THE CORRELATION OF COAL BEDS IN SQUAW BASIN AND PART OF EDEN RIDGE, T. 33 S., R. 11 W., W. M., SOUTHWESTERN OREGON

By

Russell G. Wayland

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ABSTRACT

A conflict in correlation of coal beds dating from 1914 is reexamined with the aid of new core hole data, photogeologic interpretation, a broader understanding of the stratigraphy, and brief field studies. It is concluded that the known coal beds in Squaw Basin are of limited lateral extent and are older than those exposed at Eden Ridge. Similar coal beds may be found in other rocks of the Tyee Formation in this area. More core drilling could be justified.

INTRODUCTION

This report, including its geologic map (pl. 1) and sections (pl. 3), is largely a compilation and reinterpretation of data from several sources. It is not intended for publication. Its principal purpose is to resolve a conflict in field observations (Lesher 1914 a, 1914 b; Williams 1914) made at the time when the small prospecting tunnels and pits were open. The reinterpretation has been facilitated by new core hole data from a small area in Squaw Basin and by three days of field observations in September 1961 and October 1963 by the writer. This report is expected to be of interest primarily to companies or persons seriously considering possible further exploratory trenching or drilling in Squaw Basin for coal. It necessarily places considerable emphasis on observations made in 1914 and on details of correlations of beds.

T. 33 S., R. 11 W. overlaps the Agness and Marial 15-minute quadrangles and the Coos Bay and Medford 1:250,000 scale quadrangles. Secs. 1-6 are missing from the township, but secs. 7, 18, 19, 30. and 31 are about 1 3/4 miles wide. The area of the township is about 32 square miles. Most of the township is in the Siskiyou National Forest. The South Fork of the Coquille River and its tributaries, including Squaw Creek, drain much of the township. This river drops from 2,100 feet to 800 feet altitude within the township as it loops around the south end of Eden Ridge. The Rogue River is present in the township in secs. 25, 35, and 36, at an altitude of about 240 feet. It drains most of the southeast corner and south border areas of the township. The divide between the Coquille and Rogue Rivers is Panther Ridge, which includes Bald Knob and Coal Butte. The boundary between Coos and Curry Counties follows this ridge (pl. 1). The high point on this ridge within the township is about 3,700 feet altitude.

Access to the township is through the Coquille River valley by an unpaved two-lane road south 11 miles from Powers. This road continues south to Agness on the Rogue River. A new highway up the Rogue River to Agness from the coast is under construction. A single-lane road leads eastward to Grants Pass, following the Coquille River within the township. Logging and forest lookout roads give limited, temporary access to much of the township. Heavy timber or dense brush and soil conceal most rock outcrops except in some cliffs, roadcuts, and river gorges. The closest railhead is at Powers.

The topographic base map for the geologic map (pl. 1) is an enlargement to scale 1:31,680 of parts of the Agness and Marial 1:62,500 scale quadrangles with contour interval 80 feet.

Squaw Basin is defined as the area drained by Squaw, Counts, Donnell, and Fall Creeks. These creek names are as used by Williams and Lesher in their 1914 reports. On the Agness and Marial quadrangles, new names are given to some creeks, so the old names have been added in parentheses on plate 1.

In compiling plate 1, the writer is indebted especially to Dr. E. M. Baldwin, University of Oregon, for the general geology and to Garth A. Duell of Pacific Power and Light Co. for the Eden Ridge coal outcrop pattern and for drilling information. For the description of coal prospects in Squaw Basin, the published and unpublished reports of Lesher (1914a, b) and of Williams (1914) were the principal source materials. These same reports were drawn upon for the data later published by Yancey and Geer (1940); Andrews, Hendricks and Huddle (1947); Cooper et al, (1947); and Mason and Erwin (1955). Geer and Yancey (1961) present new published work on one large coal sample. A thesis by Born (1963) on the geology of the area just north of that shown on plate 1 of this report may now be seen at the University of Oregon, Eugene, and at the State Department of Geology and Mineral Industries, Portland.

GENERAL GEOLOGY

Rocks exposed in the township range in age from Jurassic to Eocene. Small deposits of Recent alluvium are present locally in the Rogue and Coquille River valleys.

The oldest rocks are the Dothan Formation of Upper Jurassic age (Wells and Peck, 1961). They consist of beds of indurated graywacke alternating with dark gray mudstone, locally with slaty cleavage. Some conglomerate and chert lenses are present as well as altered basaltic flows and flow breccias. Ultramafic and gabbroic intrusive rocks are common elsewhere in the Dothan Formation: only a few of these bodies have been separately mapped in this township and adjacent areas. Wells and Peck (1961) show a large mass of serpentinized ultramafic rock extending northeastward from sec. 36 for about 18 miles.

Baldwin (1963, written communication) has observed a small area of Days Creek Formation (Lower Cretaceous) (Imlay and others, 1959) in sec. 35 in the bottom of the Rogue River canyon (pl. 1). Here this formation consists of siltstone and thin sandstone beds in which he says belemnites are common.

Diller (1903) mapped all Tertiary rocks which unconformably overlie the rocks of Mesozoic age in the township area as Arago Formation. Wells and Peck (1961) show two formations, the older of which is the Umpqua Formation and the younger the Tyee Formation. Based upon his recent field work in nearby townships, Baldwin (1963) now tentatively divides the Umpqua Formation into a lower unit of early Eocene age not present in this township, and middle and upper units of early and middle Eocene age. From his reconnaissance observations in this township, he tentatively believes (1963, written communication) that part of the middle unit is exposed along the west edge of the township, where it consists of thin-bedded sandstone and siltstone. Eastward in the township, in the Rogue River drainage, he tentatively assigns the exposed Umpqua Formation rocks, consisting of conglomerate and coarse sandstone, to the upper unit. This unit is present in secs. 23, 26, 27, and 32-35.

Snavely and Wagner (1963) show the general area which includes this township to be in the southern end of the coastal eugeosyncline during early and middle Eocene (Umpqua) time. "Current structures, the graded nature of many of the graywacke beds, and the high percentage of unstable rock fragments indicate rapid deposition, probably by turbidity currents that flowed generally northward and westward into the deeper parts of the basin" (Snavely and Wagner, 1963, p. 6). About 8 miles south of this township, in T. 35 S., R. 11 W., the upper unit (Baldwin, 1964, written communication) of the Umpqua Formation contains some coal beds (Diller, 1903, p. 5; Yancey and Geer, 1940, p. 4-5).

