Coalfields of the Republic of Korea

Part 1

Introduction
Geology of Mungyong-Eunsong and Hwasun coalfields

GEOLOGICAL SURVEY BULLETIN 1041-A, B

Prepared in cooperation with the Korea Geological Survey under the auspices of the Economic Cooperation Administration

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By DAVID A. ANDREWS

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By CHEONG CHANG HI

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Introduction

By DAVID A. ANDREWS

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COALFIELDS OF THE REPUBLIC OF KOREA

INTRODUCTION

By David A. Andrews

Korea is a peninsula on the eastern margin of the Asiatic mainland extending southward for about 500 miles from the Manchurian portion of the mainland. It is separated from the Japanese Islands on the south and east by the Japanese Sea and from the Chinese mainland on the west by the Yellow Sea. The race and language of the people are separate and distinct from either the Japanese or the Chinese although there has been considerable intermingling of the races during the long periods of invasion and occupation by one or the other of those peoples during the many centuries of its history.

At the close of World War II the southern part of Korea was liberated. Rehabilitation was under the auspices of the Armed Forces until 1948. After the election of officials for the Republic of Korea, the rehabilitation and aid to Korea was placed under the United States Economic Cooperation Administration. This aid continued from early in 1949 until the invasion of South Korea in June 1950.

PURPOSE OF WORK

The internal economy of Korea was seriously disrupted by the partition of Korea. The Japanese had begun some industrial development which included the hydroelectric power installations along the Yalu River to furnish power for Korea. Mining of coal, near P'yŏngyang on the west coast and both north and south of Ch'ŏngjin on the east coast, had been concentrated in northern Korea. Electric power from the Yalu continued to flow southward to Seoul and other parts of south Korea until May 1948 when the Republic of Korea was established. At that time, all power from the Yalu installations was cut off at the 38th parallel.

The railroad engines were using a bituminous coal imported from Japan but the drain on the economy of the Republic of Korea was great. The United States had furnished diesel-electric barges which were located at Inch'ŏn on the west coast and Pusan at the southern tip of Korea, as a stopgap method of furnishing some power until facilities could be built in South Korea.

The Yongwol powerplant located 2 kilometers southeast of Yongwol and 150 kilometers east of Seoul was built in 1937 with a rated capacity of 120,000 kwhr. It was designed as a thermal powerplant to use the coal from the Macha-ri (Yongwol) coalfield which had been developed 7 kilometers to the north in 1935. At the close of World War II, all mining and industry in Korea came to a halt for many months. When the Yongwol powerplant was again put into operation it soon became apparent that the Macha-ri field could not furnish the coal needed to run the powerplant at capacity or even one-half capacity. The Tangyang field 15 kilometers south of Yongwol was yielding some coal, but there was no access road from Tangyang to Yongwol and the production at Tangyang was not sufficient to justify building the road and bridges required for truck haulage. The Hambaek area 30 kilometers east of Yongwol had been prospected after World War II and plans were underway for development of this field.

The Yongwol powerplant was in this status in 1948 when power was cut off from north Korea, and Yongwol was relied upon as the principal source of power in south Korea.

PLAN OF WORK

In the spring of 1949, the Geological Survey was requested by the Korean Division of the Economic Cooperation Administration to send a geologist to Korea to make a reconnaissance of the Korean fuels resources (see fig. 1), to make recommendations concerning the types of investigations needed, and to plan for those investigations that could contribute to the solution of the coal production problems in Korea. The writer made that reconnaissance in May and June. All of the anthracite-coal producing areas except Samch'ok were visited. Samch'ok was not included because the transportation from Samch'ok to the populated and industrial parts of Korea including Yongwol was so difficult that it was not expected that Samch'ok could contribute materially to relief of the fuels problems of Korea prior to completion of an access railroad in 3 to 5 years time.

