The Leyden Uranium Prospect, Jefferson County, Colorado

Trace Elements Memorandum Report 132

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25, D. C.

NOV 30 1950

AEC - 260/1

Dr. Phillip L. Merritt, Assistant Manager,
Raw Materials Operations
U. S. Atomic Energy Commission
P. O. Box 30, Ansonia Station
New York 23, New York

Dear Phil:

Transmitted herewith for your information and distribution are eight copies of Trace Elements Memorandum Report 132, "The Leyden uranium prospect, Jefferson County, Colorado" by Garland B. Gott, November 1950.

This report presents new information on the geologic relationships at the Leyden prospect in addition to that given in Trace Elements Investigations Report 9. Because of the discovery of uraniferous lignites in other areas, it appeared advisable to collect as much information as possible concerning this mineralized coal bed. Consequently, included in this report is much of the unpublished material gathered by C. R. Butler during his recent study of the area as part of his Master's thesis at the University of Colorado.

The Old Leyden coal mine workings are being reopened at the present time and the Reconnaissance Group will again examine the property when the uraniferous deposits have been reached.

Other copies of this report are being distributed as shown on the attached distribution sheet.

Sincerely yours,

/s/ W H Bradley

W. H. Bradley
Chief Geologist

JAN 29 1951

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

THE LEYDEN URANIUM PROSPECT, JEFFERSON COUNTY, COLORADO

by

Garland B. Gott

November 1950

Trace Elements Memorandum Report 132

USGS - TEMR 132
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THE LEYDEN URANIUM PROSPECT,

JEFFERSON COUNTY,

COLORADO

by

Garland B. Gott

Abstract

The Leyden uranium prospect is in sec. 28, T. 2 S., R. 70 W., Jefferson County, Colo. Examination of the property was made in February 1950.

Uranium was first reported in this locality in 1875 by Captain E. L. Berthoud, who noted uranium minerals associated with the main coal bed. The Old Leyden coal mine workings have long been abandoned and caved, but specimens of the uranium-bearing rock can be seen on the old dump 700 feet to the south.

The mineralized coal bed is 10 to 12 feet thick and occurs near the base of the Laramie formation of Upper Cretaceous age. Uranium minerals are present in the form of yellow incrustations and inclusions in fractured and partly silicified coal. Petrographic studies indicate that the silica and uranium minerals were deposited after deposition and carbonization of the coal. Secondary uranium minerals also were found by C. R. Butler along the outcrop of the sandstones in the Laramie formation.

No uranium minerals were found in place by the writer, but four samples from the dump contained 0.001, 0.005, 0.17 and 0.69 percent uranium.

Introduction

The Leyden uranium prospect is in sec. 28, T. 2 S., R. 70 W., 6th principal meridian, in the northern part of Jefferson County, Colo. (fig. 1). The property is along State Highway 93, about one mile south of the Denver and Salt Lake Railroad, and is owned by Mrs. Susan M. Lindsay of Denver, Colo.

Uranium was first reported in this locality by Captain E. L. Berthoud / in 1875. While examining the Old Leyden coal mine, Berthoud

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/ Berthoud, E. L., On the occurrence of uranium, silver, iron, etc., in the Tertiary formations of Colorado Territory: Acad. Nat. Sci. Philadelphia Proc., vol. 27, pp. 363-365, 1875.

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noted uranium minerals associated with the coal bed. The deposit has been mentioned in subsequent articles by Fleck / and Wilson /. The

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/ Fleck, Herman, A series of treatises on the rare metals: Colo. Sci. Soc. Proc., vol. 11, pp. 103-176, 1916.

/ Wilson, J. H., An occurrence of carnotite near Denver: Eng. and Min. Jour.-Press, vol. 116, No. 6, pp. 239-240, 1923.

Old Leyden coal mine workings have long been abandoned and caved, but specimens of the uranium-bearing rock can be seen on the coal dump.

