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UNITED STATES ATOMIC ENERGY COMMISSION
DIVISION OF RAW MATERIALS
SALT LAKE EXPLORATION BRANCH
[Publication]

AIRBORNE RADIOMETRIC RECONNAISSANCE OF PARTS OF CENTRAL MONTANA

by

H. W. Norman
and
Earl M. P. Lovejoy

June 1955

To: Robert D. Nininger, Assistant Director for Exploration, DRM, Washington, D. C.

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From: Ernest E. Thurlow, Chief, Salt Lake Exploration Branch

Subject: TRANSMITTAL OF REPORT - RME-2034

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OF PARTS OF CENTRAL MONTANA

ABSTRACT

A program of airborne reconnaissance of areas in central Montana was begun in July of 1953 and completed in October 1953.

The central Montana uplifted area, including portions of the North Moccasin, South Moccasin, Judith, and Big Snowy Mountains, was examined. Emphasis was given to the Eagle and Virgelle formations of Cretaceous age, with Cretaceous-Tertiary intrusives given some attention.

Seven anomalies were discovered, one in the intrusives of the Judith Mountains and six in the Eagle sandstone. None of the anomalous areas contain significant uranium mineralization.

The Eagle and Virgelle sandstones were also flown in the Sweetgrass Hills and in the Kevin Rim area on the west flank of the Sweetgrass Arch. The intrusive cores of the Sweetgrass Hills were also examined. No anomalous radioactivity was detected.

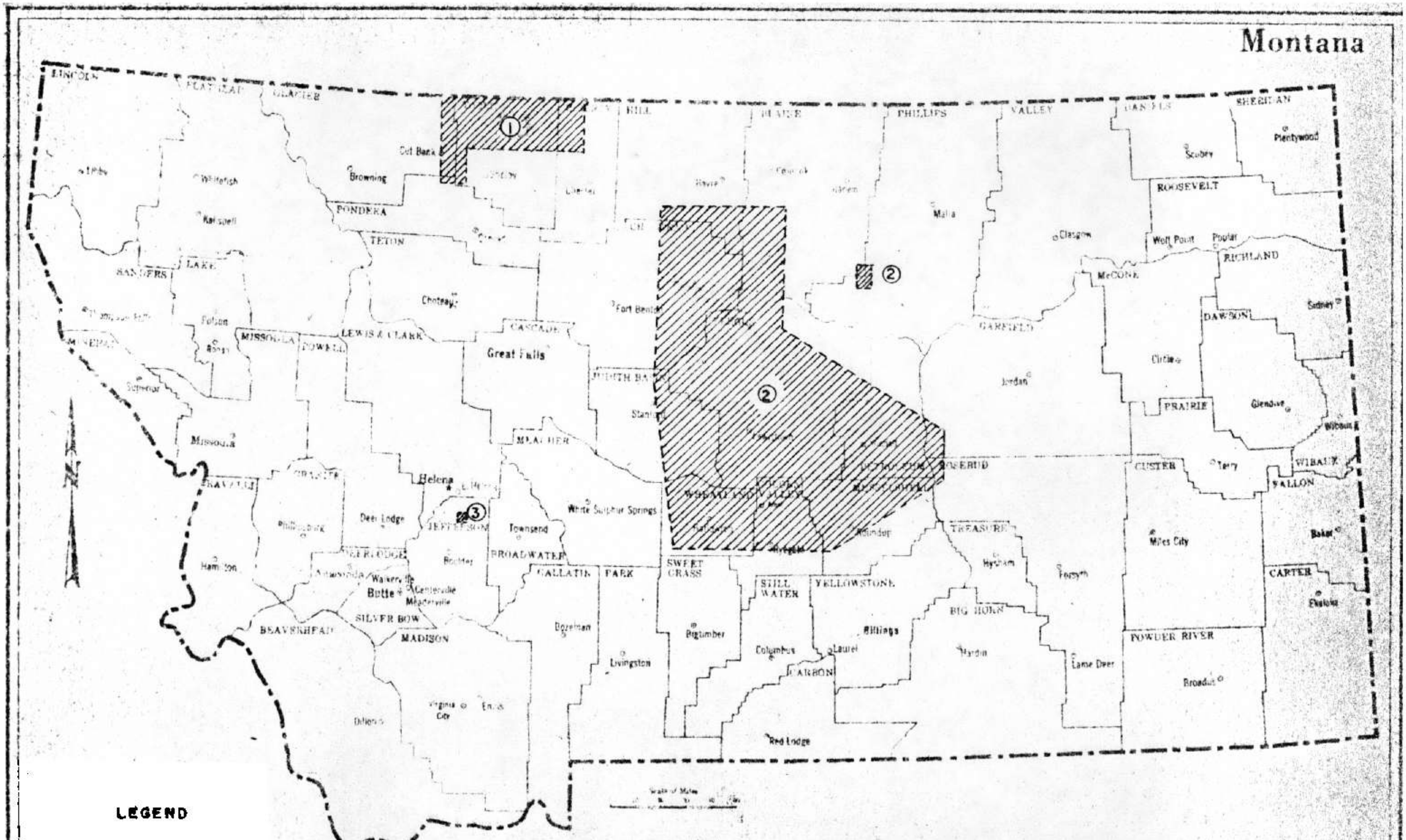
The feasibility of airborne reconnaissance in detecting vein type deposits in the Boulder batholith was tested briefly in an area containing several known uranium deposits. The experiment indicates that vein type deposits are not readily detected by airborne methods in such terrain.