Four coalfields which seemed most capable of relieving the fuel shortage in the Republic of Korea were selected for detailed examination. (See the following table.) A detailed and accurate geologic map was needed as a basis for making mine-development plans which would increase production at Macha-ri (formerly called Yongwol). The Hambaek area 30 kilometers east of Yongwol and the western end of the big synclinal area which contains the Samch'ok field at its east end had coal that had not been developed. An improved highway and an access railroad to Hambaek had been planned. An accurate

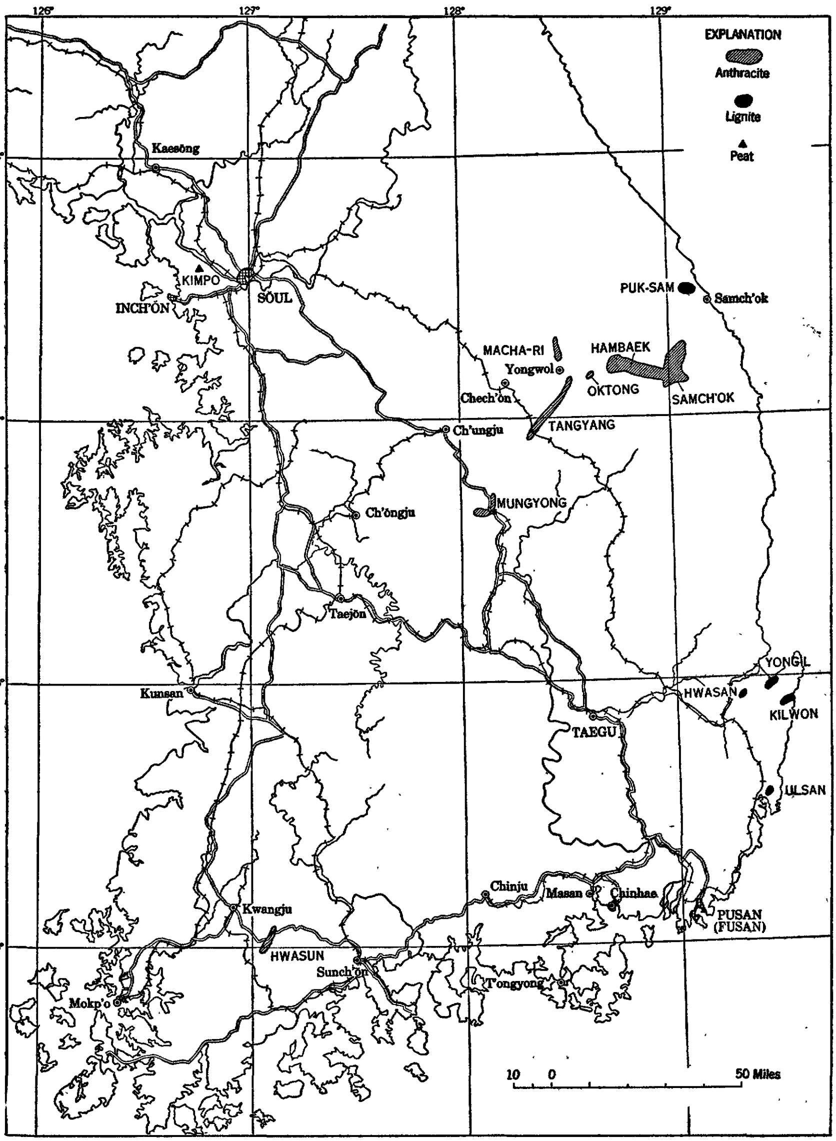

FIGURE 1.—Coalfields of the Republic of Korea.

geologic map was needed to determine whether reserves were sufficient to justify the roads, and in order to serve as a basis for possible mine-development plans.

Anthracite coal production in the Republic of Korea, 1939–49 (1,000 tons)

[Compiled from ECA reports]

	Samch'ok	Macha-ri	Hwasun	Mungyong-Eunsong	Tangyang	Other	Total
1939	497	295	184	13			989
1940	599	387	180	26			1,192
1941	533	422	137	52			1,144
1942	581	447	135	50			1,213
1943	610	343	199	59			1,211
1944	832	249	249	65			1,395
1945	278	110	85	?		?	640
1946	70	23	87	?		?	251
1947	191	76	97	?	29	33	463
1948	344	150	130	75	15	85	799
1949	415	271	156	91	19	114	1,066

The Tangyang area about 15 kilometers south of Yongwol, which had yielded some coal, extended northward to cross the Han-gang about 3 kilometers east of Yongwol. Although the coal in this area seemed to be thin and discontinuous and to be complicated by intrusion of many sills and dikes, an investigation seemed advisable because of its proximity to Yongwol. As no other area in the region of Yongwol offered appreciable promise of increased sustained production needed to supply the Yongwol powerplant, the promising area at Hwasun near Kwangju in southwestern Korea was included in the areas recommended for study.

