

# MAR 19680040: WENTZEL RIVER

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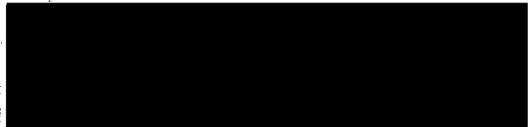
ECONOMIC MINERALS  
FILE REPORT No.  
S-AF-025(3)

GEOLOGICAL FIELD RECONNAISSANCE STUDY  
OF INLAND CHEMICALS SULFUR PERMIT NO. 25  
WENTZEL RIVER, ALBERTA

Prepared For:

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Approved by:



D. T. Cosgrove, P. Geol.

## Background

Previous work on Sulfur Permit No. 25 had been undertaken by J. C. Sproule and Associates. A photogeological study was made of the area, the known geological information discussed, the possible origins of the sulfur discussed and other pertinent information was covered. A rapid helicopter borne surface study was made in the month of November. One landing was made on the permit (Locality C-1) at a slump area where some warm, snow-free muddy ground was noted. Analyses were made of the samples taken, but values ranged only up to 3%. This information is contained in the report: "Photomosaic and Field Reconnaissance Study, Selected Sulfur Prospecting Permits, Fort Vermilion Area, Alberta".

## Procedures

The purpose of this second study was to do additional work on the permit to determine the extent of any sulfur deposits present, when the ground was snow-free.

Because of the apparent lack of any surface indications of sulfur on the permit as determined by the photogeological study, it was thought that the concentration of work should be along the Wentzel River, which traverses the permit from the northeast corner to the southwest corner. Particular attention was to be paid to determine the age of the bedrock along the river, with perhaps the most important factor being to determine if rocks of Devonian age were present on the permit. Various workers had projected the Cretaceous-Devonian contact near the southern border of the permit or along the Wentzel River itself, although no rocks of Devonian age had been mapped on the upper portion of the river to my knowledge. Many workers have postulated that the most likely place to find sulfur deposits would be along the Cretaceous-Devonian boundary, the theory being that sulfur bearing fluids have migrated upward through the Devonian along faults and fractures and deposited sulfur in shaly Cretaceous beds or surface gravels.

Because of many unknown factors, such as the nature of the terrain on the permit, the condition of the newly constructed Highway 58 east of the turnoff to Fort Vermilion, and others, several alternative methods of exploration of the permit were considered. Among them were: 1) a helicopter landing at the northeast end of the permit and a rubber raft trip down the river to the highway crossing, 2) surface access to the permit on existing seismic trails, either on foot or by horse and a traverse down river and 3) a search by helicopter only, with landings at strategic points on the river and surrounding high

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ground to check the outcrops and any unusual features. We were prepared to try any of the methods, after choosing the one which would obtain the most information in the safest way and in the most economical fashion.

The author and his assistant, Brian Templeton, arrived in Fort Vermilion 45 miles west southwest on August 17, 1968. Local authorities stated that Highway 58 was in good condition only as far east as the turnoff to the Jean d'Or Prairie Indian Reservation and the remaining portion was in poor condition because of incomplete construction and recent wet weather and travel was not advisable.

It was therefore decided to charter a wheel geared Cessna 180 from Fort Vermilion Airways to fly a reconnaissance of the permit and to meet our helicopter at the Margaret Lake fishing resort where a short landing strip was available. The helicopter, a "Super G" model, was chartered from Associated Helicopters and was to fly directly to the lake from High Level. A fixed-wing craft would enable us to make a quick check of the river conditions and check for helicopter landing spots as well as to make a quick reconnaissance of the outcrops.

The pilot was very familiar with the area having worked for the Alberta Forest Service and having considerable experience flying over the area. He would also be able to point out the Madison sulfur "show" which started the land rush in the area.

We first flew over Vermilion Rapids and Vermilion Chutes on the Peace River southwest of the permit to observe the outcrops of the Upper Devonian carbonates of the Grosmont and Mikkwa formations respectively.

After circling the rapids we flew 13 miles north northeast to the Madison deposit. The "show" is difficult to see from the air, unless its exact location is known, because of the fairly heavy tree cover surrounding the bare ground at the deposit. The most noticeable aspect of the deposit is the long strip of light coloured bare soil marking the path of the outwash stream.

We then proceeded east to the Wentzel River and then turned north over the river, looking for possible Devonian outcrops south of the permit. We flew the length of the permit along the river, making three passes over the permit, checking the condition of the river, the outcrops present, possible landing sites and the condition of the seismic lines crossing the permit. Only shale outcrops were seen. Because of the swiftness of the rapids on the river and exposed rocks because of low water conditions, it was decided that it would not be feasible to use

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the rubber raft for travel down the river. The pilot urged that we not try that method of travel.