INTRODUCTION

An airborne radiometric reconnaissance program in central Montana, the Sweetgrass Hills and Arch area, and the Clancy area of the Boulder batholith was completed in October 1953, (see Figure 1).

These areas are characterized by a semi-arid climate with wide extremes of temperature, ranging from 100° F. in summer to -40° F. in winter. Airborne procedures had to be varied according to different terrain requirements. A Piper Super Cub equipped with a Mark VI Scintillometer was used for this project.

This report is divided into three parts, and each area is discussed separately according to its geology, the airborne procedures employed, and the conclusions reached.



LEGEND

① - Sweetgrass Hills
② - Central Montana Area
③ - Clancy Area of Boulder Batholith

INDEX MAP to accompany Report on Airborne Reconnaissance in Montana

U.S. AEC Butte Sub-Office 11-53

CENTRAL MONTANA AREA

Introduction

The central Montana airborne reconnaissance project covered about 180 square miles in Hill, Wheatland, Judith Basin, and Garfield counties. The project was started August 10, 1953, and ended October 9, 1953.

Ground reconnaissance, particularly in the Judith Mountain area, had been carried on in central Montana prior to the arrival of the airborne crew. The old mining districts, mainly gold and silver-bearing, were the focal points of attention. At present there is no active metal mining.

Rolling plains surround the region flown. Four ranges, the Judith, North Moccasin, South Moccasin, and Big Snowy mountains, with maximum elevations of 6,428 feet, 5,700 feet, 5,200 feet, and 8,600 feet, respectively, are located in the area.

Good paved or graveled roads traverse the perimeters of the mountainous area, and passable roads penetrate to the interior.

Geology

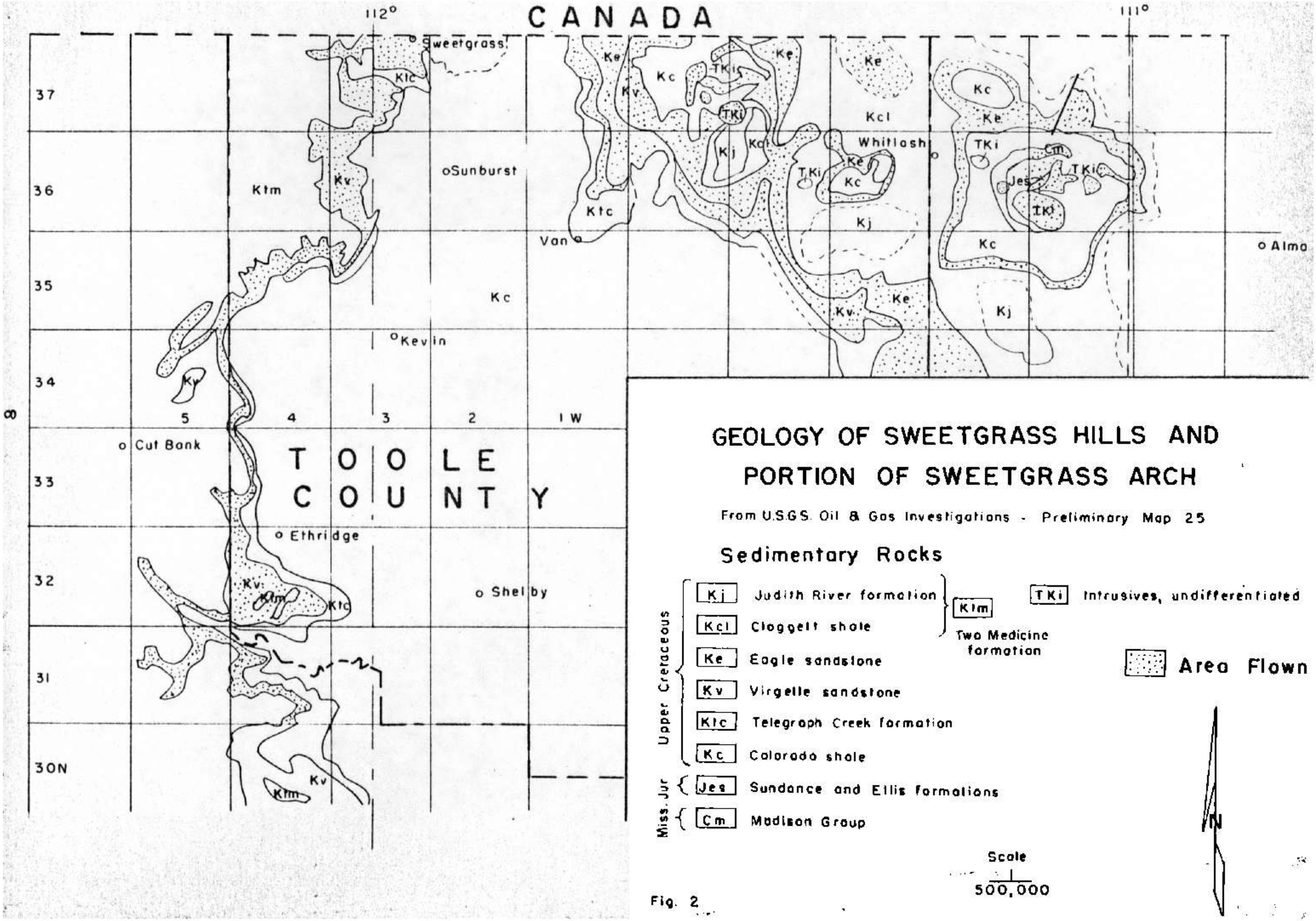
The central Montana area consists of a thick series of sedimentary rocks uplifted around a series of intrusions (Figure 2). Only formations ranging from Mississippian to lower Tertiary are exposed to any extent (Figure 3).