Topographic maps on a scale of 1:50,000 were available for all parts of the Republic of Korea. These maps had been made during Japanese occupation, and some cultural revisions were made by U. S. Army during the Provisional Government of the Republic of Korea. Because these maps were not adequate as a base map for the detailed investigations, the Air Photo Unit of the Corps of Engineers, which had photographed all of Korea from the air at a scale of about 1:40,000, at the request of the Geological Survey and ECA prepared topographic maps from enlarged aerial photographs at a scale of 1:20,000 using the ground control already available to them. This seemed to be the most satisfactory method for procuring adequate base maps in the short time available for the four areas to be mapped. Consequently the geologists mapped on the aerial photographs and transferred all geologic data to the base topographic maps. Larger scale pictures and maps were desirable, but they were not available and could not be procured in the time available for this investigation.

The writer returned to Korea late in August 1949 accompanied by Ewart Baldwin, Kenneth Brill, and John Reinemund. The field investigations continued until December 1949 when a brief preliminary report was submitted to the Economic Cooperation Administration in Seoul for use of ECA and the Republic of Korea who were the sole owners and operators of the coal-producing areas studied.

Each geologist was assigned responsibility for one of the four areas. John Reinemund studied the Macha-ri area, Ewart Baldwin, the Hambaek area, Kenneth Brill, the Tangyang area, and the writer exercised general supervision, extended the reconnaissance investigation to all known coal areas in South Korea, and mapped part of the Hwasun area.

The preliminary reports completed in December 1949 carried specific recommendations for a diamond-drilling program. This drilling was planned to ascertain the extent, character, and position of all coal beds. Eight diamond drills were purchased, and a contract was let by ECA to Longyear Drilling Company to operate the drills.

The Geological Survey was requested to send geologists to Korea in 1950 to extend the investigations to other areas and to supervise the drilling program. The writer returned to Korea in May 1950 accompanied by David Varnes and Raymond Robeck. James Vine arrived in early June. Some additional mapping was done, particularly with Macha-ri and Hambaek fields in preparation for the drilling which was to start in July. Also fieldwork had been started at Samch'ok. Unfortunately practically all notes, maps, and equipment were lost by these men in the evacuation from Korea on June 25–27, 1950, during the invasion of the Republic of Korea. It is impossible to prepare any report based on the work done in 1950 without those maps and notes. The reports of Reinemund, Brill, and Baldwin are available because they could not return to Korea and were working on their maps and reports in the United States at the time of the evacuation of American personnel from Korea.

ACKNOWLEDGMENTS

So many people have contributed materially to the progress of this project that it is impossible to give proper credit to everyone in the Economic Cooperation Administration, and to the officials of the Republic of Korea and the United States Army who have aided or assisted the members of this party. In the Economic Cooperation Administration, Edgar A. J. Johnson and Albra Fessler of the Washington office, and the late Arthur Bunce, Wilhelm Anderson, and A. C. Walker of the Korean office deserve special thanks for splendid cooperation. Stanley Adams, Azel Hatch, and Norman Thompson, of the Industry Division of ECA, deserve our sincere appreciation for counsel and assistance. All of the men in the Coal Mining Section of ECA with whom we were closely associated were of inestimable aid. They are Richard Crouse, chief, Howard Minister, the late Walter Eltringham, Claude Murphy, and Ward Vickers.

Many officials of the Republic of Korea extended hearty cooperation. Mr. Kim, Minister of Mining and Industry, and Paik Dong Gil, Director of the Korea Geological Survey were helpful and cooperative. Particular thanks are due Cheong Chang Hi and Yoo Dong Sop, chief geologist and geologist, respectively, of the Korea Geological Survey. Without their guidance, translations, and interpreting, this project could not have been carried on. Kim Il of the University of Seoul accompanied the writer on the first trip. Chai Kyung Sic, Kim Kee Hwa, and Kwak Young Goo acted as technical assistants and interpreters. Their friendship and intelligence were valuable assets.