The Tyee Formation of middle Eocene age in much of the eugeosyncline north of the township is in general nearly conformable to the underlying Umpqua Formation, but in the township area it overlaps both units of the Umpqua Formation and also rests on Mesozoic strata (pl. 1) (Baldwin, 1963, written communication). In much of the eugeosyncline north of the township the Tyee Formation consists typically of graded units 2 to 10 feet thick, with micaceous, arkosic, and lithic sandstone at the bottom, grading upward into carbonaceous siltstone at the top, suggesting submarine slumping of deltaic material and rapid redeposition from turbidity currents. In and near the township area, however, coal-bearing continental beds and near-shore, bar-type sands were laid down (Snaveley and Wagner, 1963, p. 10). The source of the detrital material for Tyee Formation beds in general was the Klamath pre-Tertiary terrane of metamorphic, igneous and sedimentary rocks.

After middle Eocene time the strandline was probably north of the township. Coal was deposited in the Coos Bay area in the Coaledo Formation of upper Eocene age. Later the Tyee Formation sediments in T. 33 S., R. 11 W. were warped into open folds. Subsequent cross faulting resulted in minor offsetting of beds in the Eden Ridge area.

Uplift during and since late Pliocene time has resulted in entrenchment by the Rogue and Coquille Rivers and their tributaries. Where oversteepened slopes have developed, especially on bedding dipping toward these rivers as in Squaw Basin, extensive creep of the thick mantle and landsliding of the shallower bedrock is the rule. The downcutting rivers remove most of this material as fast as it reaches the river channels.

COAL GEOLOGY

Because the known coal occurrences in this township are all in the Tyee Formation, the remainder of this report concerns the 60 percent of the township area underlain by this unit (pls. 1 & 2). In this southern end of the middle Eocene eugeosyncline near the source area, the massive sandstone units of the Tyee Formation are in general less well graded and less sharply defined at the base than are contemporaneous units farther north. Some show large-scale cross bedding (Born, 1963, p. 55). However, logs and cores of holes drilled in Squaw Basin and measured sections on Eden Ridge and Panther Ridge show that some recurrent grading is present. In addition to the sandstone and carbonaceous siltstone typical of the Tyee Formation farther north, the units here also contain beds of conglomerate, pebbly sandstone, flaggy sandstone, and graywacke. In the finer fractions at the top of some of the graded units or between massive sandstone beds, black shales are common. Some siltstones and shales are characterized by a high organic content. Plant debris is abundant, and carbonized logs are present. Carbonized tree stumps still in place (Born, 1963, p. 55) as well as the several known coal beds indicate a locally swampy, terrestrial environment.

The youngest beds of the Tyee Formation exposed in the township are at Eden Ridge, in secs. 8-10, 16 and 17. They were mapped and described in some detail by Lesher (1914a). Recent drilling by Pacific Power and Light Co. on the ridge has added to and essentially confirmed many of his observations. Their composite stratigraphic section and electric log (fig. 1) of this upper portion of the section corresponds reasonably well with the generalized section of these beds at Eden Ridge given by Lesher (1914a, p. 26). Much of the Eden Ridge section is massive sandstone, but some graded units are recognizable. Marker beds in this part of the section include two of the four principal known coal and carbonaceous shale beds, known as the Carter bed and the Anderson bed.

They are shown on plates 1 and 2 and on figure 1 and are described below.

Another stratigraphic marker bed is the blue conglomerate unit that underlies the Eden Ridge section of the Tyee Formation. In the words of Lesher (1914a, p. 27):

> "It is about 40 feet thick and is composed of small pebbles of altered volcanic rock, chiefly andesitic in character, and fragments of fine-grained quartzites and slates ranging in size from one-eighth of an inch to 2 inches in diameter. * * * Wherever it is thoroughly wet, as in stream beds, it has a characteristic bluish color, and for this reason it is here referred to as the blue conglomerate."

In his published report (1914a), Lesher concludes that the beds of the Tyee (Arago) Formation in Squaw Basin are stratigraphically below the blue conglomerate unit, a view also held by Williams (1914) and by Duell (1963, written communication). However, Lesher changed his mind on this point. The map accompanying his second report (1914b) shows the blue conglomerate unit underlying most of the Squaw Basin section.

A marker bed below the blue conglomerate unit, recognized by both Williams (1914) and Lesher (1914b), is called the Falls sandstone by Lesher. It is a prominent massive sandstone with a shale interbed. It forms a falls in the Coquille River and its tributaries and cliffs on the west side of Eden Ridge. It is also generally agreed to be the sandstone that forms prominent cliffs exposed more or less continuously along Panther Ridge on the Rogue River side. Williams (1914, p. 35) projects a stratigraphic interval between the Falls sandstone and the blue conglomerate "somewhat better than 800 feet" at the south end of Eden Ridge. Lesher, however, measured the interval at 511 feet in the SE¼SE¼ sec. 17 (pl. 3, left). The writer has estimated the interval at various places with the help of the largest scale contour map available, and concludes that the interval is not constant. Lesher's 511-foot interval appears to be valid for the location he measured. Near the SW cor. of sec. 8 the interval is about 300 feet, if one allows for the eastward dip of beds and assumes a constant interval of 370 feet between the top of the conglomerate and the overlying Anderson coal bed.

It is concluded by the writer that the massive blue conglomerate unit has a limited lateral extent. It was deposited rapidly in a submarine trough and scoured the unconsolidated sediments which now underlie Eden Ridge. The basis for this conclusion is discussed below.

In Squaw Basin proper (secs. 20-22, 28-29) and bordering areas, stratigraphic information suitable for correlation of beds is limited to four core holes drilled in the SW¼ sec. 21 by Pacific Power & Light Co. in 1957 and later, and to stratigraphic sections described by Lesher (1914b, p. 4) and by Williams (1914, p. 36-37). These cores and sections are shown graphically on plate 3. The locations of the four core holes are shown in plate 1, and their logs are given in table 1. The writer made a brief inspection of the cores in October 1963.

In correlating beds between the core holes in the SW¼ sec. 21, the datum is between overlying light-colored, massive, micaceous sandstone beds and an underlying carbonaceous siltstone or dark shale that marks the top of a 300-foot sequence of rudely graded units containing coal beds or partings in their upper portions.

