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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE NORTHWEST QUARTER OF THE SCOFIELD 15-MINUTE QUADRANGLE CARBON, EMERY, AND SANPETE COUNTIES, UTAH

(Report includes 12 plates)

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INTRODUCTION

Purpose

This report was compiled to support the land planning work of the Bureau of Land Management and to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the Western United States. It supplements the land planning requirements of the Federal Coal Leasing Amendments Act of 1976 (Public Law 94-377) sec. (3)(B) which states, in part, that "Each land-use plan prepared by the Secretary [of the Interior] (or in the case of lands within the National Forest System, the Secretary of Agriculture pursuant to subparagraph (A) (i)) shall include an assessment of the amount of coal deposits in such land, identifying the amount of such coal which is recoverable by deep mining operations and the amount of such coal which is recoverable by surface mining operations."

This text is to be used in conjunction with the Coal Resouce Occurrence (CRO) Maps (11 plates) and the Coal Development Potential (CDP) Map (1 plate) of the Northwest Quarter of the Scofield 15-minute quadrangle, Carbon, Emery, and Sanpete Counties, Utah (U.S. Geological Survey Open-File Report 79-483).

Published and unpublished public information were used as data sources for this study. No new drilling nor field mapping were done to supplement this study. No confidential nor proprietary data were used.

Location

The Northwest Quarter of the Scofield 15-minute quadrangle is located in central Utah at the north end of the Wasatch Plateau coal field. Approximately three quarters of the quadrangle lies in Carbon County; most of the southwest quarter lies in Emery County; and a narrow strip along the western edge of the quadrangle lies in Sanpete County.

The town of Scofield is located in the northeast quarter of the quadrangle and the town of Clear Creek is in the southeast quarter. The city of Price, the county seat of Carbon County, is 17 miles (27 km) east and one mile (1.6 km) south of the quadrangle. Castle Dale, the county seat of Emery County, is approximately 29 miles (47 km) south and 6 miles (10 km) east of the quadrangle. Manti, the county seat of Sanpete County is 33 miles (53 km) southwest of the quadrangle.

Accessibility

The quadrangle is reached by traveling 15 miles (24 km) southwestward on Utah Highway 96 from its junction with U.S. Highway 6-50. Utah Highway 96 continues southward six miles (10 km) from Scofield to the town of Clear Creek and the terminus of the highway. Utah Highway 31 passes through the southwest corner of the quadrangle and connects the city of Huntington on the east side of the Wasatch Plateau to the town of Fairview on the west side. Unimproved dirt roads and jeep trails provide access into most of the main canyons in the quadrangle area.

The Pleasant Valley Branch of the Denver and Rio Grande Western Railroad extends northward from its terminus at Clear Creek to its junction with the main railroad line at Colton approximately 9 miles (14 km) to the northeast. Single car rail-loading facilities exist at Clear Creek and Scofield. Unit train loading equipment is operating at the old Utah mine between Scofield and Clear Creek.

Physiography

The Wasatch Plateau is a high, deeply dissected tableland rising abruptly from Castle Valley on the east and Sanpete Valley on the west. The eastern margin forms a sweeping stretch of barren sandstone cliffs some 80 miles (129 km) long.

The topography in the quadrangle area is rugged and mountainous, with altitudes ranging from 7,600 ft (2,316 m) on Pleasant Valley Creek at the north edge of the quadrangle to 10,052 ft (3,064 m) on a peak near the south side of the quadrangle. Pleasant Valley trends north-south through the eastern part of the quadrangle.

Perrenial streams flow in the main canyons and the principal drainage system in the quadrangle is Pleasant Valley Creek which flows northward into Scofield Reservoir at the north edge of the quadrangle. Scofield Reservoir drains into Price River which flows into Green River. The southwest corner of the quadrangle lies in the Huntington Canyon drainage area, and Huntington Creek flows into the San Rafael River.

Climate

The normal annual precipitation in the quadrangle area ranges from approximately 23 inches (58 cm) in the lower elevations at the north side to 33 inches (84 cm) on the highest peaks in the southwest quarter of the quadrangle (U.S. Department of Commerce, (1964)). Most of the precipitation occurs as snowfall during the winter months. Occasional late summer cloudburst storms may create flash flooding.