The cooperation of the U. S. Army and particularly the Engineer Section of the Far East Command was of great value to the project. The vertical aerial photographs were the only satisfactory base for field use available to us, and the compilation of the topographic maps by the 64th Engineer Topographic Battalion furnished a very satisfactory base map for the areas of rugged terrain where no other adequate base maps were available.

Robert Grant, chief of Mineral Resources in the Natural Resource Section of Supreme Commander of Allied Powers very generously made available all the mineral resources data collected during the Provisional Government's activities in Korea.

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COALFIELDS OF THE REPUBLIC OF KOREA

GEOLOGY OF MUNGYONG-EUNSONG AND HWASUN COALFIELDS

By CHEONG CHANG HI*

Little is available in English-language publications concerning the coalfields of Korea. There is scanty knowledge of many areas either in Japanese or Korean, and several of the publications, even in Japanese, have very limited distribution in the United States. Therefore, the following brief summary was prepared for general information from the literature and from personal knowledge of members of the Geological Survey and Bureau of Mines of the Republic of Korea prior to the invasion in June 1950.

GEOLOGIC SUMMARY

Coal is widely distributed in Korea in rocks of Permian, Jurassic, and early to middle Tertiary age. The Sa-dong formation of Pennsylvanian and Permian age is the chief source of coal. This formation is a series of dark shales and siltstones generally a few hundred feet thick locally and thin beds of sandstone or quartzite and lenses of limestone. In most places this formation contains one or more coal beds. The Kobangsan formation, a cliff-forming series of massive quartzites, also of Permian age overlies the Sa-dong and interfingers with it. In some places coal beds are found in the Kobangsan, particularly near the base of the formation. Coal occurs in the Tae-dong system of Jurassic age in many places in Korea. It has been prospected and studied at several localities, but there has been no appreciable commercial production.

During the late Mesozoic all of the Korean peninsula, particularly the northeastern part of the Republic of Korea, was subjected to rather intense deformation which was accompanied by or preceded by batholithic intrusions. This intense deformation produced rather complicated folds, appreciable readjustment particularly in some of the more shaly incompetent formations, and much thrust faulting and normal faulting. In the five fields studied to some degree by the geologists, the Sa-dong formation and the enclosed coal beds have

*Chief geologist, Korea Geological Survey.

reacted in a fairly uniform manner which seems to apply to other coalfields in south Korea and perhaps to those in north Korea.

In the folded areas the coal has been metamorphosed to an anthracite coal of a somewhat graphitic flaky nature. This coal has reacted as a rather plastic medium and has been squeezed into lenticular masses. Particularly it has been thickened on the crests of the folds and thinned along the flanks. Where thrust faulting has occurred, there seems to have been a great deal of movement concentrated in the coal beds, which are a good lubricant for the movement. This movement has not only crushed and distorted the bed but has also introduced into the bed itself much shale, clay, and even siltstone from adjacent beds. One or both of these factors have affected the coal beds in nearly every place seen, and it seems reasonable to expect similar conditions in most of the coal beds in the Permian or Jurassic rocks of Korea.

Although coal-bearing rocks of Permian and Jurassic age are fairly widely distributed in south Korea, all of the areas offering appreciable mining opportunities are found, with one exception, in the northeastern part around the late Mesozoic batholithic intrusions. In most of the remaining parts of south Korea the late Paleozoic rocks have been removed by erosion, exposing older rocks. At a few places only small remnants of the coal-bearing sequence are preserved in fault slices or in folded areas. Hwasun, in the southwestern part near Kwangju, is one folded area where coal preserved in the Sa-dong has permitted appreciable mining.

In northern Korea the Sa-dong formation containing coal beds is preserved in the vicinity of P'yŏngyang on the western coast, and near the Chongchon-gang 50 miles north of P'yŏngyang. This area constituting the Namp'yongnam and Puky'yongnam fields was the source of more than half the coal produced in Korea prior to World War II.