If this correlation of the four core holes is correct, then these units can be correlated with described stratigraphic sections on the Rogue River side of Panther Ridge at Coal Butte given by Lesher (1914b, p. 4) and by Williams (1914, p. 36-37). Their descriptions of the upper 400 feet from the shale and coal beds to the top of the ridge are in reasonably good agreement. They both note the presence of massive sandstones above a predominant shale and coal section.

According to Williams (1914, p. 36-37), the position of the Falls sandstone member near Coal Butte is about 500 feet below his lower coal bed (pl. 3). Lesher's presentation of his Coal Butte section on page 4 of the 1914b report as "the strata above the Big Falls Sandstone" suggests that the coal beds immediately overlie the Falls sandstone. However on page 5 he states that the blue conglomerate member is "on Coal Butte in NW¼NW¼ sec. 33 and the NE¼NE¼ sec. 32", and on page 6 he states that "the coal bed or beds in this area are immediately above it (i.e. the blue conglomerate) stratigraphically." This would indicate that Lesher does not dispute Williams on the position of the Falls sandstone about 500 feet below the outcropping coal beds on Coal Butte. The writer therefore correlates the top of the Falls sandstone in the Coal Butte area with the top of the thick siltstone and sandstone section below 828 feet depth in hole 101 (table 1; pl. 3).

In Lesher's measured section in the SE¼SE¼ sec. 17, the base of the blue conglomerate is 511 feet above the Falls sandstone. There is no corresponding conglomerate at approximately this stratigraphic position above the Falls sandstone in core holes 101, 103, or 104 in SW¼ sec. 21.

In core hole 102, however, there is a conglomerate about this position. Williams and Lesher both describe a conglomerate at Coal Butte below the coal outcrops at about this position (pl. 3). Lesher calls this bed at Coal Butte the blue conglomerate, but Williams (1914, p. 17) clearly disagrees.

The writer now believes from the evidence at hand that the blue conglomerate unit of Eden Ridge is not the same as the conglomerate at Coal Butte. As noted earlier, and as shown on plate 3, the blue conglomerate unit rests unconformably on the northern edge of the upper beds of Squaw Basin. The southeastward extension of the blue conglomerate unit may be present in the Panther Ridge area in about secs. 14, 22, and 23, perhaps as near-surface remnants.

As the conglomerate bed of Coal Butte was found in only hole 102 of the four core holes in the SW$\frac{1}{4}$ sec. 21, it appears to have filled a scoured channel or basin of limited lateral extent. And as the only thick coal bed cored is in the same core hole, above this conglomerate, it would appear that this same channel or local basin later became a coal swamp. Still later the seas returned to deposit the extensive micaceous sandstone beds overlying the siltstone-shale-coal units in this part of Squaw Basin. These micaceous sandstone beds are in turn older than the blue conglomerate because they appear to be truncated by the blue conglomerate (pl. 3).

The cores and field observations confirm that other, less conspicuous chert and quartz pebble conglomeratic beds and pebbly sandstones reported by Williams (1914, p. 34) and Born (1963, p. 55, 78) are common in the Tyee Formation in this area. Many of these beds are assumed to be elongate bodies of limited extent deposited in scoured channels.

Reported conglomerate occurrences which the writer now considers to be the same bed as that at Coal Butte are in the NE¼ sec. 28 (Lesher, 1914b, p. 5) and in the W½SE¼ sec. 29 (Williams, 1914, p. 38; Lesher, 1914b, p. 5), both on branches of Squaw Creek.

In the E½NW¼ sec. 29, Lesher's map (1914b) shows the blue conglomerate dipping steeply to the northeast. The writer visited the top of this hogback and observed that the rocks here resisting erosion are typical of the light-colored micaceous medium- to fine-grained sandstone beds. They appear to underlie the conglomerate of Coal Butte, which would here occur on the lower dip slope.

Below the Falls sandstone member and above the unconformity with the Umpqua Formation, the Tyee Formation at Coal Butte (pl. 1) consists of beds that are not notably cliff forming and are masked in part by talus or landslide material. The thickness of these beds is perhaps 200 feet. In the northwest part of the township, however, the lower portion of the Tyee Formation is evidently thicker, as suggested by the map (pl. 1) and section A-A' of plate 2. There the Coquille River exposes a thick Tyee section below the Falls sandstone.

In core hole 101 the base of the Tyee Formation may tentatively be taken at a depth of 1,150 feet. At this depth, about 72 feet of interbedded conglomerate and sandstone beds overlie a 46-foot, gray-green, massive shale bed. The Tyee section below the Falls sandstone therefore is about 188 feet thick in the SW¼ sec. 17. It is noteworthy that carbonaceous shales and a few coal pieces were cored in the tops of graded units in this part of the formation.

FOLDS

Northward-plunging open folds in the Tyee Formation are illustrated by structure symbols on plate 1 and by the geologic sections on plate 2. The broader features of these folds in the Tyee Formation within the township are described below.

A synclinal axis plunges gently northward at about 7° from Coal Butte through Squaw Basin and under Eden Ridge where it apparently flattens out in the township to the north. Section B-B' (pls. 1 and 2) follows the axis approximately. The west flank of the syncline is much steeper than the east flank, as shown by sections A-A' and C-C'.

The distribution of Tyee beds in the west side of the township suggests that an open anticlinal axis plunges northward from Bald Knob at about the same 7° angle. The west flank is nearly flat in an east-west direction in the southwest corner of the township, where the Tyee Formation caps a long spur. At its north end the structure appears to become the top of an eastward dipping monocline.

In the northwest corner of the township another open synclinal axis may be present along the South Fork of the Coquille River. It was not observed in the field, but unless it and the above-mentioned anticline are there, or unrecognized faulting is present, the Tyee Formation beds in secs. 7 and 18 must be overthickened considerably more than indicated on section A-A' (pl. 2).

In addition to these major structures, local flattening and steepening is evident from individual measurements on bedding. Reported dips on coal beds in some prospects described below are somewhat anomalous. In the less competent beds, some minor folding is to be expected, reflecting differential movements between the more competent members of the formation during the regional open folding.

FAULTS

The east-west Bear Creek fault of Lesher (1914a, p. 27, pl. 24) is in secs. 31-34 of the township to the north (pl. 1). Lesher describes it as a hinge fault, with the south side down on the east and up on the west. Williams does the same (1914, p. 35). However drilling and mapping by Garth A. Duell, Pacific Power & Light Co., shows it to be a near-vertical fault with its south side down about 500 feet in sec. 33 and down about 400 feet in sec. 31.