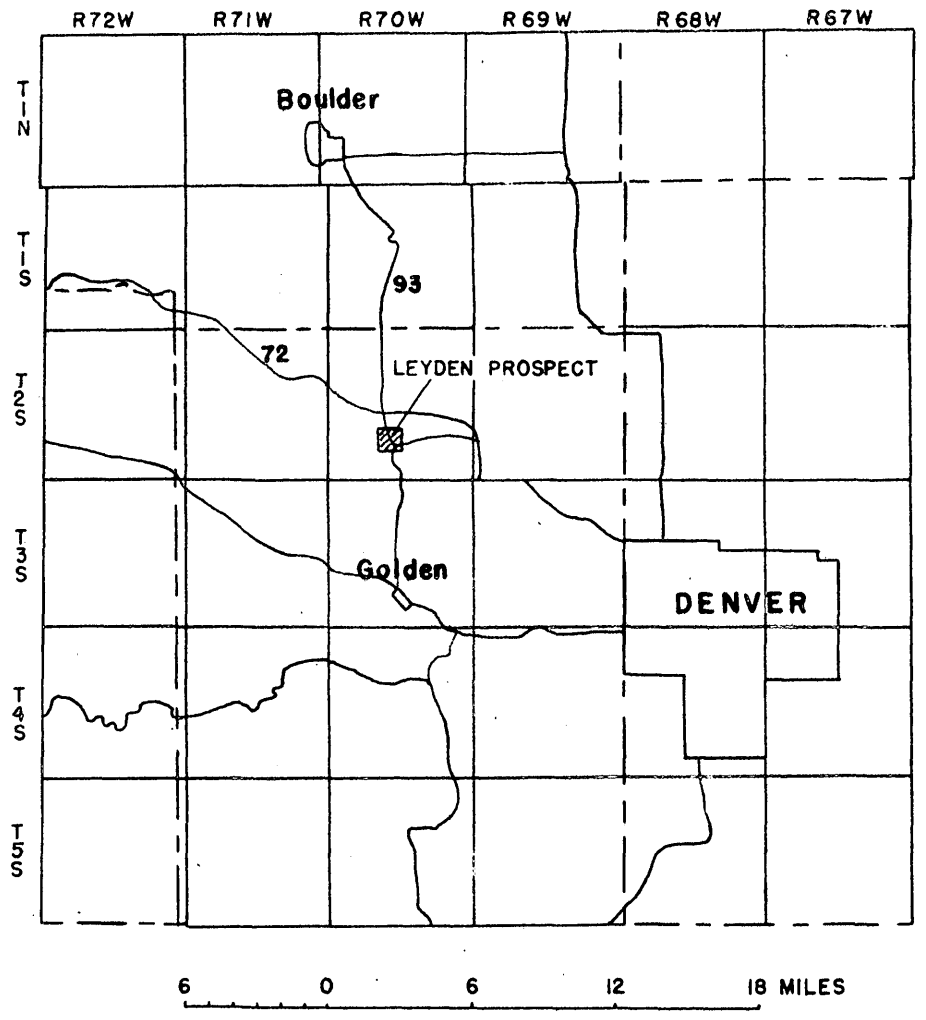

FIGURE 1.— INDEX MAP SHOWING LOCATION OF LEYDEN URANIUM PROSPECT, JEFFERSON COUNTY, COLORADO.

Slaughter and Clabaugh _/ gave a short description of the uraniferous

_/ Slaughter, A. L. and Clabaugh, S. E., Official communication, 1945.

material on the dumps of the Leyden mine. This property was re-examined briefly in February 1950, by Garland B. Gott and John W. Adams of the U. S. Geological Survey as part of the general investigation of lignites and coals. Charles R. Butler _/ mapped and described the geology of the

_/ Butler, C. R., Structure of the post-Cambrian formations in the vicinity of Coal Creek, Colorado: Unpublished Masters' thesis, University of Colorado, 1950.

uranium prospect in 1949-1950 as part of a Masters' thesis presented at the University of Colorado. The unpublished maps (pl. 1 and fig. 2) and thesis were made available by Butler for use in preparing this report.

Development on the prospect consists of the Old Leyden coal mine workings, now caved, which extended from the portal northeastward to the coal bed; surface and underground clay workings; and shallow caved workings on the coal bed about 700 feet south of the Old Leyden coal mine. The present Leyden coal mine workings are about 2 miles east of this area (pl. 1).

The Moreno-Cripple Creek Corporation of Colorado holds an option to lease the Leyden property and in August 1950 was doing development work to determine the value of the deposit.

General geology

The Leyden uranium prospect is in the foothills region of the Colorado Front Range. Sedimentary formations of pre-Tertiary and early Tertiary age are exposed along the eastern flank of the range.

The prospect is in the Upper Cretaceous Laramie formation which crops out about 3 miles east of the contact between the sediments and the pre-Cambrian igneous rock of the Front Range. The formation consists of about 600 feet of interbedded sandstones, clays, carbonaceous claystones, and thin lenticular lignite coal beds. Dips of the basal sandstones of the Laramie formation range from 45° E. to vertical. Near the Leyden prospect, the basal sandstones are vertical or slightly overturned, and form a conspicuous, elongate topographic feature known as Leyden Ridge.

Butler _/ made a detailed structural study of the Leyden Ridge

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_/ Butler, C. R., op. cit.

