

(200)

T67a

no. 722

DISTRIBUTION OF URANIUM  
IN ROCKS OF PENNSYLVANIAN AGE  
IN NORTHEASTERN OKLAHOMA, SOUTH-  
EASTERN KANSAS, AND WESTERN MISSOURI

By Walter Danilchik and H. J. Hyden

---

Trace Elements Investigations Report 722

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY



Geology and Mineralogy

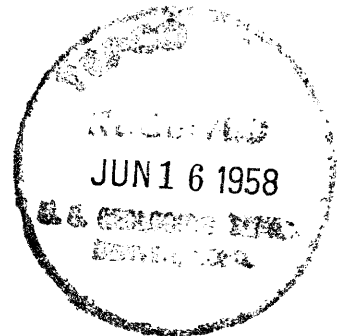
UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

DISTRIBUTION OF URANIUM IN ROCKS OF PENNSYLVANIAN AGE  
IN NORTHEASTERN OKLAHOMA, SOUTHEASTERN KANSAS,  
AND WESTERN MISSOURI\*

By

Walter Danilchik and H. J. Hyden

May 1958



Trace Elements Investigations Report 722

This preliminary report is distributed without editorial and technical review for conformity with official standards and nomenclature. It is not for public inspection or quotation.

\*This report concerns work done on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

## USGS - TEI-722

## GEOLOGY AND MINERALOGY

<u>Distribution</u>	<u>No. of copies</u>
Division of Raw Materials, Albuquerque.....	1
Division of Raw Materials, Austin.....	1
Division of Raw Materials, Casper.....	1
Division of Raw Materials, Denver.....	1
Division of Raw Materials, Rapid City.....	1
Division of Raw Materials, Salt Lake City.....	1
Division of Raw Materials, Spokane.....	1
Division of Raw Materials, Washington.....	3
Grand Junction Operations Office.....	1
Production Evaluation Division, GJOO.....	1
Technical Information Service Extension, Oak Ridge.....	6
U. S. Geological Survey	
Foreign Geology Branch, Washington.....	1
Fuels Branch, Washington.....	1
Geochemistry and Petrology Branch, Washington.....	1
Geophysics Branch, Washington.....	1
Mineral Deposits Branch, Washington.....	1
A. L. Brokaw, Grand Junction.....	1
N. M. Denson, Denver.....	1
R. L. Griggs, Albuquerque.....	1
P. E. Hotz, Menlo Park.....	1
W. R. Keefer, Laramie.....	1
E. M. MacKevett, Menlo Park.....	1
L. R. Page, Washington.....	1
P. K. Sims, Denver.....	1
Q. D. Singewald, Beltsville.....	1
A. E. Weissenborn, Spokane.....	1
TEPCO, Denver.....	2
TEPCO, RPS, Washington, (including master).....	2

DISTRIBUTION OF URANIUM IN ROCKS OF PENNSYLVANIAN AGE IN NORTHEASTERN  
OKLAHOMA, SOUTHEASTERN KANSAS, AND WESTERN MISSOURI

By Walter Danilchik and H. J. Hyden

ABSTRACT

Sedimentary rocks of Middle Pennsylvanian (Des Moines) age in northeastern Oklahoma, southeastern Kansas, and western Missouri comprise cyclothems that include both marine and nonmarine lithologic units. Distribution of uranium and other trace elements in these rocks was studied during 1955 and 1956. Rocks of primary interest were black shales and phosphatic nodules but samples of coal, oil-well fluids, and naturally occurring hydrocarbons were also collected for chemical analysis for uranium and for semiquantitative spectrographic analysis for other trace elements. The investigation was conducted by the U. S. Geological Survey on behalf of the Division of Raw Materials of the U. S. Atomic Energy Commission.

Two general types of black shale were differentiated in the rock units under study: those containing conspicuous numbers of phosphatic nodules and those containing very few or no phosphatic nodules. For the purposes of this report these two types are called phosphatic shale and carbonaceous shale, respectively. The average uranium content of carbonaceous shales from six rock units in the Des Moines series ranges from less than 0.001 to 0.002 percent. The average uranium content of eight phosphatic shale units ranges from 0.002 to

0.005 percent. Phosphatic nodules from these phosphatic shale units have average uranium contents ranging from 0.009 to 0.023 percent and average  $P_2O_5$  contents ranging from 23.9 to 29.4 percent. Channel samples of phosphatic shale from closely spaced intervals have uranium contents ranging from 0.004 to 0.009 percent; gradational range in uranium content across small horizontal distances is as great as the total uranium content range on a regional basis. In general, the lower parts of phosphatic shale units have larger uranium and phosphate contents than the upper parts. There is as much as 60 percent variation in the uranium content of phosphatic nodules from the same outcrop, and lens-shaped nodules and light-colored nodules are less phosphatic and less uraniferous than round nodules or dark-colored nodules from the same outcrop.

The uranium in the black shale is concentrated mostly in the phosphatic material, probably as a substitute for calcium in minerals of the apatite group. Precipitation of phosphate, uranium, and sulfides took place about nuclei of brachiopod and other shell fragments and fish spines and teeth. Closely spaced samples collected in a quarry near Fort Scott, Kans., show lateral gradations in the ratio of uranium to phosphate. These gradations may have resulted from randomly distributed local areas of small differences of abundance or availability of calcium as compared to uranium. At a locality in Bourbon County, Kans., the uppermost few inches of the Mulky coal bed contains as much as 0.085 percent uranium in the ash of the coal (11.8 percent ash); the lower part of the coal bed contains much less uranium but contains as much as 0.07 percent germanium in the

ash of the coal (8.0 percent ash). No unusual amounts of other trace elements were found in any of the other rocks but the phosphatic nodules contain rare earths, including dysprosium, erbium, and neodymium, in concentrations that correlate directly with  $P_2O_5$  contents and are generally higher than in phosphatic rocks from other areas.

Recycled water in areas of secondary production in the Nowata oil field, Oklahoma, was collected at injection and at production wells; some of the samples of produced water showed gains in sulfate, uranium, and radioactive daughter products of uranium as compared to the samples of water prior to injection. Uranium contents of the oil from this field range from 0.007 to 0.052 percent of the ash of the oil and from 0.0010 to 0.0358 parts per billion in the oil. The highest percentages of uranium are in samples from the Lowery water-flood area in the Nowata field. Coaly material, asphalt-like material, and oil extracted from cores of the oil-producing horizon in this area were separated and analyzed; only the ash of the extracted oil was found to contain appreciable amounts of uranium.