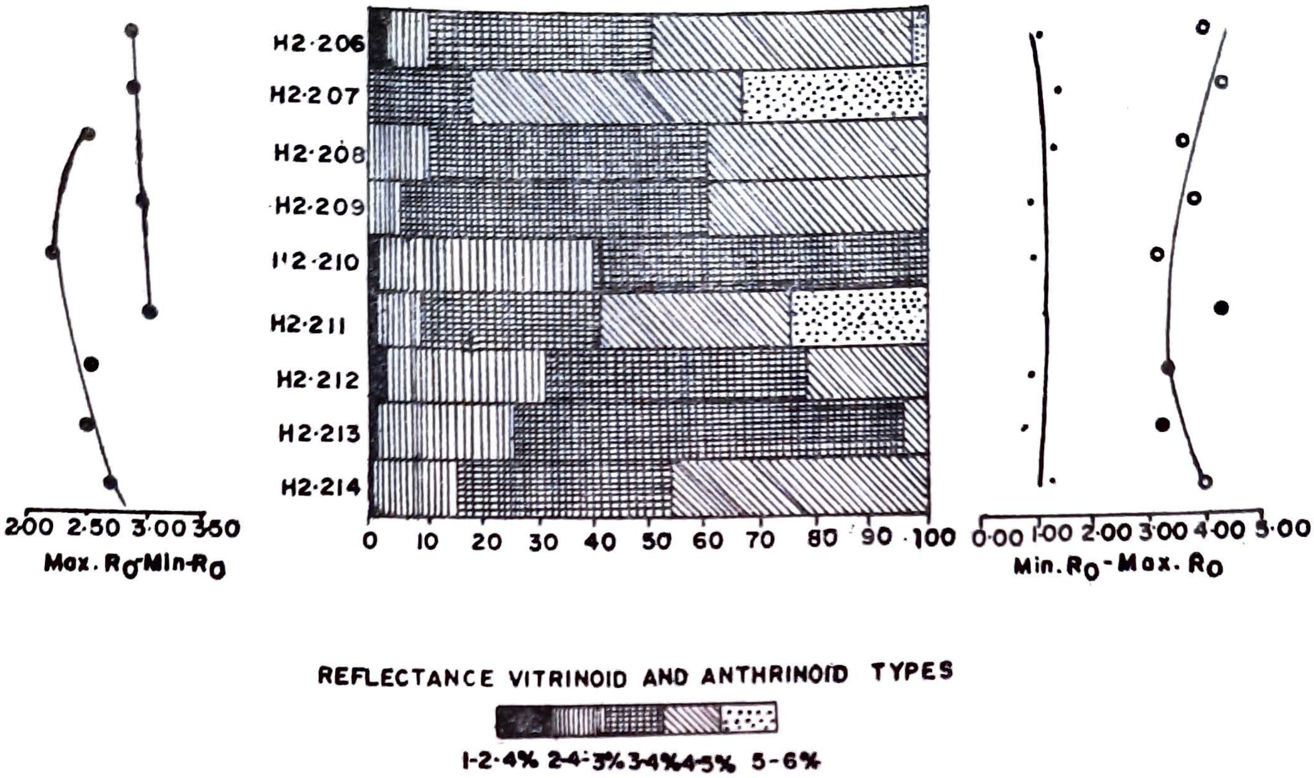
The minimum reflectance values when plotted show an almost linear relationship, as shown in text-figure 1.

In table 1, the differences between the maximum and minimum values of reflectance (bireflectance) of anthrinoids is presented. According to Brown and Taylor (1961), "these differences are a measure of the optical anisotrophy and—since optical anisotrophy is an expression of submicroscopic order—of the degree of graphitization". The bireflectance values are very closely similar to the values reported by Brown and Taylor (1961) for the coals from the Theron Mountains of Antarctica (Samples A, B, C, G). These bireflectance values correspond to those of normal anthracites and semianthracite.