The maximum temperature recorded at Clear Creek is 88 degrees F (31 degrees C), and the minimum winter temperature recorded is -29 degrees F (-34 degrees C)(U.S. Department of Commerce, 1957).

Land Status

The Northwest Quarter of the Scofield 15-minute quadrangle is located in the northern part of the Wasatch Plateau Known Recoverable Coal Resource Area (KRCRA). Approximately 27,700 acres of the quadrangle lies within the KRCRA. This area includes 11,700 acres of non-Federal land, 7,300 acres of unleased Federal coal land, and 8,700 acres of leased Federal coal land (plate 2).

GENERAL GEOLOGY

Previous Work

Spieker (1931) mapped the geology and coal occurrences in the Wasatch Plateau and his maps are the most detailed original work presently available. The stratigraphy is also described by Taff (1907), Katich (1954), Spieker and Reeside (1925), and Hayes and others (1977). Doelling (1972) has summarized the geology and updated the coal information.

Stratigraphy

The coal beds of economic importance in the Wasatch Plateau field are Upper Cretaceous in age and are confined to the Blackhawk Formation of the Mesaverde Group. The Mesaverde consists of the following four formations in ascending order: the Star Point Sandstone, Blackhawk Formation, Castlegate Sandstone, and the Price River Formation.

The Mancos Shale of Upper Cretaceous age underlies the Mesaverde Group. The North Horn Formation of Upper Cretaceous and Paleocene ages overlies the Price River Formation. Small areas on two high ridges in the northwest corner of the quadrangle are capped with incomplete sections of the North Horn Formation.

The oldest formation exposed in the quadrangle is the Star Point Sandstone which crops out over a long north-south strip on the west side of Pleasant Valley Creek. The Star Point is considerably thicker here than in other parts of the coal field. On the west side of Pleasant Valley between Clear Creek and Scofield at least 1,000 ft (305 m) of sandstone have been measured below the horizon of the Hiawatha coal bed (undeveloped in this quadrangle).

The coal-bearing Blackhawk Formation overlies the Star Point Sandstone and has the largest outcrop area of the formations exposed in the quadrangle.

Spieker (1931) indicates that the Blackhawk Formation ranges from 700 and 1,000 ft (213 and 305 m) in thickness. The formation consists of alternating sandstone, shale, and coal.

In this area the Castlegate Sandstone and Price River Formation are undifferentiated on the geologic maps of Spieker (1931) and Doelling (1972) and appear as a remnant on the tops of the mountains in the northwest corner of the quadrangle. Together these units total approximately 750 ft (286 m) in thickness. The Castlegate contains distinctive beds of extremely coarse grained rocks, intermediate between sandstone and conglomerate. The sandstones in the Price River Formation are generally finer grained than those in the Castlegate.

Several igneous dikes up to 10 ft (3 m) thick occur in the quadrangle. The dominant trend of the dikes is east-west. Spieker (1931) reports that the dikes are basic lamprophyres similar to those found in the Wasatch Mountains about 30 miles (48 km) to the west. The exact age of the intrusions is unknown. They cut Upper Cretaceous rocks, but there is no positive proof that they are younger than Late Cretaceous. The dikes have altered the adjacent rocks and have coked coal beds from 1 to 10 ft (0.3 to 3.0 m) away (Spieker, 1931).

Structure

The dominant structural feature of the quadrangle is the Pleasant Valley fault zone which consists of multiple north-south trending normal faults in the east half of the quadrangle. Spieker (1931) believes the Pleasant Valley area contains the most complex and intricate faults of the Wasatch Plateau. This fault system has created numerous mining problems which have been solved in most cases. Generally the fault displacements are small, but some have been large enough to significantly change mining plans and create new mining units.

The dips of the beds in the fault blocks are generally to the north and northwest. On the west side of the fault zone the beds dip gently to the northwest at angles less than 7 degrees.

COAL GEOLOGY

In the Pleasant Valley area and Upper Huntington Canyon at least four coal beds or zones are recognized. In ascending order above the Star Point Sandstone the coal beds recognized by Spieker (1931) are the Union Pacific bed, Castlegate "A" bed, and the Bob Wright zone. Other local names such as "Flat Canyon", "Lower O'Connor", "Upper O'Connor", and "McKinnon" have also been used as names for the coal beds found or mined in the area.