The intrusives are for the most part felsic to intermediate in composition, being predominantly syenite porphyry with a small percentage of granite (Corry, 1933). Phonolite and tinguaite porphyry dikes and sills are common, cutting both the syenite porphyry and the surrounding sediments.

Most mineralization in the area is hydrothermal in origin, with the mineral deposits generally occurring close to the contact of the igneous cores with adjoining carboniferous limestones.

Stratigraphy

The Eagle formation was the only horizon that exhibited anomalous radioactivity. This formation is essentially a massive sandstone



GEOLOGY OF SWEETGRASS HILLS AND PORTION OF SWEETGRASS ARCH

Fig. 2

GENERALIZED SECTION OF SEDIMENTS IN CENTRAL MONTANA EXAMINED BY AIRBORNE RECONNAISSANCE

ERA	PERIOD	GROUP	FORMATION	THICKNESS (feet)	LITHOLOGY
CEN.	Tertiary		Tullock	300	Yellow ss & sh with lent. coal beds, calcareous bands carbonaceous sh.
MESOZOIC	Upper Cretaceous		Hell Creek	400-600	Fresh Water deposits of alt. ss and clay shales.
		Montana Group	Fox Hills	50-500	Gray to yellowish ss and sandy sh.
		Montana Group	Bearpaw	600-700	Marine, dark clay sh. w/calc. concret.
		Montana Group	Judith River	300-600	Interbedded light-colored ss & sandy sh, locally carbonaceous.
		Montana Group	Claggett	400	Marine shales and sandstones.
		Montana Group	Eagle	50-300	Brown, lignitic, nodular ss to friable massive.
		Montana Group	Virgelle	220	Gray-buff, coarse-gr., massive ss, x-bedded. Fe upper ½, sh. lower ½.
			Colorado Group	2200	Dark shales.
	Lower Cretaceous	Kootenai	1st Cat Gr. 2nd Cat Gr. 3rd Cat Gr.	300-600	Sandstone beds with interbedded vari-colored clay-shale and silts.
	Jurassic		Morrison	200	Fresh water shales & dirty ss.
		Ellis Group	Swift	10-300	Fine-gr., thin-bedded, glauconitic ss. often calc. & foss., interbedded sh.
		Ellis Group	Rierdon	50-250	Gray to gray-green, calcareous shales. Locally sandy.
		Ellis Group	Piper	0-150	Vari-colored shales & silts. Thin limestones & some gypsum.
		Ellis Group	Gypsum Spring	50-200	Gypsum, red silts, & clay shales, interbedded earthy dol. & ls.
	Triassic		Absent		
PALEOZOIC	Permian		Absent		
	Upper Penn.		Absent		
	Lower Penn.		Amsden	150-350	Red shales, white limestones & cherts, sandy, limestones.
	Miss.	Big Snowy Gr.	Heath	0-400	Black, fissile, marine, shaly with local beds bl. dense ls. thin ss beds.
		Big Snowy Gr.	Otter	100-500	Alternating vari-colored shales & earthy nodular limestone.
		Big Snowy Gr.	Kibbey	50-300	Red to yellow, dirty ss and red sh. Occasional gypsum & anhydrite.
		Madison Gr.	Charles	50-600	Clastic to dense & crystalline ls. Interbedded anhydrite.
		Madison Gr.	Mission Canyon	300-500	Massive, white, clastic marine ls.
		Madison Gr.	Lodgepole	300-800	Thin-bedded limestone, locally very cherty to anhydrite with occ. sh.

Figure 3

ranging in thickness from 50 to 300 feet. The basal member, known as the Virgelle sandstone, contains shaly beds with lignitic staining, concretions, and nodular iron. These grade up into a pure white sandstone which forms bluffs up to 100 feet high along the Missouri River. The upper portion of the formation contains interbedded lignite seams, (Weed, 1899). Marine fossils have been found in both sandy and shaly zones east of central Montana, and Stanton and Hatcher (1903) postulate a north-south shoreline across central Montana in upper Cretaceous time.

Geology of Deposits

The airborne reconnaissance discovered seven radiometric anomalies. Six of the anomalies were detected in a restricted horizon of the Eagle sandstone. This favorable indurated zone, varying from five to fifteen feet in thickness, occurs as closely as could be determined at the top of the Virgelle sandstone, the basal member of the Eagle formation.

Dark brown iron staining was the most diagnostic feature of the radioactive bands. The stained zones seldom exceeded a few feet in thickness, and radioactivity appeared directly proportional to the iron content.

