GIS Representation of Coal-Bearing Areas in Antarctica

By Matthew D. Merrill

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Introduction and Description of Work

Coal was first discovered in Antarctica during the 1907–1909 British Antarctic Expedition (Schopf and Long, 1966). Detailed reports of coal deposits began to emerge during the second half of the twentieth century, and studies have continued to this day. Article 7 of the Protocol on Environmental Protection to the Antarctic Treaty (Secretariat of the Antarctic Treaty, 1991) states that "any activity relating to mineral resources, other than scientific research, shall be prohibited." Rose and McElroy (1987) point out that Antarctic coal is an uneconomical resource for various reasons, including a lack of information, high startup costs, environmental considerations, practical difficulties, and competition within the global market.

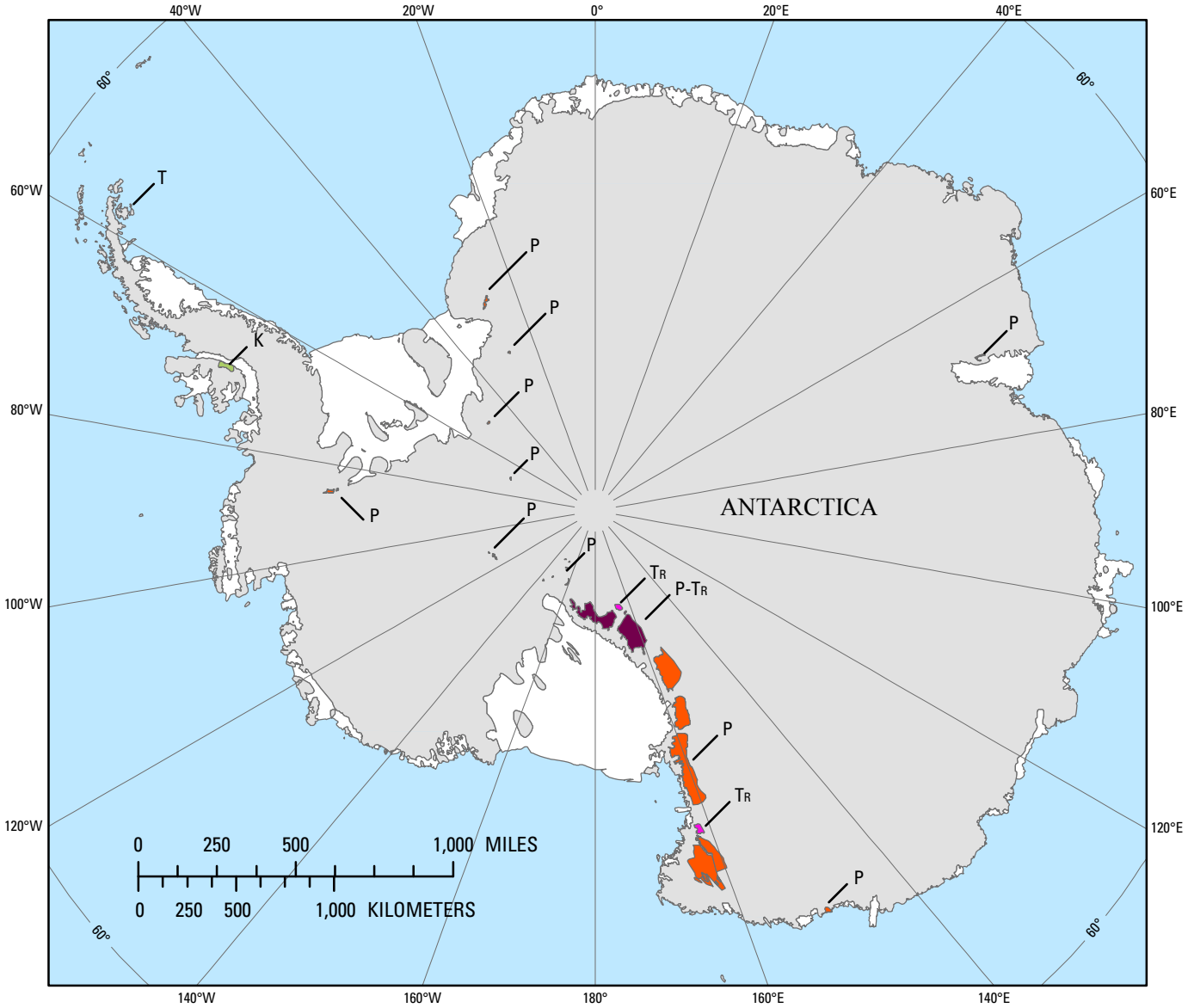
Regardless of the current political and economic realities behind Antarctic coal production, understanding the distribution of coal-bearing geologic units in Antarctica provides information that can be used in sedimentary, geomorphological, paleontological, and climatological studies. This report is a digital compilation of information on Antarctica's coal-bearing geologic units found in the literature (Schopf and Long, 1966; U.S. Geological Survey, 1966; Adie, 1969a,b; Craddock, 1969; Gair and others, 1969; Grindley and Laird, 1969; McGregor and Wade, 1969; Mirsky, 1969; Roots, 1969; Schmidt and Ford, 1969; Trail and McLeod, 1969; Warren, 1969; Brook, 1972; Marsh, 1985; Rose and McElroy, 1987; Polar Rock Repository, 2015). It is intended to be used in small-scale spatial geographic information system (GIS) investigations and as a visual aid in the discussion of Antarctica's coal resources or in other coal-based geologic investigations.