Duell mapped another east-west fault south of the Bear Creek fault (pl. 1). It is along Stemmler Creek near the township line, and is here called the Stemmler Creek fault. Its downthrow of about 200 feet is on the north side, making the structure between it and the Bear Creek fault a graben.

Lesher (1914a) shows a minor northeast-trending fault in secs. 9 and 17 along a stretch of the Coquille River valley. This fault is not shown in the detailed Pacific Power and Light Co. mapping, and is omitted from plate 1 of this report.

A prominent straight escarpment faces south along Falls Creek (Drowned Out Creek) in secs. 15 and 16 (pl. 1). It is called the Bluff by Lesher and the rim of Squaw Basin by Williams. The alignment of this escarpment with the western course of the Coquille River in sec. 17 and with upper Paradise Creek in sec. 23 suggests the presence of another east-west fault. However, Duell (1963, oral communication) found no actual evidence for it during his geologic mapping, nor did Lesher (1914a, p. 30). The writer notes that most of the rocks exposed in Squaw Basin just south of the Bluff are sliding toward the Coquille River, and that a southward dip observed in the center of the SE$\frac{1}{4}$ sec. 15 appears to be due to this mass movement.

Snavely (1964, written communication) suggests the possible presence of faults extending northward and northwestward from the west side of Bald Knob. If such faults are found during later detailed mapping, they may account for the distribution of the Tyee beds discussed above under the subject of folds.

COAL PROSPECTING HISTORY

Diller in 1903 knew of the coal on Eden Ridge but not of that in Squaw Basin. Reports of float coal along the streams in Squaw Basin were unconfirmed until M. J. Anderson, Forest Supervisor, reported them in 1907 (Williams, 1914, p. 31). This resulted in the Forest Service withdrawing Squaw Basin from coal entry on June 22, 1907, for examination. In August of that year Diller and G. F. Kay of the U. S. Geological Survey visited the basin and issued an unfavorable report on the probability of finding mineable coal. The area was restored to mineral entry in 1908.

In 1912 the Seven Foot coal bed on the east fork of Squaw Creek ($N\frac{1}{4}$ cor., sec. 28) was discovered, and by the end of October the basin was covered with claims. M. R. Campbell of the Geological Survey, accompanied by Dean Milnor Roberts of the College of Mines, University of Washington, visited the basin at that time. The area was again withdrawn from entry October 22, 1912, to await classification as to its mineral character. Lesher (1914a) visited prospects 29 and 30 (pl. 1) in the summer of 1913 while mapping Eden Ridge, and returned in the late summer of 1914 for field work leading to his township report (1914b). Williams' field observations were made in late October and in November, 1913; his report (1914) is not mentioned by Lesher (1914b), so it is presumed not to have been available to him. The cadastral survey of the township was made in the early summer of 1914.

Prospecting in the Eden Ridge and Squaw Basin areas was negligible between 1914 and 1957. Pacific Power and Light Co. then began its exploration of the Eden Ridge coals with a view to possible on-site steam power generation to be integrated with hydroelectric development of the Coquille River. A part of the results of their drilling and mapping have been utilized in the foregoing paragraphs.

EDEN RIDGE COAL BEDS

Two of the four recognized coal beds or zones of the Eden Ridge area, the Anderson coal bed and the Carter coal bed 500 feet above it, were mentioned above in the discussion of the Tyee Formation stratigraphy. Their location is now well known from drilling and prospecting, and is shown on plates 1 and 2. The Lockhart coal zone is above the

Carter coal bed about 70 feet and the Meyer coal zone is now shown by drilling to consist of three thin beds within a 50-foot interval below the base of the Anderson bed (fig. 1).

Lands underlain by the Meyer, Anderson, Carter, and Lockhart beds are largely in the township to the north, but they also underlie this township in parts of secs. 8, 9, 10, 16, and 17 (pl. 1). The Anderson bed is the most extensive in this part of the township and underlies approximately $2\frac{1}{4}$ square miles. Prospects 14 and 15 as numbered by Lesher (1914a, b) are in the Anderson bed in sec. 9 (pl. 1). By means of graphic sections (1914a, pl. 15), Lesher shows the coal here to be about 5 to $5\frac{1}{2}$ feet thick, including a 2-inch white clay parting near the middle of the coal bed. Most of the bed in the two prospects is depicted as impure coal or bone, but in prospect 14, just above a clay parting, Lesher shows about 20 inches of clean coal. He did not sample the coal in these two prospects.

The closest outcrop of Anderson coal for which proximate analyses are available is at prospect 18 in the SE$\frac{1}{4}$NE$\frac{1}{4}$ sec. 33 of the township to the north. Three analyses of coal from prospect 18 are given in table 1. For a 6-foot mining width, the ash content for run-of-mine coal would be quite high. A recent Bureau of Mines washability test (Geer and Yancey, 1961) on coal from the prospect tunnel there shows that "the coal contains 23 percent of impurity heavier than 1.80 (specific gravity), the elimination of which would reduce the ash content from 35 to 24 percent." A sample of the best $15\frac{1}{2}$ inches of the seam at prospect 18 by M. R.

Campbell in 1912 ran 15.2 percent ash. Geer and Yancey say the coal is high volatile C bituminous in rank.

Much of sec. 8 is also underlain by the Carter bed (pls. 1 and 2), and probably by the near-surface Lockhart bed. Power company core holes 3, 10, 11 and 13 penetrate the Carter coal bed in this area, but detailed information on the nature of the coal is not available to the writer.

Northward in the next township, four of Lesher's ten measured sections of the Carter coal bed indicate several feet of coal, although impure coal or bone are predominant in his sections. Of four analyses published by Lesher (1914a), the one lowest in ash was of a sample taken by M. R. Campbell in 1912. It represented 51 inches of a 60-inch thickness of Carter coal in the SW$\frac{1}{4}$NE$\frac{1}{4}$ sec. 29, T. 32 S., R. 11 W., and it contained 19.9 percent ash. No published analyses of Lockhart coals are available. Lesher's two measured sections (1914a, pl. 25) depict the bed as impure coal and bone.

At prospects 13 and 16 (pl. 1), measured sections and analyses are given for what Lesher (1914a) considered the Meyer bed. However, from his later map (1914b), from his sections and analyses, and from the more accurate recent mapping, it appears that these prospects may actually be in the Anderson bed. The thickness, mid-seam clay parting, and elements of the proximate analyses correlate as well with available Anderson bed data as do the Anderson bed data among themselves. As noted above, drilling by the power company now depicts Meyer beds as three thin beds within a shale zone 50 feet thick lying below the Anderson bed (fig. 1). The analyses given by Lesher (1914a) are repeated here in table 2.