All the anomalies occur on the limbs of prominent anticlinal features, namely, the Cat Creek, Shawmut, and Devil's Basin anticlines. The degree of radioactivity appeared to vary directly with the dip of the bedding, and the more radioactive beds had less lateral extent than the weakly anomalous beds.

Airborne Procedures

Type of Coverage

The extremely varied terrain that was flown in the central Montana region required different methods of flight examination. Rim flying methods were utilized in the Judith and Arrow River areas along the Eagle and Virgelle sandstone outcrops. Altitudes or distances from rims were generally less than 75 feet and as little as 20 feet. Flights along cuestas were used in the area of the Judith and Big Snowy mountains. In some places these flights were ten miles long and the rate of coverage was high. Rim flying methods were used where dissection had increased the scarp length of the cuestas. The Eagle and Virgelle sandstone outcrops have been examined almost completely in central Montana east of a line from Harlowtown to the Judith River debouchment and north of the Musselshell River.

The Kootenai and Morrison formations, and the Ellis group between the Big Snowy Mountains and the approximate latitude of Lewistown, and from south of Moore on the west to near Grass Range on the east, have been examined by rim and grid flying methods. Grid methods were used in the large flat areas, and rim flying methods were used in the canyons and along the scarps. Altitudes varied from ten to 75 feet and grid spacing was about 500 feet. About ten percent of the mapped formations and about 75 percent of the outcrops of these formations were examined.

The Cretaceous-Tertiary intrusives of the Judith, Moccasin, and Bearpaw mountains were examined by flights down canyons and around mountain slopes. About 25 to 50 percent of the intrusive outcrops was examined. Approximately 50 percent of the mapped extent of the intrusives in the Judith Mountains was covered. Altitudes of flight lines varied from 25 to 200 feet. Grid lines were unevenly spaced but were generally not over 500 feet apart.

Small and scattered outcrops of the Eagle and Virgelle sandstones were examined in the breaks of the Missouri River and in the thrust-faulted area south of the Bearpaw Mountains. Single flights over the outcrops at altitudes varying from 25 to 75 feet usually sufficed for an examination.

In the Little Rocky Mountains, much of the Eagle sandstone outcrop and some of the mapped Kootenai and Morrison formations and Ellis group were surveyed.

Results of Airborne Procedures

Seven anomalies were found; one in the Cretaceous-Tertiary intrusives of the Judith Mountains and six in the Eagle sandstone.

Radioactive background varied considerably for the different formations. The following table enumerates the background ranges for the formations generally exposed in the region.

Formation	Microamperes
Till	0-25
Tertiary intrusives	25-125
Eagle, Virgelle, Judith River sandstone	5-30
Colorado, Bearpaw (black) shale	25-50
Kootenai, Morrison, Ellis sandstone, shale (red, gray), limey shale, etc.	10-50
Madison limestone	0-10

Description of Anomalies

Each anomalous area was examined by a ground crew to evaluate the occurrence. In addition to checking the anomalies themselves, adjacent areas were examined for radioactivity.

Plate I is a portion of the geologic map of Montana showing the coverage allotted to the various formations which outcrop in the area of investigation.

None of the seven anomalies proved to be of commercial interest. A description of each occurrence follows.

Anomaly No. 1

Anomaly No. 1 is located in Section 20, Township 17 North, Range 20 East, in Fergus County. The anomaly occupies a talus-covered south slope of syenite porphyry immediately west of Red Mountain. This was the only anomaly discovered in the igneous rocks forming the core of the central Montana uplifts.

The highest reading obtained was twice background. No uranium was found in any of the fragments covering the slope, and none of the syenite porphyry was observed in place. When removed from the area, none of the rock fragments was abnormally radioactive.

Anomaly No. 2

Anomaly No. 2 is located in Section 1, Township 16 North, Range 25 East, and Section 6, Township 16 North, Range 26 East, Petroleum County. The radioactive zone occurs in a sharp hogback ridge formed by resistant beds of iron-stained Eagle sandstone. The thickness of the zone averages about six feet, and the length is approximately one mile. It apparently terminates at both ends by faulting. Stratification varies from thin bedded to massive. The ridge, which strikes north 50° west and dips 65° northeast, represents a portion of the north limb of the Cat Creek anticline.

When removed from the area, individual samples exhibited only slight radioactivity although readings as high as eight to ten times background were recorded over the anomaly itself.

Anomaly No. 3

Anomaly No. 3 is located in Sections 28 and 33, Township 12 North, Range 26 East, Petroleum County. The anomaly occurs over an extensive flat-dipping area of thinly bedded, iron-stained Eagle sandstone lightly covered with overburden. The radioactivity is traceable for approximately two miles in a northeast direction parallel to a steep escarpment and one-half to three-quarters of a mile back from the rim to the southeast. The radioactivity is very weak or absent on the face of the rim.

Numerous small areas of relatively high radioactivity were found in the area, reading up to five times background.