MUNGYONG-EUNSONG COALFIELD

The Mungyong coalfield is about 25 kilometers south of Ch'ungju and 60 kilometers east of Ch'ŏngju in Mungyong-gun, Kyŏngsang-pukto. The field consists of three isolated areas of coal-bearing formations in which some mining has been done. Anthracite coal is produced from the Kobangsan formation of Permian age at the Mungyong and Eunsong mines, and is present in rocks of the Tae-dong system of Jurassic age at the Masong area where little mining has been done. The coal lies within a thick belt of quartzite referred to the Kobangsan, but the Sa-dong formation is very thin in that region. Since the Sa-dong and Kobangsan interfinger at the localities studied it is possible that the coal lies within a thin tongue of Sa-dong within the Kobangsan.

The northward-trending belt of nearly vertical Kobangsan at Mungyong has an extent of only a few kilometers. It is cut off at the north by a small intrusion which has metamorphosed the coal to a graphite mined and sold during the Japanese regime. Apparently a fault cuts off this belt at its southern terminus. The Eunsong area a few kilometers west of Mungyong dips less steeply than at Mungyong but also has limited areal extent. The Eunsong mine, however, has had a uniform, steady, although not large, production and was the only mine in south Korea where development was in evidence ahead of the actual working.

HWASUN COALFIELD

The Hwasun coalfield is in Chŏlla-namdo 20 kilometers southeast of Kwangju. The Sa-dong coal-bearing formation and the overlying and interfingered Kobangsan quartzite are exposed for about 15 miles along a northward-trending anticline. Cretaceous sedimentary rocks overlap and conceal the coal-bearing Sa-dong formation on the east and west flanks and the northern end. Little is known about the southern end of the anticline.

Coal has been mined in about six mines near the northern end of the anticline along the Hwasun-chon. Mining has been concentrated along the axes of small folds where the coal has been thickened during folding, in one place as thick as 15 meters. Normal production from these mines in late 1949 and 1950 was about 500 tons per day. A production of 1,000 tons per day was reached in November 1949, although some of this rated production may have come from stockpiles.

The anthracite coal at Hwasun has an ash content of 20–25 percent. Such a relatively low ash content is found elsewhere in south Korea only at Samcho'k. Probably the faulting, whereby ash from adjacent clay or shale beds becomes intimately invcorporated in the coal bed, is less intense here than in most coalfields of the Republic of south Korea.

OTHER COALFIELDS

In other areas containing the Sa-dong formation, the prospecting has been so meager that there is little available evidence on which to evaluate the deposits. These areas include the Chongsan field—the northern extension of the Macha-ri field—and the Kangnŭng field north of Samch'ok which has yielded some graphite.

Anthracite coal occurs in rocks of Jurassic age at the Yonch'on field, the Kumpo field, the Hongsong field, the Tangjin field, and the Sochon field, but available information has not warranted appreciable prospecting or development at this time. Coal also occurs in rocks which have been assigned to the Lower Cretaceous in the Oekwan and Sachon fields.

Lignite has been mined from rocks of Tertiary age (Miocene) in four areas near the southeast coast. The Tongson area, adjacent to Yongil Bay at Pohang, and the Kilwon area, 12 kilometers to the south, were yielding some lignite in 1950 which was black and low in inherent moisture. Brown woody lignite was mined from the Hwasan area 25 kilometers southwest of Yongil Bay from 1935 to 1947, but the mines were abandoned and caved in 1950. Lignite of a similar brown woody character was being mined in 1950 from the Ulsan area farther to the south (see fig. 1). Lignite occurs in the Puk-sam area just north of Samch'ok on the east coast and was being prospected in the summer of 1950. Several drill holes had been completed under Korean auspices, but the extent of the field and correlation of the beds was not known; the surface outcrops had not indicated lignite of minable thickness in this area.

Lignite has been reported at scattered localities between Samch'ok and Pohang on the east coast and west of Pusan on the south coast. These localities had not been prospected under Korean auspices sufficiently to make any estimates as to their value or potentialities and had not been visited by the U. S. Geological Survey group.

[redacted]