The Meyer beds are in the same 120-foot thick, interbedded carbonaceous shale, siltstone, and thin-bedded sandstone unit as the Anderson bed. During this Anderson-Meyer depositional episode, the general environment for the occurrence of coal swamps apparently existed for a considerable period of time. It is possible that some of the known occurrences of impure coal beds in this graded unit may be at the edge of a former swamp in which clean coal may have formed nearby. The extensive area of the known occurrence of the Anderson bed here and to the north represents what is probably an exceptionally large coal swamp.

SQUAW BASIN COAL BEDS

If the stratigraphic and structural data and the interpretations and correlations presented earlier in this report and its illustrations are accepted, the coal beds in Squaw Basin are older than the blue conglomerate member of the Tyee Formation and therefore older than the beds at Eden Ridge. In Squaw Basin the portion of the Tyee Formation present has been shown above to include numerous coal partings and, locally, two coal beds. Most of these are in a 300-foot section consisting of six or seven graded units, each with tops of carbonaceous siltstone and shale. This sequence of units lies below a massive, light, micaceous sandstone bed (pl. 3).

The two prospect tunnels in Squaw Basin that found coal in place were the Donnell prospect 29 in about the N$\frac{1}{2}$NW$\frac{1}{4}$ sec. 22 and the

Squaw Creek Association prospect 30 near the $N\frac{1}{4}$ cor. sec. 28 (pl. 1). Several other prospect tunnels that encountered only fragments of coal in creep and landslide debris were driven in the basin (table 3). An adit was driven in coal south of Squaw Basin on the Rogue River side of Coal Butte at prospect 31 in about the $NE\frac{1}{4}NE\frac{1}{4}$ sec. 32. None of these prospect tunnels were open in 1963, and surface indications of the former presence of the mine workings were meagre or lacking. Accordingly the recorded observations of Williams and of Lesher are the only source of information still available on mine openings in Squaw Basin. The four core holes in the $SW\frac{1}{4}$ sec. 21 provide new information. The writer noted a thin coal seam in a road cut in $NE\frac{1}{4}NW\frac{1}{4}NW\frac{1}{4}$ sec. 21. A summary of all observations on coal occurrences in Squaw Basin is present in table 3, and prospect symbols are shown at their approximate locations on plate 1.

At prospect 29, the claim of G. W. Donnell on Donnell Creek, both Lesher (1914a) and Williams (1914) observed a 5-foot bed of coal in the upper of two adits driven at creek level. Summaries of their observations and analyses are given in tables 2 and 3. Williams reported the dip of the coal seam to be 10° to 11° northerly, but a nearby outcrop of the overlying sandstone and shale in a roadcut on the ridge just north of the creek in the $NE\frac{1}{4}NW\frac{1}{4}$ sec. 22 was observed by the writer to strike N. 25° E. and dip 20° westerly. The lower adit, 100 feet west and downstream from the upper adit, found only rubble with coal fragments, as could be expected if the coal dips westerly steeper than the stream course.

The coal exposed in the upper adit at prospect 29 lies immediately under a bluish shale (Williams, 1914, p. 39). The uppermost 2 feet 6 inches of coal is brittle and shattered by movement and contains some bone. Below a 3-inch clay parting another 2 feet 4 inches of coal was exposed; it was firm, jointed, and slightly bony. Lesher's (1914a) graphic description of the exposed seam shows about the same thickness, character, and parting. Williams says, however, that test holes proved another 5 feet of the seam is present below the adit. Proximate analyses (table 2) from samples taken by the two men are comparable, with the Williams sample the higher in ash (30.9 percent).

The Squaw Creek Association claim, prospect 30, is on the coal discovery that touched off the flurry of prospecting in 1912 in the basin (Williams, 1914). The adit started at stream level in the channel of the East Fork of Squaw Creek where the creek has cut through sandstone beds to expose the less competent beds beneath. The observed 26° northerly dip (Williams, 1914) of the coal is considerably steeper than the average 7° northerly plunge of the syncline noted above. This local oversteepening may represent a minor fold within the syncline, or it may be due to rotation within a block of beds sliding on a bedding plane toward the Coquille River.

The coal bed at prospect 30 was named the Seven Foot bed (Lesher, 1914a, p. 41; Williams, 1914, p. 39). At the time of the visit by Williams, less than 7 feet of the coal were exposed. Under a shale capping, Williams observed 3 feet of brittle, shattered coal with little bone, a 3-inch shale parting, and 2 feet of firm, more compact, less broken, clean coal below the parting. Lesher's visit was earlier, when more than 8 feet of section were exposed. He graphically shows 5 feet 6 inches of clean coal, of which almost 4 feet immediately underlies the parting. His sample represents only 5 feet 8 inches of the total bed. Both analyses (table 2) show that this bed is relatively clean coal, compared with the Donnell bed and the beds on Eden Ridge. The ash content was 14.7 percent in Lesher's sample and 18.0 percent in Williams'.

The upper coal bed of the two found on the south side of Coal Butte, at prospect 31, was developed by an adit 40 or more feet long driven by H. B. Hillis (Lesher, 1914b, p. 8-9). Hillis wrote Lesher in November 1914 that the coal was "still weathered and checked" at 40 feet. Lesher's graphic section shows 7 feet 7 inches of coal in a bed 8 feet 2 inches thick. Above a 3-inch white clay parting he shows 49½ inches of clean coal, and below it 44½ inches. He did not sample the coal, but he states that it is the best exposure of coal in either this township or the township to the north.

Williams earlier had taken a sample from the outcrop at or near prospect 31 (1914b, p. 36) and had described the coal as brittle, jointed, and apparently free from bone and other foreign matter. He also observed the clay parting near the center of the seam, and noted a 12° dip. Williams' sample was of selected pieces from a deep channel cut across the 8-foot thickness of the bed. He omitted weathered coal and clay in his sample. The result is shown here in table 2. The ash content of 7.2 percent is the lowest of all available analyses from the Eden Ridge and Squaw Basin area. but it probably reflects the manner of sampling.