Anomaly No. 4

Anomaly No. 4 covers an area in Sections 25, 26, and 36, Township 11 North, Range 25 East, and Sections 6, 7, 18, and 19, Township 10 North, Range 26 East, Musselshell County. The anomaly occurs in iron-stained, slabby to massive beds of Eagle sandstone overlain by white, massive sandstone and underlain by massive light buff-colored sandstone. The bedding strikes roughly northwest and dips about 5° northeast, and forms the northeast limb of the Devil's Basin anticline. The anomalous radioactivity is traceable for approximately seven miles. It is strongest to the northwest, where the iron-stained beds plunge below the surface, and weakens gradually to the southeast and south. The radioactive beds vary from five to 15 feet in thickness, with a maximum reading of two times background.

Anomaly No. 5

Anomaly No. 5 occurs in Section 17, Township 7 North, Range 18 East, Wheatland County. The anomalous radioactivity occurs in a zone of iron-stained, thin-bedded Eagle sandstone which strikes approximately northeast and dips 3° northwest, and forms the north limb of the Shawmut anticline. The radioactivity extends approximately 300 feet in east-west dimension and outcrops on both sides of an east-west trending gully. Overburden conceals the actual north-south dimensions. It averages about three feet in thickness.

The highest reading obtained was 20 times background.

Anomaly No. 6

Anomaly No. 6 is located in Section 5, Township 6 North, Range 18 East, Wheatland County. The anomalous radioactivity occurs in a zone of iron-stained thin-bedded Eagle sandstone striking about north 80° east and dipping 35° south, which forms the south limb of the Shawmut anticline. The radioactivity is traceable for approximately 150 feet along the strike. Dimensions along the dip are concealed by overlying beds of sandstone. Thickness of the radioactive beds averaged about four feet.

The highest reading obtained was 40 times background.

Anomaly No. 7

Anomaly No. 7 is located in Section 1, Township 10 North, Range 24 East, and Section 6, Township 10 North, Range 25 East, Musselshell County. The anomaly occurs in a portion of a hogback ridge striking north 50° west with a dip of about 75° southwest, which forms the southwest limb of the Devil's Basin structure. The radioactive zone is 0.35 mile in length and has an average thickness of about five feet.

The radioactive zone, as in Anomalies Nos. 2 through 6, is composed of thin-bedded, heavily iron-stained Eagle sandstone. The overlying and underlying sandstone is typically massive light-colored Eagle formation.

Anomaly No. 7 exhibited considerably higher radioactivity than the others, giving a reading of 1100 counts per second on a Halross

Scintillometer as compared to a background of 40 counts per second. A picked sample assayed 0.067 percent eU_3O_8 but only 0.006 percent cU_3O_8.

Conclusions and Recommendations

None of the seven anomalies appears to offer possibilities of commercial development, because the grade of material obtainable at the outcrop would be considerably less than 0.005 percent U_3O_8.

However, the fact that six anomalies were found in a single formation, the Eagle sandstone, is considered significant. Recent discoveries made in Wyoming by drilling anomalies showing little in the way of uranium minerals on outcrops should also be considered encouraging. Particular emphasis in future airborne reconnaissance should be given to such sandstones as the Eagle (Cretaceous) and the Flathead (Cambrian) in which uranium mineralization has been found.

SWEETGRASS HILLS AND ARCH AREA

Introduction

The Sweetgrass Hills are located in northern Toole County, eight miles from the Canadian border and from 15 to 45 miles east of Sunburst, Montana, with which they are connected by graded fair-weather roads. The Kevin Rim, on the west flank of the Sweetgrass Arch, is located west of U. S. Highway 91 at a distance varying from one mile at Sweetgrass to 15 miles at Shelby, Montana. Operational flying began on July 25, 1953, and finished on August 6, 1953. During this period 20 hours of rim and 15 hours of reconnaissance flying were undertaken along outcrops of the Eagle and Virgelle sandstones and the intrusive syenites of the Sweetgrass Hills.

There has been no production of uranium in either of the areas examined. Gold, copper and iron deposits were examined without finding significant radioactivity.

Except for the Sweetgrass Hills themselves, the area is either covered with glacial till or has been but recently exposed. The hills are elongated in a southeasterly direction parallel to glacial transport. Relief is between 200-300 feet in the arch area. In the Sweetgrass Hills area the maximum relief is 3,000 feet.

The poorly exposed Sweetgrass Hills are domal uplift mountains, in early mature stage of erosion. Glacial debris covers their bases and slopes up to about 1,800 feet above the plains. The hills offer a difficult area to examine aerially because of the few exposures.

Geology

Stratigraphy

The Sweetgrass Hills are Cretaceous-Tertiary intrusive masses of hornblende-rich, syenite porphyry. They are flanked in the East Butte area by Paleozoic and lower Cretaceous sediments and in other areas by small and scattered outcrops of upper Cretaceous sedimentary rocks. Figure 4 is a generalized section of the Sweetgrass Arch region. The Virgelle sandstone varies gradually from massive white quartzose fine-grained sandstone in the north to a very thin-bedded shaley limonite-stained facies south of Cut Bank. This facies change limits the area to be examined to the west and south of Cut Bank. The Virgelle sandstone is found much farther south, but those characteristics favorable for uranium deposition are absent.

Structure

The Sweetgrass Hills form an irregular and roughly elliptical uplift on the east flank of the Sweetgrass Arch. They comprise an area of complexly intruded, arched, and faulted Mesozoic and Paleozoic sediments surrounding three central masses: East, Gold, and West Butte. The Sweetgrass Arch is a very broad, slightly arched anticline trending southerly from Canada to the Missouri River, where it is widest and slightly arched.