Coal Bed Correlation Problems

The correlation of coal beds from the east side of the Wasatch Plateau to the Pleasant Valley area has been made difficult, if not impossible, by several conditions. Much of the surface is forested and has a thick soil cover. Coal outcrops are few in number and cannot be traced on the surface. There is a lack of non-proprietary drilling data in the wide areas between outcrops. The dislocation of coal beds by numerous faults has made correlations difficult. The pinching and thickening of coal beds and non-coal intervals has added to the uncertainty of correlation. The characteristic rock succession and rock-interval separation between coal beds has been difficult to correlate because of facies changes in this area.

Because of the correlation uncertainties, many of the coal beds were given local names and little or no attempt was made to solve the correlation problems. Spieker (1931) has probably made the greatest attempt at correlating the coal beds in the quadrangle even though little drilling data was available to him. Spieker (1931, p. 87) summarized his correlations as follows: "The Castlegate "A" bed is the one mined at the Clear Creek Nos. 1 and 2, Utah, Gibson, Upper Union Pacific, Winter Quarters, Kinney, and Blue Seal mines.

The thick bed mined at the Union Pacific No. 1 mine is probably at the horizon of the Gordon bed of the North Gordon area. The Hiawatha bed is not known to be economically important anywhere in Pleasant Valley. The beds 150 to 200 feet above the Castlegate "A" bed at Winter Quarters and Clear Creek and in the intervening territory probably belong to the Bob Wright coal group."

There has not been a consistent use of local coal bed names in the past. One preliminary naming system (U.S. Geol. Survey, personal communication) includes the following coal-bed names, in ascending order, above the Star Point Sandstone: Flat Canyon, Lower O'Connor "A", Lower O'Connor "B" (200 to 300 ft (61 to 91 m) above the Star Point may be equivalent to Spieker's Castlegate "A" bed), Upper O'Connor "A", Upper O'Connor "B", and the McKinnon bed. The coal bed names used in this report are those used by Spieker (1931) and Doelling (1972).

Union Pacific Coal Bed

The Union Pacific coal bed, also called the U.P. bed, is a localized bed of high grade bituminous coal up to 30 ft (9 m) thick. For many years it was produced in the Union Pacific mine on the east side of Pleasant Valley near Scofield. The bed is lenticular and disappears west of Scofield. It thins and becomes split by sandstone and shale partings north of the mine and is absent in the Clear Creek area south of the mine. Spieker (1931) suggests that it may correlate to the Gordon bed in the North Gordon area east of the quadrangle.

Castlegate "A" Coal Bed

The Castlegate "A" bed of Spieker (1931) is 70 to 80 ft (21 to 24 m) above the Union Pacific bed in Pleasant Valley and in Upper Huntington Canyon it is 200 ft (61 m) above the Star Point Sandstone. Most of the large mines in the area have operated on this bed.

The Castlegate "A" bed exhibits a wide range of thicknesses in the quadrangle from 1.1 to 19.4 ft (0.3 to 5.9 m). The lack of non-proprietary drilling data in the west half of the quadrangle limits a discussion of thickness trends in that direction. The thicker sections of the Castlegate "A" in the Pleasant Valley area appear to be lenticular in shape and elongated in a north-south direction. This may be due to the distribution of control points along both sides of Pleasant Valley and the absence of measurements to the east and the west.

Doelling (1972) refers to the Castlegate "A" as the most valuable coal bed of the area. Many of the coal mines in the quadrangle have operated on this bed which may be equivalent to one of the beds with a local name.

Bob Wright Zone

The Bob Wright zone or group of coal beds is 100 to 200 ft (30 to 61 m) above the Castlegate "A" coal bed. The beds occur in scattered exposures on the west side of Pleasant Valley. The individual beds cannot be traced and their identification is based entirely on their position with reference to the Castlegate "A" bed (Spieker, 1931).

Intervals reported as "bony coal," "bone," "shaly coal," or other similar terms in the data sources are shown as "rock" intervals in this report on plates 1 and 3. These intervals were not included in the coal thicknesses used to construct the coal isopach maps.

No non-proprietary drill hole data were available in the quadrangle. The coal thicknesses reported were measured at surface outcrops and in mine workings.