Williams (1914, p. 43-44) concluded that the Seven Foot bed (prospect 30) is not the same coal bed as the Donnell bed (prospect 29), but he provisionally regarded the upper bed at Coal Butte (prospect 31) as the Seven Foot bed. He considered that some of the float coal along Squaw Creek, including the pieces he sampled from the M. J. Anderson claim (table 2), came from a seam below the Seven Foot bed, perhaps one equivalent to the lower bed at Coal Butte. As conglomerate is also exposed here along the creek, a local fold, or tilting of beds by landsliding, in the N½NW¼ sec. 28, as suggested by the writer in the fourth paragraph, above, is probably present to expose these deeper beds.

Lesher (1914b, p. 9-10) infers that the coals exposed at prospects 29, 30, and 31 are all in the same coal bed. His map shows this bed present under all of Squaw Basin north and northeast of Coal Butte, overlying the blue conglomerate. As discussed above under the heading of coal geology, the writer does not believe that the blue conglomerate is present in Squaw Basin except perhaps on the east side as local surface remnants on ridge tops. This view supports Williams' major observations and conclusions, also Lesher's earlier published conclusion (1914a, p. 30) which he later repudiated.

From the analyses (table 2), the general structure (pls. 1 and 2), and the stratigraphic correlations (pl. 3), the writer agrees with Williams, as well as with Lesher, that the upper bed at Coal Butte (prospect 31) is the same as the Seven Foot bed of the East Fork of Squaw Creek (prospect 30).

As noted above, unknown to each other, Lesher and Williams reached opposite conclusions concerning the correlation of the Seven Foot bed with the Donnell bed. Lesher infers they are the same, but Williams says there is no question but what they are distinct. Williams bases his opinion on the analyses and on the apparent stratigraphic separation. Concerning the analyses, it is true that the Donnell coal is higher in ash and correspondingly lower in Btu than the Seven Foot bed (table 3), but in sea-marginal coal swamps and lagoons, lateral variation in ash content is to be expected. Williams also states flatly that the two beds "are separated by a few hundred feet of sedimentary shales and sandstones." However, the writer observed that surface evidence of deep-seated landsliding is unmistakable in the 1.1 mile distance between prospects 29 and 30. Williams seems to have given considerable weight to the difference in attitude of the coal beds at the two occurrences, but this could be accounted for by either minor folding or by rotation of slump blocks involving either or both occurrences, as noted above.

The writer concludes that correlation of the Donnell coad bed with the Seven Foot coal bed in Squaw Basin is indeterminate without further core drilling. In thickness, in the clay parting, and in analyses on an ash-free, moisture-free basis, the coals are comparable. What is indeterminate is whether or not the Donnell coal is near the top of the same graded unit as the Seven Foot bed. It may be, as the sandstone bed on the ridge just north of the Donnell coal appears to be stratigraphically in the same position as the sandstone above the coal at Coal Butte and in core hole 102.

In summary, the data at hand on the nature of the occurrence of coal in the Tyee Formation in this area indicates that any land in this township underlain by Tyee Formation rocks may contain coal. Local coal zones may exist at many places throughout the stratigraphic section, from the oldest to the youngest known Tyee beds. The presence of carbonaceous shales and coal partings at the tops of most graded units indicate that subaerial environments were intermittent but repetitive, and the climate and vegetation were right for coal swamps to form. The problem is to find the location of the largest and cleanest of these coal occurrences. More core drilling for coal in the basin could be justified, particularly in view of the possibility of strip mining.

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Table 1. Logs of four core holes in SW¼ sec. 21

101. Spudded May 11, 1957, cased 50 feet, abandoned July 26, 1957. Following is a log prepared by R. G. Wayland from inspection of a log prepared by Lith-O-Log, Inc., supplemented by some notes made in 1963 during a brief inspection of the cores.

0-50	No record.
50-53	Conglomerate, small-pebble, brown, weathered.
53-70	Shale, silty, dark.
70-90	Siltstone, shaly, dark, indurated.
90-138	Sandstone, massive, fine- to medium-grained, light, with muscovite, jasper.
138-162	Interbedded dark siltstone and gray sandstone. Apparent dip 25°-35°.
162-168	Shale, compact, gray.
168-169	Shale, carbonaceous.
169-179	Shale, compact, gray.
179-182	Shale, gray, carbonaceous, with coal stringers.
182-188	Siltstone, massive, indurated, gray-green.
188-192	Shale, massive, gray-green.
192-204	No record.
204-208	Siltstone and shale, gray.
208-212	Sandstone, massive, gray, hard.
212-222	Siltstone.
222-228	Shale, massive, black.
228-246	Siltstone.
246-256	Shale, dark-gray, some carbonaceous partings.
256-262	Siltstone, massive, hard, gray-green.
262-266	Sandstone, fine, gray, with silty partings.
266-280	Shale, dark-gray, with carbonaceous partings.
280-298	Siltstone with some shale.
298-302	Sandstone, very fine, hard, gray.
302-314	Shale, carbonaceous, gray, with a few coal stringers. Megafossils.
314-332	Sandstone with some siltstone.
332-342	Siltstone.
342-374	Sandstone, massive, light-gray, well-sorted. Core badly fractured.
374-380	Shale, massive, dark-gray, hard, with interbedded siltstone.
380-384	Sandstone.
384-386	Siltstone, banded, carbonaceous.
386-392	Sandstone.
392-394	Coal partings.
394-398	Sandstone.
398-404	Siltstone.
404-410	Shale.
410-433	Sandstone.
433-434	Conglomerate, dark, sandy, pebble.