Airborne Procedures

Type of Coverage

In Figure 2 is shown the area examined for outcrops of Eagle sandstone, Virgelle sandstone, and intrusives. Methods of examination varied with terrain and spacing and continuity of outcrop. In the hills flight lines paralleled the slopes and the canyon courses. Spacing between flight lines was determined roughly according to conditions and was usually from 1,000 to 1,500 feet in the intrusives. There was no grid flying in the Eagle and Virgelle sandstones. Over the till-covered plains, where outcrops of the Eagle and Virgelle were scattered, much of the flight time was spent in looking for outcrops.

From Montana Bureau of Mines and Metallurgy, Memoir No. 1, Table I

GENERALIZED TABLE OF STRATIGRAPHY FOR THE SWEETGRASS ARCH REGION

	SYSTEM	FORMATION	THICKNESS (feet)	DESCRIPTION
CENOZOIC	Quaternary	Alluvium	0 - 40	Light colored silt and clay with local gravel beds.
		Glacial deposits	0 - 50	Present nearly everywhere from Great Falls to the Canadian line. An unsorted mixture of gravel, sand, and clay, mainly clay; at times large boulders; locally stratified by outwash waters; perhaps some lake beds. Great variety of crystalline rocks, also limestone and sandstone pebbles.
	Tertiary	(Fort Union Beds)	absent	Absent on the Sweetgrass arch but present in one small area to the east of arch above Bearpaw. Shales near Big Sandy.
MESOZOIC	Surface at Cutbank and Joplin Upper Cretaceous	(Lance Formation) (Willow Creek) (Horsethief SS)	1800 ±	Present 50 miles west and 130 miles east of the crest of the arch. Alternating beds of greenish yellow, drab, gray or yellow sandstone and shales. West of arch chiefly maroon to chocolate, giving red soils. Impure coal in upper part. Arkose sandstone (Horsethief) in lower part. Abundant flora.
		Bearpaw Formation	500 - 700	Present 30 miles west and 100 miles east of the arch. Dark gray, clayey, gypsiferous shale, concretions in several zones, produces infertile soil. Dark shales grade to light sandstones in southern Pondera County. Marine fossils common in concretions.
		Two Medicine: Judith River Formation (East side of Arch	450	On east flank of arch. Alternating sandstone, shale, coal, and sometimes oyster beds. All beds local in extent and of varying proportions. Abundant fossils, mainly fresh water.
		Two Medicine: Claggett Form. (East side of Arch	700 ±	On flanks of arch, similar to Bearpaw, except more sandy. Abundant marine fauna.
		Two Medicine: Virgelle (Eagle) sandstone (Rim Rock)	200 ±	On flanks of arch, Thick to thin bedded sandstone, in places somewhat shaley; white to light gray or brown; cross-bedded; concretions; cliff-forming on west side, with grotesque shapes. Plant fossils scarce. Basal member known as Virgelle.
		(Two Medicine) (West side of Arch only)	(2000)	On the west side of the arch the upper Eagle, the Claggett, and Judith River grade into a mass light colored clays and sandstones, mainly continental origin; beds local; coal.
	Surface at Oil Fields	Colorado Form. ("Stray Sand")	1750 ←	Surface formation over area of arch. Upper 1000 feet of blue and brown shale with thin layers of bentonite and sandstone; several zones of concretions. Lower 750 feet sandy shale with several sandstone lentils. Marine fossils abundant. Highly bituminous in places. Mowry shale equivalent on Ragland Butte 700 ± above base. First Cat Creek sand equivalent near base.
	Lower Cretaceous (Surface at (Great Falls	Kootenai Formation (Sunburst oil(?) sand)	400 ± ←	Crops out at and near Great Falls. Massive gray sandstone, red sandy shale and clay, occasional beds of white limestone. Red shales with some limestone predominate in upper portion, sandstones predominate in lower portion. "First Red" shale of drill records considered near top. Sunburst sand at base. Great Falls coal about 60 feet above base. Thickens northward.
	Jurassic	(Morrison Shale)		About 100 feet of variegated shales with sandstone, reported between Ellis and Kootenai south of Great Falls. Not recognized in area of Sweetgrass arch.
		Ellis Formation (Stray sand)	250 ←	Light brown to gray (sometimes yellowish) shaley or limey sandstone in upper portion; dove colored to black shaley limestone in lower portion. Locally a pebbly conglomerate bed at base. Marine fossils abundant. Sandstone members present.
GREAT UNCONFORMITY (Ancient Land Surface) Triassic, Permian, and Pennsylvanian Formations missing.				
PALEOZOIC	Mississippian	("Ellis Oil Sand") Madison limestone	← 1075	Depth on top of Sunburst dome about 1400 feet. Massive gray limestone above, appears white in cuttings. Lower portion shaley, sandy, and thin-bedded limestones. Upper surface affected by ancient erosion, leached, fractured, locally replaced by silica or altered to dolomite, and with marked local porosity, resulting in the so-called "Ellis Oil Sand".
	Devonian	Potlatch Anhydrite Formation	940	Depth on top of Sunburst dome about 2500 feet. Alternating and interbedded shale, anhydrite, gypsum, dolomite, and limestone. 20 feet of rich oil shale at top. Anhydrite and gypsum are compact massive pearl-gray, sometimes cleavable, also irregularly associated with dolomite giving mottled appearance. Dolomite horizons sometimes porous and with gas and oil showing.
		?	300	Dark to light gray limestone. Black limestone at top.
	Cambrian	Barker Shale	705	Dark to light gray shale, sometimes greenish and reddish. Fine grained and jointed, often breaking into slivers two or more inches long.
		Flathead Quartzite	25 ?	Clear, transparent quartz grains, firmly cemented.
GREAT UNCONFORMITY				
	Pre-Cambrian	?	75+	Igneous rock, fine-grained, intermediate in composition, probably diorite. Greatly altered with much limonite, kaolin, and calcite. Probably Archeozoic.