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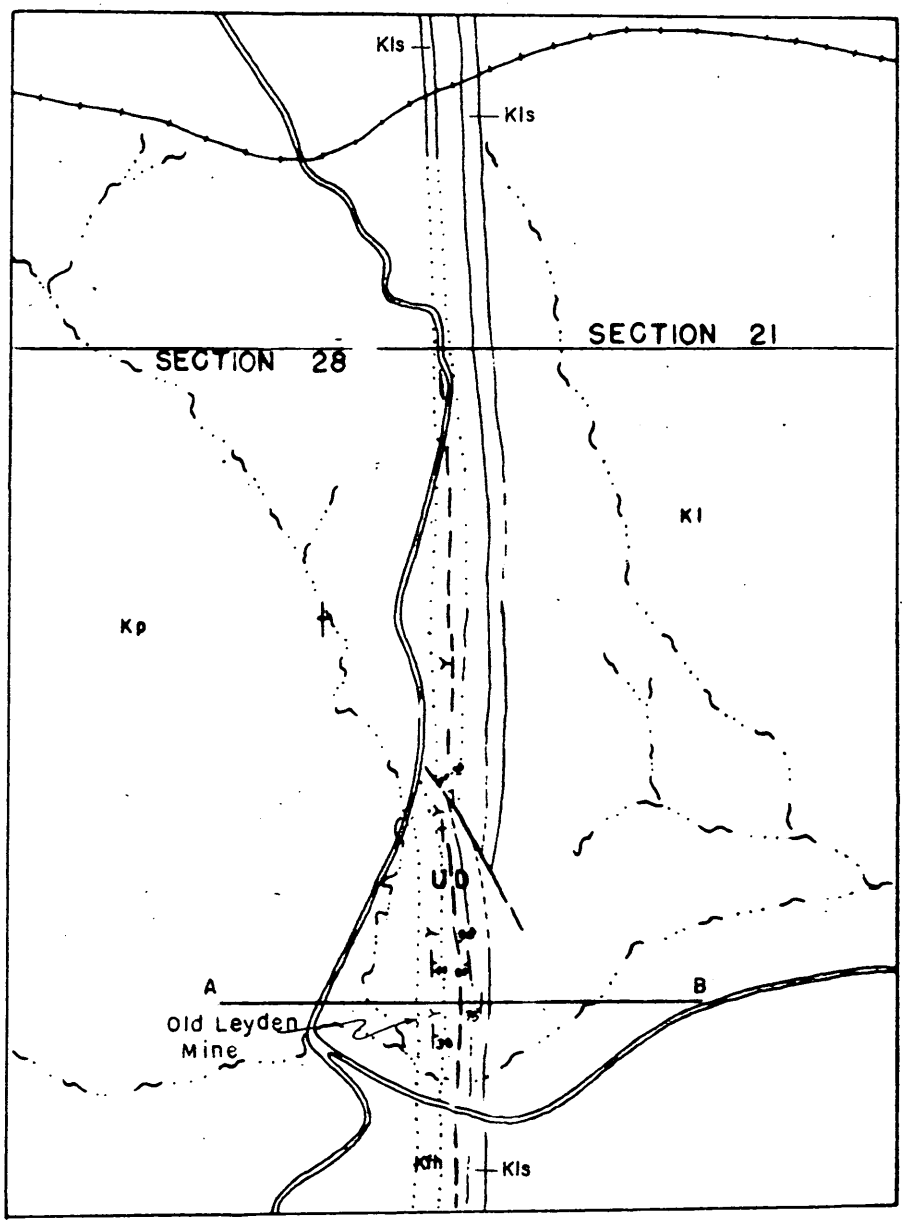
area and concluded that a north-trending fault, probably associated with the Golden thrust fault to the south, was present along the ridge.

Uranium minerals occur in a lignite bed about 10 feet thick, directly west of the ridge-forming sandstones (fig. 2 and pl. 1). Secondary uranium minerals were also found along the outcrop of the Laramie sandstones directly east of the lignite.