Instead of using spatially insignificant point markers to represent large coal-bearing areas, this dataset uses polygons to represent actual coal-bearing lithologic units. Specific locations of coal deposits confirmed from the literature are provided in the attribution for the coal-bearing unit polygons. Coal-sample-location data provided by the Polar Rock Repository (2015), sponsored by the National Science Foundation, Division of Polar Programs, were used to confirm some reported coal-bearing geology. The age and extent of the coal deposits indicated in the literature were checked against geologic maps ranging from local scale at 1:50,000 to Antarctic continental scale at 1:5,000,000; if satisfactory, the map boundaries were used to generate the polygons for the coal-bearing localities. Topographic maps and, to a lesser extent, higher resolution (larger scale) regional coal maps were also used to generate the actual polygons in situations where the small-scale base-map geology conflicted with the geologic data and (or) specific locations mentioned in the literature. Snow cover obscured significant proportions of the surface geology; therefore, some locations marked as coal bearing were inferred from the known or hypothesized extent of the geologic units. Where polygons are represented with straight boundaries and edges, the geology is unclear or the extent of coal-bearing strata is poorly known.

This dataset includes information regarding the age, rank, and location of coal in Antarctica as well as the detailed source information about coal-bearing geologic units for each polygon. The rank recorded was either explicitly stated in cited source materials or inferred from the fixed-carbon percentage in dry, mineral-matter-free samples containing less than 20 percent ash, using American Society for Testing and Materials (ASTM) specifications (ASTM International, 2008). Rank information was not available for all coal-bearing localities in the dataset. This product is not appropriate for use in spatial calculations, models, or resource assessments of any kind. Attributes necessary for such tasks, such as the number of coal seams, thickness of seams, and depth to coal are rarely provided in the literature and, therefore, are not included in this product. Additionally, much of the source material was compiled at a continental scale and does not have the resolution necessary for use in spatially significant work.

Revisions and Updates

This GIS compilation may be superseded in the future if new discoveries of coal are made and more detailed information becomes available, or if additional effort is invested in refining the method of depicting coal-bearing areas.



Base map from Antarctic Digital Database 4.1
WGS 1984 datum
Stereographic South Pole projection

EXPLANATION

Coal-bearing geologic units

- T — Tertiary (Paleocene to Eocene)
- K — Cretaceous
- T_R — Triassic
- P-T_R — Permian to Triassic
- P — Permian

- Ocean water
- Ice shelf
- Ice, snowpack, or non-coal-bearing geologic unit

Figure 1. Map of coal-bearing areas in Antarctica. Colors represent coal age.

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