TABLE OF STRATIGRAPHY FOR THE SWEETGRASS ARCH

Figure 4

Single passes over the outcrops usually sufficed for an examination. Along the Kevin Rim, customary rim flying methods were used. Altitudes of flight lines varied according to terrain from 25 feet above the ground in the plains area surrounding the hills to 50 feet along the Kevin Rim and to 150 feet in the intrusives of the Sweetgrass Hills.

An estimated 90 percent of the outcrop area of Eagle and Virgelle sandstones in the portions outlined in Figure 2 was examined during the investigation. Along the Kevin Rim only the actual scarp was completely flown; areas behind the rim where the sandstone outcropped were examined, but areas covered by overburden were not. Only about five percent of the intrusive rocks was examined.

Conclusions and Recommendations

The uranium production potential of the Sweetgrass Hills and Arch area seems slight. No appreciable amount of uranium, either in concentrated or disseminated form is known to occur in the area.

Further airborne work in this area seems unwarranted. Farther west, where the possibility of fissure-vein type primary ore deposits is relatively good, airborne work may be of value.

CLANCY AREA OF BOULDER BATHOLITH

Introduction

The Clancy area within the Boulder batholith was investigated to establish a comparison between known anomalous radioactivity on the ground and radioactivity detectable from the air. Flying commenced on October 12 and continued until October 28, 1953. Included in the area flown were the only three properties from which uranium has been mined in Montana.

The area investigated is in the rounded mountains typical of the Boulder batholith. Larger moderately sloping areas near the summits are common, and rugged precipitous sides are the exception. Elevations range from nearly 4,000 feet along Prickly Pear Creek to over 7,500 feet near Clancy. Much of the area is made accessible by secondary roads. The streams, although small and generally intermittent, have incised rather steep gulches and valleys in places.

General Geology

The area covered by this reconnaissance project lies in the northern portion of the Boulder batholith (Figure 1). The batholith is exposed over a length of about 80 miles and trends north-northeast. The predominant rock is quartz monzonite with bodies of aplite and alaskite. On the southern edge of the area, rhyolitic flows have concealed the quartz monzonite. Remnants of older andesite and latite bodies occur as roof pendants in the intrusive throughout the northern half of the batholith.

Uranium-Bearing Deposits

Uranium is found in commercial amounts in two types of deposits in the batholith. To date, the most important of the two is the siliceous reef type in which uranium and some silver occur in lenticular bodies within brecciated chalcedonic quartz veins. The reefs are readily discernible from the air as they stand out in bold relief and persist for as much as five miles in length. Both secondary uranium minerals and pitchblende have been mined from two such deposits. A second type of uraniferous deposit was formed by the addition of uranium and chalcedonic quartz to certain base metal deposits which were apparently re-opened at a late stage. One of these deposits has yielded a small tonnage of uranium ore. In general, the base metal uraniferous deposit is essentially devoid of anomalous radioactivity at the outcrop but anomalies and small showings of secondary uranium minerals are rather common along the siliceous reefs.

Project Procedures

Rim and grid flying were undertaken in the Clancy Creek area, in the Blizzard Hill area, and in the Whitehall mining district. Only one day was devoted to each of the latter two areas, and no anomalies were found. Since methods employed there were similar to those employed in the Clancy Creek area, no general reference will be made to them.

Normal rim and grid type of flying could not always be utilized in the Clancy Creek area. About one-third of the area consisted of terrain flat enough for normal grid flying. In these areas grid lines were spaced about 200 feet apart, and the airplane was flown at an altitude of between 25 and 75 feet above the surface. In the two-thirds of the Clancy Creek area where normal grid flying methods were found to be unsatisfactory, a composite method of flying was utilized. Flight lines paralleled slopes and drainage courses. Distances between flight lines were kept within an estimated 200 feet. Altitudes varied from 25 to 100 feet above the surface. About 39 square miles in the Clancy Creek area were examined in about 18 hours of flying time.

Results of Survey

No new anomalies were discovered in this region as a result of the airborne project. The existence of a zone of higher than normal radioactivity which trends parallel to the regional structure and extends from the abandoned mining district west of Corbin to the town of Corbin was verified. Many of the previously known anomalies were not detectable from the airplane. The best chalcedonic vein deposit known to date in the batholith, the W. Wilson mine, as well as the only base metal deposit from which uranium ore has been shipped, the Lone Eagle mine, were in the area flown. Only the ore dump of the W. Wilson showed a detectable anomaly.