It now appeared that a helicopter borne survey of the permit would be the most feasible. Because landing spots appeared to be available at several spots on the river and with the obvious advantage of being able to check out the entire permit away from the river also, a helicopter would provide a quick and relatively inexpensive, all factors considered, method of surveying the river.

We then flew northwest to the landing strip at the northeast corner of Margaret Lake and we were followed shortly by the helicopter. The airplane returned to Fort Vermilion for Templeton, our gear, and a load of gas for the helicopter. We secured comfortable lodging at the fishing resort for our party of four, the helicopter pilot and engineer, Templeton and myself.

On August 18, Templeton and the author flew by helicopter to the permit. We started at the northeast corner of the permit to check for outcrops. We then flew down the river, checking for outcrops and flying to the sides to check for any unusual topographic or textural conditions, unusual colourations, springs, barren spots, unusual soils or anything else which could indicate the presence of sulfur. We criss-crossed the stream and retraced our flight wherever necessary to check unusual outcrops or features. In addition to the stream itself, side trips were made over the other portions of the permit. All photogeologic features were checked with nothing interesting noted.

One of the most prominent characteristics of the outcrops and banks of the river were the prominent slump and landslide features. A good portion of the shale outcrops owe their existence to these slumps, as the slumping has exposed fresh outcrops of shale. It was felt that the slumped areas could likely be due to warm sulfurous springs and seeps which would cause the perpetually damp soils to slump easily. However, in the very warm temperatures prevalent (in the 80's), no warm springs could be detected. The only spring, which was cool, was found at Station 4DC (see station descriptions). The slump areas were dry or damp depending mainly on side stream activity, although some of the slumps were possibly damp due to springs. Traces of sulfur and vague sulfurous odours were noted in a few slump areas, especially in the northeast portion of the permit.

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Six landings were made on the river, spread over the entire permit, and seven stations were visited. These stations are described at the end of the report. All outcrop stations were walked over with particular emphasis paid to locating springs, sulfur indications, sulfurous odours, warm areas, etc. Representative samples were taken at all stations. Landing spots were available reasonably close to all stations visited, the furthest being approximately 1/2 mile from the outcrop. All landings were made on gravel bars, which were well exposed due to low water conditions. The stream was swift and rocky and some difficulty was encountered in crossing the stream at Station 4DC, which is the only station where a river crossing was necessary. In high water conditions some of the gravel bars would be covered with water, limiting the number of landing spots available.

Most of the slumped areas and most outcrops on the stream, at least those that appeared unusual were checked on the ground, except for a few for which no landing spots were available.

All photogeologic anomalies were checked, particularly the possible NW/SE trending fault zone which interests the river at a point about 1 - 1/4 mile upstream from Station 5DC (see map). There is a small stream in the valley. No unusual conditions were noted along the side stream or at its mouth. There were some sparse outcrops of shale approximately 1.4 miles up the side stream from its mouth. These are the only outcrops noted on the permit which were not on the river itself.

There were no outcrops northeast of Station 1DC, either on the permit or for a distance of at least 5 miles northeast of the permit. The depth of the river canyon is much shallower and the stream gradient appears to be slightly lower northeast of the permit. The area is heavily vegetated, masking any outcrops.

The southeast portion of the permit, away from the river, was flown over several times and nothing unusual was noted. Because of the flatness of the land the presence of thick soil overburden and the thick muskeg, no outcrops whatever were noted. The light coloured areas showing on the photographs are due to vegetation colourations. We flew as to the southeast corner of the permit to near the Imperial Rennie wellsite and then along the east border of the permit and returned to the lake camp.

All stations are marked on the accompanying map and on the back of the photomosaic and aerial photographs.

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On August 19, we returned to the permit, flying over the southwest portion of the permit, west of the river and then again criss-crossed over the southeast portion of the permit. Nothing unusual was noted.

No outcrops were visible on the NE/SW trending stream which enters the Wentzell about 1/2 mile south of the permit boundary. This was thought to be a possible area for outcrops because of the depth of the sidestream canyon.

We flew south along the river, checking for possible Devonian outcrops south of the permit. All of the outcrops were apparently of the same Cretaceous shale seen on the permit. We flew south to the highway crossing, then further south along the river to the point where the road turns west toward the Madison deposit.

#### Madison Deposit

The Madison deposit, in approximately the SW portion of section 16, Twp. 110, Rge. 5, W5M, is located approximately 1 - 1/2 mile SW of a sharp corner of the road (see map). A seismic trail passes through the show. The show has been known to local natives for a long time because of the fact that it is heavily used as a mineral lick by buffalo. As stated previously, for a distance of about 1/8 mile downhill from the deposit there is no vegetation along the low gradient stream which runs off of the barren sulfur deposit. The exposed glacial boulders (mostly granitic) are stained yellow due to sulfur deposition by the stream waters. The soil itself over the deposits has no vegetation although the surrounding poplars appear vigorous.