Table 1

| SAMPLES | % Reflectance in Oil | | |
|---|---|---|---|
| | Max—Ro | Min—Ro | Max—Ro Min—Ro |
| *Mt. Schopf, Antarctica* | | | |
| H2-206 | 3.9 | 1.0 | 2.9 |
| H2-207 | 4.3 | 1.4 | 2.9 |
| H2-208 | 3.7 | 1.3 | 2.4 |
| H2-209 | 3.9 | 0.9 | 3.0 |
| H2-210 | 3.1 | 1.0 | 2.1 |
| H2-211 | 4.3 | 1.2 | 3.1 |
| H2-212 | 3.4 | 1.0 | 2.4 |
| H2-213 | 3.3 | 0.8 | 2.5 |
| H2-214 | 4.1 | 1.3 | 2.8 |
| *Mittagong, Anthracite* | 3.3 | 1.9 | .. |
| *Welsh, Anthracite* | 4.2 | 2.2 | .. |
| | 3.5 | 2.2 | .. |
| | 4.2 | 2.1 | .. |
| *Pennsylvania Anthracite* | 4.6 | 3.2 | .. |
| *Ohio Range, Horlick Mountains, Antarctica* | | | |
| 91b | 4.7 | .. | .. |
| 92b | 2.8 | .. | .. |
| 94b | 3.1 | .. | .. |
| 100b | 3.5 | .. | .. |
| *Theron Mountains, Antarctica* | | | |
| A | .. | .. | 2.3 |
| B | .. | .. | 3.1 |
| C | .. | .. | 3.2 |
| G | .. | .. | 2.9 |

When the bireflectance is plotted against depth (Text-fig. 1), there appears to be a bimodal distribution. Generally the bireflectance increasing with depth indicating to a general increase in rank excepting at the top owing to the diabase sill.




PETROGRAPHY

Since attempts to prepare a thin section failed owing to the high rank of coal, pellets were prepared for observation under reflected light by polishing technique. The various petrographic constituents are quite readily distinguished by the difference in reflectance as well as morphological features of the coal. Because of the uniformly high reflectance of coal, it was not possible to distinguish all the petrogrprhic constituents. For petrographic identification the constituents were classified as (i) anthrinoid—vitrinite like material with homogeneous structure and uniform reflectance, (ii) inerto-detritus—detrital material (macerals) which are inert and (iii) mineral matter. Much of the preponderant anthrinoid material was structureless. The inerto-detritus consists of fusinoids, semifusinoids and micrinoids distinguished on the basis of reflectance. The micrinoids are mostly of massive type as contrasted with the granular type characteristic of the coals from Northern Hemisphere (Babu & Dutcher, 1965). The semifusinoids preponderate among the inerto-detritus. The form and distribution of macerals in these coal samples is similar to that of many of the Permian coals of Southern Hemisphere. Finely divided mineral matter in the form inclusions filling up the cracks of anthrinoid were not uncommon. The minerals were mostly chalcedony, detrital quartz, clay minerals and disseminated pyrite.

CONCLUSION

From petrographic and reflectance studies instituted on these coals it may be concluded that: (i) the high reflectance of the macerals is indicative of high rank, (ii) anthrinoid macerals are anisotrophic and the bireflectance shows bimodal distribution, (iii) structureless anthrinoids predominate and inerto-detritus material, consisting of semifusinoid and micrinoid, are abundant, and (iv) massive micrinoid is present in the manner characteristic of Gondwana coals. The abundance of semifusinoids and the presence of micrinoid is consistent with the Permian coals of Gondwana age as contrasted with the coals of Northern Hemisphere (SCHOPF, 1961).

ACKNOWLEDGEMENT

The assistance given by Ron Williams of the Coal Research Section of the Pennsylvania State University in preparing polished pellets and the laboratory facilities afforded for reading reflectance of the pellets by Dr. P. A. Hacquebard is thankfully acknowledged. This study was made possible by the kind courtesy of Dr. J. M. Schopf of the U. S. Geological Survey, who gave the samples presented in this paper. The author thanks Dr. J.M. Schop for making available the samples from Antarctica and for his constructive criticisms of the manuscript.

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