A few very minor anomalies discovered by the airborne unit were examined by geologists of the Butte sub-office. In no instance was definite mineralization observed, and a generally higher background in the area appeared to be the only cause for the reaction noted on the airborne instrument.

Conclusions and Recommendations

Although the evidence is not conclusive, it would appear that the Boulder batholith is not especially amenable to airborne reconnaissance. The linear narrow characteristics of a vein-type deposit make detection difficult. Although the siliceous uranium-bearing veins may persist for several thousand feet, the uranium mineralization is discontinuous. The actual ore zones or pods are sometimes only a few feet in length. In addition, surface outcrops are not indicative of the ore tenor at even slight depths, which accounts for some totally insignificant reefs giving anomalies of the same magnitude as the producing deposits. The irregularity of the terrain and timber cover makes maintenance of uniform height and flight pattern by aircraft difficult.

The fact that abnormal radioactivity could be detected even to a slight degree is of definite value, not so much for this portion of the Boulder batholith but for the large areas which have only been given the most cursory ground examinations to date.

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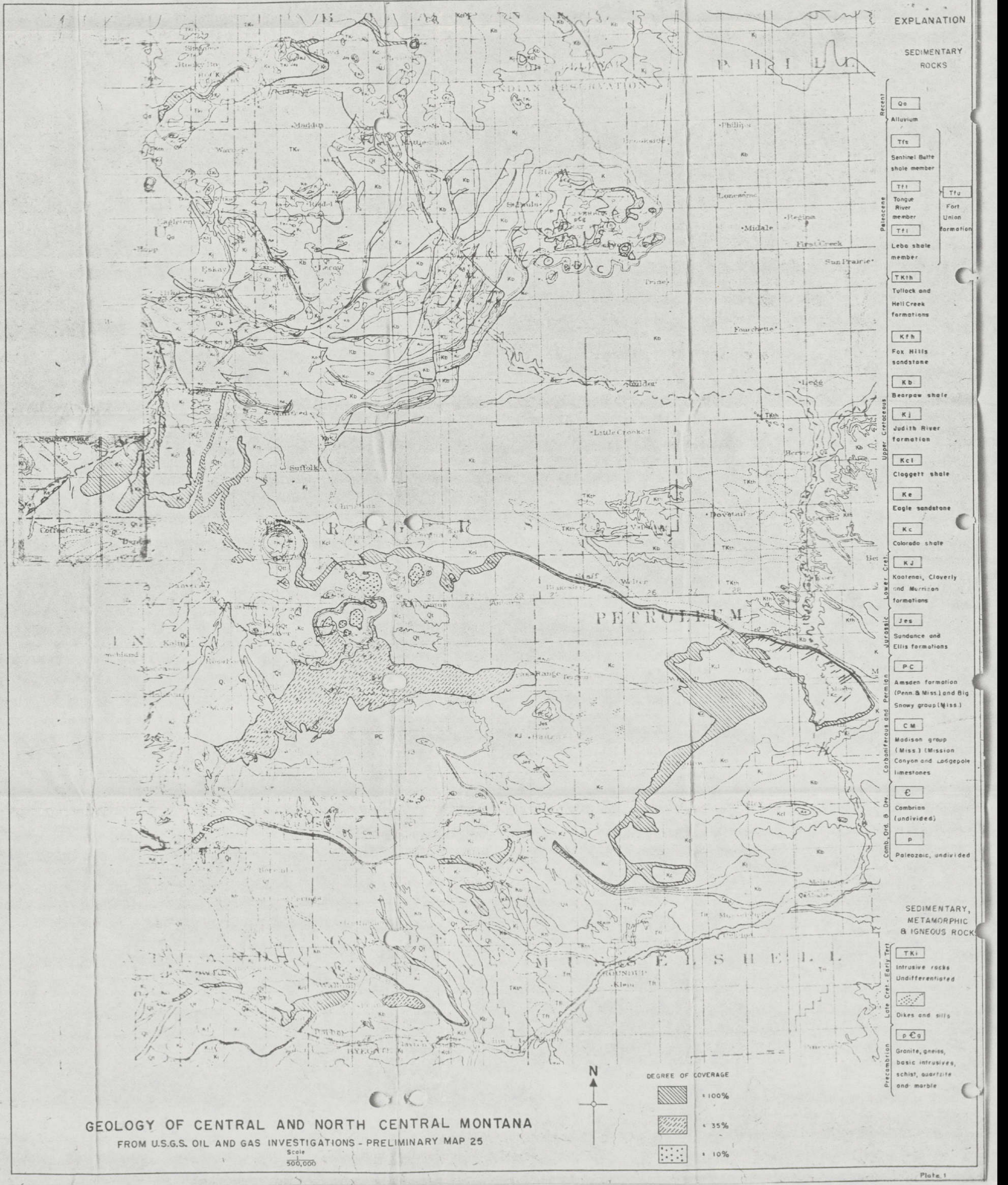

GEOLOGY OF CENTRAL AND NORTH CENTRAL MONTANA
FROM U.S.G.S. OIL AND GAS INVESTIGATIONS - PRELIMINARY MAP 25
Scale 1/500,000

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