Chemical Analyses of the Coal

Doelling (1972) lists ninety-three analyses of coal samples from the quadrangle. Eighty-eight of the samples were taken from the Castlegate "A" coal bed and five from the main bed in the Bob Wright zone. The five samples from the Bob Wright zone were all taken in the Clear Creek No. 4 mine in the southeast corner of the quadrangle. The analyses are summarized in table 1.

Table 1. Average coal analyses, Northwest Quarter of the Scofield 15-minute quadrangle, Carbon, Emery, and Sanpete Counties, Utah*

	No. Analyses	Percent	
		Average	Range
Castlegate "A" Coal Bed			
Moisture	88	7.54	3.6-14.5
Volatile matter	81	41.11	35.3-54.3
Fixed carbon	81	44.91	28.3-53.5
Ash	86	6.24	3.8-13.5
Sulfur	65	0.61	0.4-1.06
Btu/lb**	76	12,042	10,250-13,650
Bob Wright Main Coal Bed			
Moisture	5	6.15	2.8-8.2
Volatile matter	5	44.90	42.0-46.1
Fixed carbon	5	45.00	44.1-46.9
Ash	5	3.94	3.1-5.0
Sulfur	5	0.52	0.5-0.6
Btu/lb**	5	12,900	12,680-13,100

*After Doelling, 1972, p. 221
**To convert Btu/lb to Kj/kg multiply by 2.326

Based on the average analyses in table 1, the Castlegate "A" coal is ranked on the borderline between high volatile B and high volatile C bituminous. The Bob Wright coal is ranked as high volatile B bituminous (American Society for Testing and Materials, 1977).

Mining Operations

The mining of coal in the Pleasant Valley area dates back to the late 1800's. Numerous coal mines have been operated at various and intermittent times in the quadrangle. The earliest mines generally had small productions and only produced coal for local use. Several mines developed into operations that eventually produced many millions of tons. Doelling (1972, p. 223) reported an estimated total coal production from mines with portals in the quadrangle from 27.0 to 29.6 million short tons (24.5 to 26.9 million metric tons). Specific mine production totals were also reported by Doelling (1972) as follows:

Mine(s)	Short tons	Metric tons
Clear Creek mines	14,196,000	12,878,611
Winter Quarter mines	10,800,000	9,797,760
Scofield (Union Pacific) mine	2,000,000	1,814,400
Utah mines	713,800	647,559
Kinney mine	687,000	623,246
Eagle mine	116,000	105,235
Colombine mine	69,000	62,597
Monay mine	63,000	57,154

Table 2 shows a list of mines, their approximate locations in the quadrangle and the years during which they were active. At the time of this report (1979) the only active mine in the quadrangle was the Belina No. 1 operated by Valley Camp of Utah, Inc. The "Upper O'Connor" coal bed was being mined. That company was also preparing to open a new mine, the Belina No. 2, on a coal bed above the one being produced in the Belina No. 1 mine.

Table 2. Mines and their locations in the Northwest Quarter of the Scofield 15-minute quadrangle, Carbon, Emery, and Sanpete Counties, Utah.*

Mine Name(s)	Approximate Location	Remarks and Period(s) of Active Mining
Amber mine	SE¼ NW¼ Sec. 3, T. 14 S., R. 6 E.	1877
Belina No. 1	NW¼ NW¼ Sec. 30, T. 13 S., R. 7 E.	1977-
Black Oaks mine	?	1898
Blue Seal mine (Utah-Wyoming)	NW¼ NW¼ Sec. 33, T. 12 S., R. 7 E.	1921-1940's (Intermittent)
Clear Creek mines (Pleasant Valley Coal Co., Utah Fuel Co., Independent Coal and Coke, North American Coal Corp.)		1899-1967
No. 1	SW¼ NW¼ Sec. 33, T. 13 S., R. 7 E.	West side of faults
No. 2	SW¼ NW¼ Sec. 33, T. 13 S., R. 7 E.	West side of faults
No. 3	SW¼ SE¼ Sec. 34, T. 13 S., R. 7 E.	East side of faults
No. 4	SE¼ SW¼ Sec. 34, T. 13 S., R. 7 E.	In Bob Wright bed
Colombine mine (Standard-Columbine, McAlpine, Olsen, Carbon, Fuel, Spring Creek, Rio Grande Colombo)	NW¼ SW¼ Sec. 33, T. 12 S., R. 7 E.	?
Eagle mine (Jones)	SW¼ Sec. 31, T. 13 S., R. 7 E.	1923-1941 (Intermittent)
Eccles Canyon mine (Crandall)	SE¼ SW¼ Sec. 13, T. 13 S., R. 6 E.	1899-1952 (Intermittent)
Fish Creek mine (Wood Canyon)	Sec. 31, T. 12 S., R. 7 E. (?)	1908-1910
Gibson mine	SW¼ NE¼ Sec. 8, T. 13 S., R. 7 E.	1922-? (Abandoned)
Jones mine	SW¼ SW¼ Sec. 33, T. 12 S., R. 7 E.	Abandoned
Kimball mine	NW¼ SE¼ Sec. 30, T. 12 S., R. 7 E.	1885-1900
Kinney mine (Monay)	SW¼ NW¼ Sec. 33, T. 12 S., R. 7 E.	1920-1926 1946-1956