Explanation

Upper Cretaceous

Kls-Kl — Laramie formation with ridge forming sandstone (Kls)

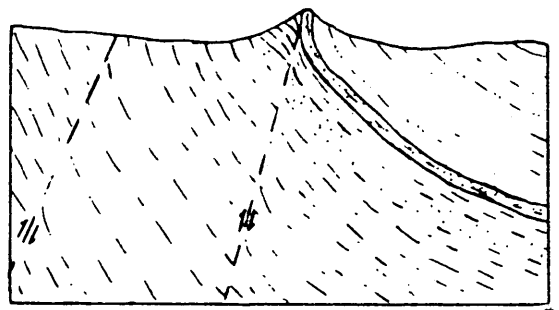
Kth — Fox Hills formation

Kp — Pierre formation

Inferred fault

Mine Adit

N



0 440 880 1760 2640

Scale in feet

GEOLOGIC MAP of LEYDEN RIDGE

Sections 21 and 28, T. 2 S., R. 70 W.,
Jefferson County, Colorado

Charles Butler 1950

FIGURE 2

The uranium deposit

Mineralogy

The uranium minerals at the Leyden prospect occur as yellow incrustrations and inclusions in fractured and partly silicified coal. Berthoud [1] described the material as "an exceedingly hard black vein

[1] Berthoud, E. L., op. cit.

of mineral matter, containing geodes of brilliant quartz crystals, and small veins of pyrites, the honeycombed mineral full of a green ochrey powder, with veins of chalcedony, and small orange-colored crystals and concretions."

Petrographic studies of dump specimens by Butler [2] show that the

[2] Butler, C. R., op. cit.

uranium minerals are associated with quartz, and that the lignite fragments themselves are unaltered (fig. 3). Qualitative chemical tests showed that both uranium and vanadium are present. According to Wilson [3]

[3] Wilson, J. H., op. cit.

the uranium mineral is carnotite. However, the variety of colors mentioned by Berthoud in his description of the deposit and the fact that some of the rock is fluorescent under ultraviolet light indicate that several secondary uranium minerals are probably present.

Figure 3.--Camera lucida drawing of a thin section of the silicified and mineralized coal showing a network of quartz veinlets around the coal fragments. Black areas are coal fragments, lined areas are quartz veinlets, white areas are open spaces, and stippled areas are uranium minerals. (From Charles R. Butler, 1949.)

Origin

The coal from this mineralized zone has been highly brecciated and pulverized. The brecciation was probably contemporaneous with the upturning and faulting of the enclosing sediments during the Laramide revolution. The coal fragments were cemented by a network of thin quartz stringers and the walls of the larger openings were coated by drusy quartz crystals. In the specimens examined by Butler from 10 to 90 percent of the rock mass was silicified. The sharp boundaries between the coal fragments and the siliceous material indicates that the silica and associated minerals were added after the organic material had been deposited and carbonized.

The following hypotheses should be considered in any attempt to determine the source of the uranium.

(1) Uranium salts were deposited in the Laramie sandstone at the time of sedimentation _/. Later the uranium was dissolved in the ground

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_/ Wilson, J. H., op. cit.

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water and concentrated in the underlying coal.

(2) The mineral solutions containing uranium had a deep-seated igneous source and moved upward along faults. The basaltic dikes and sills in the vicinity of the Leyden property may have a genetic connection with the deposits.

(3) Uranium was deposited in formations older than the Laramie, such as the Morrison sandstone, Dakota sandstone, or Pierre shale, and was

transferred to the coal of the Laramie formation by solution and redeposition from ground waters.

Grade and size

According to Berthoud's _/ description, uranium-bearing rock was

_/ Berthoud, E. L., op. cit.

found at two places in the Old Leyden mine, and locally, completely replaced a coal bed from 10 to 12 feet thick. Specimens of the uranium-bearing rock were found by the writer only on a coal dump about 700 feet south of the Old Leyden mine (pl. 1).

Recent analyses made in the laboratories of the U. S. Geological Survey and the Atomic Energy Commission are shown in the following table.

Denver serial number	Sample number	Equivalent U_3O_8 (percent)	U_3O_8 (percent)	Remarks
	1	0.40	---	Silicified coal.
	2	0.66	---	Do.
19197	3	0.17	0.17	Do.
19196	4	0.003	0.005	Do.
17550	5	0.48	---	Composite sample of silicified coal.
19198	6	0.000	0.001	Unsilicified coal.
31240	7	0.60	0.69	Twenty-pound composite sample of silicified coal. Also contains 0.80 percent V_2O_5.

Analyses by Berthoud _/ showed that the uranium-bearing rock

_/ Berthoud, E. L., op. cit.

contained from 0.2 to 2.0 percent uranium and 8 oz. bullion (probably silver).

Wilson _/ reported the following equivalent uranium analyses, which

_/ Wilson, J. H., op. cit.

were made at the Colorado School of Mines.

	Equivalent U_3O_8
Average of carnotite-stained rock from old coal dump	0.397
Silicified coal from near openings described by Berthoud	0.282
Unsilicified coal from seam near old workings of Leyden coal mine	0.076
Picked specimens of carnotite-stained silicified coal	1.300
Unstained Laramie sandstone	negative

Further development of the property is necessary before an adequate evaluation of the ore body can be made.