434-464	Sandstone.
464-500	Siltstone, dark-gray, slightly carbonaceous, with shale partings.
500-532	Sandstone, gray, fine- to medium-grained, hard, with thin carbonaceous stringers.
532-536	Siltstone.
536-576	Sandstone (micaceous, with biotite and muscovite - RGW).
576-586	Siltstone, gray, banded, with interbedded sandstone.
586-614	Sandstone, fine, gray.
614-620	Siltstone, gray, with sandstone stringers.
620-654	Sandstone, fine, bedded, gray, with carbonaceous inclusions.
654-658	Siltstone.
658-682	Sandstone, massive, hard, very fine, with siltstone partings.
682-694	Siltstone, gray to dark-gray, with sandstone and shale.
694-828	Shale, massive, dark-gray, hard, well-indurated.
828-876	Siltstone, gray, massive, hard, fossiliferous.
876-884	Sandstone, gray, hard, poorly sorted, fossiliferous.
884-914	Siltstone, massive, gray, interbedded with carbonaceous shale.
914-942	Sandstone, hard, light-gray, quartzose (with muscovite - RGW); also coarse, pebbly.
942-962	Conglomerate, coarse, gray, sandy; pebbles of basalt, chert, quartzite.
962-974	Shale, dark-gray, carbonaceous.
974-988	Siltstone.
988-1010	Shale, hard, dark, with carbonaceous streaks.
1010-1016	Siltstone, light-gray, fractured, slickensided.
1016-1024	Shale, gray, bedded, silty, with 6-inch carbonaceous shale with a few coal pieces.
1024-1036	Shale, massive, gray, fractured and slickensided.
1036-1042	Siltstone.
1042-1046	Sandstone, fine, hard, massive (dark-greenish graywacke with lithic fragments, no mica - RGW).
1046-1054	Siltstone, black to gray, hard, massive.
1054-1060	Shale, dark-gray, massive, slightly carbonaceous.
1060-1078	Siltstone, dark-gray.
1078-1086	Sandstone, medium- to coarse-grained, gray, quartzose (lithic fragments, no mica).
1086-1088	Conglomerate, light-gray.
1088-1094	Sandstone (dark, graywacke - RGW).
1094-1100	Conglomerate, gray; pebbles of quartz, chert, highly chloritized.
1100-1136	Sandstone, dark-gray, fine- to medium-grained, banded and cross-bedded (argillite bands - RGW).
1136-1138	Conglomerate, interbedded with siltstone.
1138-1150	Sandstone, medium-grained, with siltstone fragments.
1150-1196	Shale, gray-green, massive, slightly carbonaceous.
1196-1200	Sandstone, medium-grained, banded with siltstone. T.D.

102.

0-65	Sandstone, tan, medium-grained, micaceous.
65-85	Conglomerate, dark-gray.
85-120	Sandstone, tan, medium- to coarse-grained.
120-140	Siltstone, dark-gray, altered, with thin carbonaceous shale, and coal zones at 124, 129 and 134.
140-160	Sandstone, tan to gray, fine- to medium-grained.
160-162	Clay, brown to gray.
162-176	Siltstone, sandy, gray to dark gray, with thin coal partings.
176-182	Coal, bony, shattered, with thin clay partings.
182-184	Clay, light-gray.
184-186	Sandstone, light-gray, fine-grained.
186-201	Siltstone, gray, hard. Thin coal parting at 192.
201-214	Sandstone, fine-grained, well-cemented, hard. Thin coal parting at 213.
214-221	Sandstone, gray, medium- to coarse-grained, well-cemented.
221-230	Gravel, gray, well- to poorly cemented.
230-235	Conglomerate, gray, poorly cemented.
235-237	Sandstone, gray to green, medium-grained, hard.
237-244	Siltstone, dark-gray, hard. Thin coal partings.
244-274	Sandstone, gray to green, fine- to coarse-grained, hard.
274-309	Siltstone, dark-gray, hard. Occasional coal partings at 288, 298. Sandstone beds at 281, 285, 294.
309-319	Sandstone, gray, medium-grained, hard.
319-327	Siltstone, gray, slightly carbonaceous.
327-333	Interbedded gray, medium-grained sandstone, and sandy siltstone.
333-351	Sandstone, light-gray, medium-grained, well-consolidated, coarser at bottom. T.D.

103.

0-55	Sandstone, brown, medium- to coarse-grained.
55-70	Sandstone, gray and brown, medium-grained, micaceous, interbedded with arenaceous and gravel clay. Gravels at 56, 59, 63-65, and 69 feet.
70-85	Siltstone, gray, micaceous, interbedded with brown, medium-grained sandstone.
85-92	Sandstone, gray to brown, medium- to coarse-grained.
92-113	Siltstone, gray and brown, micaceous, arenaceous.
113-118	Sandstone, gray, fine-grained, hard. Some fracturing and slickensides.
118-128	Siltstone, dark-gray, interbedded with gray, fine-grained, hard sandstone.
128-133	Siltstone, dark-gray, hard, with thin coal partings at 129, 133.
133-155	Siltstone, crushed, dark-gray, hard. Thin coal partings at 135, 138.
155-163	Sandstone, gray, fine- to medium-grained, hard.
163-215	Siltstone, dark-gray, occasional coal and sandstone partings, incl. coal partings at 175, 183, 193, 198, 208.
215-218	Sandstone, gray, medium-grained, hard.
218-222	Siltstone, dark-gray, hard.
222-232	Sandstone, gray, fine- to coarse-grained, interbedded with siltstone.
232-234	Siltstone, gray, to carbonaceous shale.
234-246	Sandstone, gray, fine-grained, hard, to medium-grained compacted sand.
246-262	Siltstone, gray, micaceous, crushed, interbedded with gray, fine-grained sandstone.
262-287	Sandstone, gray, medium- to coarse-grained.
287-318	Siltstone, black, with occasional calcareous and sandstone beds.
318-320	Sandstone, gray, medium-grained, hard.
320-325	Siltstone, black, with occasional coal partings, e.g. at 321, 323.
325-343	Sandstone, gray, medium- to coarse-grained.
343-394	Sandstone, gray, medium-grained, hard, gradationally interbedded with conglomerate at 344, 348, 353, 358, 370, 379, 384, 386-389, 391-394.
394-416	Siltstone, dark-gray, with thin coal partings, e.g. at 398, 403, 406, 410, 413.
416-485	Sandstone, gray, fine-grained, with interbedded conglomerate in lower half. T.D.

104.

0-100	Sandstone, tan, medium- to coarse-grained, scattered zones of rounded pebbles.
100-102	Siltstone, gray, sandy.
102-108	Sandstone, gray, fine-grained.
108-133	Siltstone, gray, hard.
133-178	Sandstone, gray, fine- to medium-grained, hard.
178-185	Sandstone, gray, coarse-grained, hard.
185-190	Siltstone, black.
190-198	Sandstone, gray, fine- to medium-grained.
198-203	Interbedded black siltstone and fine- to medium-grained sandstone.
203-230	Siltstone, dark-gray, hard, with occasional sandstone. Coal partings at 205, 211, 215, 221, 226, 228.
230-238	Sandstone, gray, fine-grained, banded.
238-244	Siltstone, black, hard, with thin coal partings at 239, 241, 243.
244-260	Sandstone, gray, fine-grained.
260-270	Siltstone, dark-gray, hard.
270-288	Sandstone, banded, fine- to medium-grained, hard, with thin coal partings at 273, 276, 281, 286.
288-316	Siltstone, gray, hard. Shattered zone 302-307.
316-318	Sandstone, gray, fine-grained.
318-334	Siltstone, gray, hard.
334-337	Sandstone, gray, medium-grained.
337-350	Siltstone, black, with thin coal partings at 339, 342, 345, 347.5, and 349.
350-365	Sandstone, fine- to medium-grained, banded.
365-371	Siltstone, black.
371-396	Interbedded gray, medium-grained sandstone and black siltstone.
396-401	Siltstone, dark-gray. T.D.