Mine Name(s)	Approximate Location	Remarks and Period(s) of Active Mining
Lewellyn	In Mud Creek	1897-1898
O'Conner (Black Diamond)	SW¼ NE¼ Sec. 32, T. 13 S., R. 7 E.	1956-1967
Scofield mine (Pleasant Valley, Union Pacific)	SW¼ NW¼ Sec. 4, T. 13 S., R. 7 E.	1884-1936 (Intermittent)
Utah mine (Utah Central, Mud Creek)	NE¼ NE¼ Sec. 17, T. 13 S., R. 7 E.	1910-1925 (Main activity)
Utah No. 2	SE¼ SE¼ Sec. 8, T. 13 S., R. 7 E.	1974-1978
Utah Collieries (Smith and Nelson)	?	1909-1910
Weeks mine	SE¼ NE¼ Sec. 3, T. 13 S., R. 6 E.	1877
Williams mine	4 miles up Mud Creek	1897
Winter Quarters mines		
No. 1	Sec. 1, T. 13 S., R. 6 E.	1878-1895
No. 2	NW¼ SW¼ Sec. 6, T. 13 S., R. 7 E.	1896-1940's
No. 3	Sec. 6, T. 13 S., R. 7 E.	
No. 4	SE¼ NE¼ Sec. 1, T. 13 S., R. 6 E.	
No. 5 (Smith, Cox, and Smith)	Sec. 1, T. 13 S., R. 6 E.	
No. 6	SW¼ NE¼ Sec. 31, T. 12 S., R. 7 E.	

*After Doelling, 1972

COAL RESOURCES

The principal sources of data used in the construction of the coal isopach, structure contour, and coal data maps were Doelling (1972) and Spieker (1931).

Coal resource tonnages were calculated for measured, indicated, and inferred categories in unleased areas of Federal coal land within the KRCRA boundary. Data obtained from the coal isopach maps (plates 4 and 8) were used to calculate the Reserve Base values. The coal-bed acreage (measured by planimeter) multiplied by the average isopached thickness of the coal bed times a conversion factor of 1,800 short tons of coal per acre-foot of bituminous coal yields the coal resources in short tons of coal for each isopached coal bed. Reserve Base and Reserve values for the Bob Wright zone and the Castlegate "A" bed are shown on plates 7 and 11 and are rounded to the nearest tenth of a million short tons. The Reserve values are based on a subsurface mining recoverability factor of 50 percent.

"Measured resources are computed from dimensions revealed in outcrops, trenches, mine workings, and drill holes. The points of observation and measurement are so closely spaced and the thickness and extent of coals are so well defined that the tonnage is judged to be accurate within 20 percent of true tonnage. Although the spacing of the points of observation necessary to demonstrate continuity of the coal differs from region to region according to the character of the coal beds, the points of observation are no greater than ½ mile (0.8 km) apart. Measured coal is projected to extend as a ¼ mile (0.4 km) wide belt from the outcrop or points of observation or measurement.

"Inferred quantitative estimates are based largely on broad knowledge of the geologic character of the bed or region and where few measurements of bed thickness are available. The estimates are based primarily on an assumed continuation from Demonstrated coal for which there is geologic evidence. The points of observation are 1 1/2 (2.4 km) to 6 miles (9.6 km) apart. Inferred coal is projected to extend as a 2 1/4-mile (3.6 km) wide belt that lies more than 3/4 mile (1.2 km) form the outcrop or points of observation or measurement." (U.S. Bureau of Mines and U.S. Geological Survey, 1976).

Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 16.3 million short tons (14.8 million metric tons) for the unleased Federal coal lands within the KRCRA boundary in the Northwest Quarter of the Scofield 15-minute quadrangle. The Reserve Base tonnages are also shown in the following tabulation.

Table 3. Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the Northwest Quarter of the Scofield 15-minute quadrangle, Carbon, Emery, and Sanpete Counties, Utah.

(To convert short tons to metric tons, multiply by 0.9072)

Coal Bed Name	High development potential	Moderate development potential	Low development potential	Total
Bob Wright	900,000	-0-	-0-	900,000
Castlegate "A"	15,400,000	-0-	-0-	15,400,000
Total	16,300,000	-0-	-0-	16,300,000

AAA Engineering and Drafting, Inc. has not made any determination of economic mineability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Development Potential for Surface Mining Methods

No development potential for surface mining methods exists in the area of this quadrangle because of the rugged topography, steep-sided canyons, extreme relief, and thick overburden. There may be very small areas where some rim stripping could be done, but in general the area is not conducive to surface mining methods.

Development Potential for Subsurface Mining and In Situ Coal Gasification Methods

The coal development potential for the subsurface mining of coal is shown on plate 12. In this quadrangle the areas where coal beds 5 ft (1.5 m) or more in thickness are overlain by less than 1,000 ft (305 m) of overburden are considered to have a high development potential for subsurface mining.

Areas where such beds are overlain by 1,000 to 2,000 ft (305 to 610 m) and 2,000 to 3,000 ft (610 to 914 m) of overburden are rated as having a moderate and a low development potential respectively. Areas that contain no known coal in beds 5 ft (1.5 m) or more thick, but coal-bearing units are present at depths of less than 3,000 ft (914 m) are classified as areas of unknown coal development potential. Areas where no coal beds are known to occur or where coal beds are present at depths greater than 3,000 ft (914 m) have no coal-development potential. The areas of unleased Federal coal land within the KRCRA in the quadrangle fall within the "high" development potential classification.

The designation of coal development potential classification is based on the occurrence of the highest-rated coal-bearing area that may occur within any fractional part of a 40-acre BLM land grid area or lot area of unleased Federal coal land. For example, a certain 40-acre area is totally underlain by a coal bed with a "moderate" development potential. If a small corner of the same 40-acre area is also underlain by another coal bed with a "high" development potential, the entire 40-acre area is given a "high" development potential rating even though most of the area is rated "moderate" by the lower coal bed. Another possibility is a 40-acre area devoid of any coal except a small corner where a 5-ft (1.5 m) coal bed crops out. In this case the 40-acre area will have a "high" development potential rating.

The in situ coal gasification methods of development potential classification are based on the dip and depth of coal beds having a minimum thickness of 5 ft (1.5 m). There are only two development potential classification--moderate and low. The criteria for in situ gasification include coal bed dips of 15 to 90 degrees and coal bed depths of 200-3,000 ft (61-914 m).

Inasmuch as the coal beds dip less than 15 degrees in the quadrangle, except possibly in fault zones, the in situ coal gasification methods of development potential classification do not apply.

Table 4. Source of data used on plate 1

Source	Plate 1 Index Number	Data Base: Measured Section No.	Data Base: Page or Plate No.
Doelling, 1972	1	6	220
	2	5 and 21	220
	3	20	220
	4	4 and 19	220
	5	18	220
	6	17	220
	7	16	220
	8	3	220
	9	14	220
	10	15 and 97	220 and 221
	11	2 and 13	220
	12	1, 12, and 45	220 and 221
	13	11	220
	14	10 and 44	220 and 221
	15	9	220
	16	8	220
	17	7	220
	18	22	220
	19	23	220
	20	26	220
	21	27	220
	22	28	220
	23	29	220
	24	30	220
	25	31	220
	26	32	220
	27	33	220
	28	34	220
	29	35	220
	30	36	220
	31	37	220
	32	38	220
	33	39	220
	34	40	220
	36	43	221
Spieker, 1931	35	11	pl. 14

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