Table 2. Summary of published coal analyses

Map No.	Prospect: Name	Sampler and date	Thickness: Bed	Thickness: Part sampled	Proximate analyses (as received, also moisture & ash free): Moisture	Volatile matter	Fixed carbon	Ash	S	Btu
13	Everett Assoc. - Meyer bed (?)	C. E. Lesher, 1913	5'11"	5'2"	15.1 -	33.2 51.4	31.4 48.6	20.3 -	1.29 2.00	9,040 13,990
16	W. B. Meyers - Meyer bed(?)	C. E. Lesher, 1913	8'9"	8'5"	9.2 -	34.2 51.5	32.3 48.5	24.3 -	1.68 2.52	9,190 13,810
18	O. L. Hollis - Anderson bed	W. M. Stephens, 1912?	6'3"	6'-	7.6 -	36.0 58.2	25.8 41.8	30.6 -	1.24 2.00	8,460 13,690
18	O. L. Hollis - Anderson bed	M. R. Campbell, 1912	6'10"	1'3½"	10.0 -	38.5 51.4	36.3 48.6	15.2 -	.63 .84	10,530 14,070
18	Anderson No. 1 (Peacock) adit - Anderson bed	Geer & Yancey, 1960	6'6"	6'6"	6.9	35.0	35.7	22.4	1.5	9,790 1/
29	G. W. Donnell - Donnell bed	C. E. Lesher, 1913	5'1"	4'3"	10.8 -	30.9 49.3	31.8 50.7	26.5 -	1.0 1.6	8,680 13,840
29	G. W. Donnell - Donnell bed	I. A. Williams, 1913	5'3"	5'	11.0 -	29.5 50.8	28.6 49.2	30.9 -	.98 1.68	7,670 13,200
30	Squaw Creek Assoc. - Seven Foot bed	C. E. Lesher, 1913	6'-	5'8"	12.6 -	35.0 48.2	37.7 51.8	14.7 -	1.3 1.8	10,350 14,230
30	Squaw Creek Assoc. - Seven Foot bed	I. A. Williams, 1913	7'	5'	10.8 -	35.5 49.7	35.7 50.3	18.0 -	1.53 2.15	9,550 13,400
30	M. J. Anderson prospect - below Seven Foot bed?	I. A. Williams, 1914	selected lumps from dump		2.53	45.08	41.96	10.44	-	-
31	Hillis prospect - Coal Butte upper bed	I. A. Williams, 1913	8'	selected fresh cuttings	12.8 -	42.8 53.6	37.2 46.4	7.2 -	N.A. N.A.	N.A. N.A.

1/ Washed coal - float on 1.80 S.G. from float-sink test.

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Table 3. Summary of observations on coal occurrences in Squaw Basin

Section	Prospect name	Observation (see plate 1)	Reference	
			Lesher	Williams
16 - SW$\frac{1}{4}$SW$\frac{1}{4}$?	Harry B. Hillis	Adit 90 ft. A bed of carbonaceous shale less than 2 ft. thick.	b., 8	-
(20 - S$\frac{1}{2}$SE$\frac{1}{4}$) (29 - NE$\frac{1}{4}$)	Several shallow prospects	Along W. fork of Squaw Creek. Found no coal or rock in place.	b., 8	38
21 - SW$\frac{1}{4}$NE$\frac{1}{4}$	Harry B. Hillis	Adit 30 ft. southerly. Many lumps and masses of crushed coal. No coal in place. Hard blue shale at 30 ft.	-	40
21 - NE$\frac{1}{4}$NW$\frac{1}{4}$NW$\frac{1}{4}$	Road cut	One-foot weathered coal seam in interbedded sands and shales noted by R.G. Wayland. Strike N. 30° E., dip 10° E.	-	-
21 - SW$\frac{1}{4}$	4 core holes, Pacific Power & Light	See table 1, figure 2, plate 3. Hole 102 in SE$\frac{1}{4}$SW$\frac{1}{4}$ cored a 6-ft. bed of bony coal at 176 ft. depth, also coal zones and partings at other depths.	-	-
21 - SW$\frac{1}{4}$SW$\frac{1}{4}$	Several shallow prospects	Along lower E. fork of Squaw Creek. Found no coal or rock in place.	b., 8	38
21 - E$\frac{1}{4}$ cor.	C. R. Count	Long shallow adit driven southwesterly. Some coal pieces and much crushed coal in "mud". No coal or rock in place.	b., 8	40
22 - N$\frac{1}{2}$NW$\frac{1}{4}$	G. W. Donnell (prospect 29)	Two adits. Upper adit struck 5-ft. coal bed at 25 ft. Lower found only clay with coal fragments for 50 ft. See table 2, analyses.	a., 30, 36 pls. 24, 25	38-42
28 - N$\frac{1}{4}$ cor.	Squaw Creek Assoc. (prospect 30)	In the Seven Foot bed of Williams. Adit north at stream level for 30 ft., of which last 15 ft. in coal dipping 26° NW. Upper part of bed shattered. See table 2, analyses.	a., 37, 41-2 pls. 24, 25	39-43
28 - NE$\frac{1}{4}$NW$\frac{1}{4}$	M. J. Anderson	A 40-ft. adit through loose bouldery clay with masses of broken coal. Williams considers the coal to be from a bed stratigraphically below the Seven Foot bed. See table 2, analysis.	-	40-43
(32 - N$\frac{1}{2}$NE$\frac{1}{4}$) (33 - NW$\frac{1}{4}$NW$\frac{1}{4}$)	Coal Butte (prospect 31)	Adit 40 ft. in NE$\frac{1}{4}$NE$\frac{1}{4}$ sec. 32 is in upper of two beds. Coal described as weathered and checked at 40 ft. See plate 3, table 2. Williams correlates the upper 8-ft. bed with the Seven Foot bed. Lower bed is 12 ft. of "coaly material".	b., 8	36-7, 43