The barren areas are spotty and some small ones, especially to the northwest, are almost invisible under the surrounding trees. Some of the barrenness is due to having been trampled by buffalo and other animals. There is no surface spring at the location. The area is not warm, and it is reported that the snow does not melt there in winter.

The sulfur shows cover an area approximately 325 feet long (north-south) by 250 feet wide with a few other areas scattered to the sides. The area has numerous drill holes of various diameters and some hand dug holes and trenches to 95 feet long. The sulfur is mixed in with the soils in an erratic pattern and the sulfur content varies considerably from area to area. The sample taken from the most concentrated sulfur patch seen analyzed 88.9% sulfur.

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There was no evidence of recent activity when the area was visited. No recent trenching had been done and no caterpillar work had been done although publications had stated that some would probably be undertaken this summer.

### Geological Conclusions

All outcrops visited were dark grey marine shales of Cretaceous age, belonging to the Loon River formation. Rusty weathering ferruginous concretions were very common, especially in the northeastern portion of the permit. Silty beds were common in the northeastern portion of the permit especially at Stations 3DC and 4DC. The shales in the southwestern portion of the permit were monotonous, had fewer concretions and no arenaceous content. Well preserved ammonites were found in concretionary nodules in "float" along the river bank at Station 7DC. These nodules appear to have come from the banks above and have not traveled far. The ammonites are of Cretaceous age.

One of the most significant results of the study was to determine that Devonian beds do not appear to outcrop on the permit area and as far south as the highway bridge in section 25-110-5W5. It appears that the Devonian edge as mapped by the GSC in Memoir 313 passes to the south of the permit. If the Devonian did outcrop on the permit, it would likely have been mapped as such by the GSC. A Devonian outcrop of map unit 4, the shale unit older than the Mikkwa Limestone (Hay River or Ireton of the sub-surface) is shown in the memoir to outcrop at the sharp bend of the Wentzel River 2 - 1/2 miles upstream from its mouth. The memoir shows the Cretaceous-Devonian contact just south of the permit boundary although it appears to the author that the contact is much farther downstream. The beds along the river south of the permit were not examined on the ground, but appeared to resemble Cretaceous beds just north of the permit boundary.

As mapped in the GSC memoir, the Cretaceous unconformity truncates progressively older beds to the northeast from the Vermilion Rapids area. Therefore south of the permit, the Cretaceous rests on the shale unit (Hay River) under the Mikkwa, the Grosmont and Mikkwa of course having been eroded. A brief study of the subsurface beds confirms this.

At the Imperial Rennie 3-22 well just southeast of the permit, the Beaverhill Lake comes in at 660 feet. The shales above that are of unknown age, either Devonian Hay River or Cretaceous Loon River. It is likely that the Cretaceous is present in the upper portion of the hole behind casing and that they rest on Hay River shales.

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Therefore a Cretaceous-Devonian contact, a shale-on-shale contact, would be present somewhere south of the highway crossing and north of the Devonian outcrop mapped by the GSC mentioned previously. South of the bridge there are no apparent outcrops at all in the low relief country with deep vegetal cover. There should be a thin basal Cretaceous sandstone (Bullhead or Gething) but none was seen along the river.

The Cretaceous beds, which are practically flat lying, are most likely older at the SW and younger at the NE portions of the permit.

### Sulfur Showings

Sulfur showings were found at Station 4DC, associated with a small sulfurous spring, as stated in the station description. The sulfur is located in three silty ferruginous rusty weathering lenses 3", 8" and 12" thick. These sulfurous lenses do not extend for great distances along strike. The sulfur appears to have been carried by solutions from the spring laterally through the slightly porous silty lenses for short distances along strike. There are only traces of sulfur indications in the slumped area to the northeast. The slumped shale is lumpy and sun baked and sulfur indications may be obscured. On the hill-top above the shale outcrop there are no indications of sulfur in the soil. The three sulfur bearing beds analyzed 7.9%, 10.2% and 5.8% from bottom to top.

Station 4DC is the same as Locality C-1 of the Sproule report, where warm ground and yellow staining were noted in the concretionary beds, in an area where the snow had been melted. The samples taken by the Sproule party, in shaly slump material, analyzed less than 3% sulfur.

Although sulfur is present at this station, the area does not appear to offer any commercial possibilities, because of the lack of areal extent of the lenses and the fairly thick overburden. If further work is warranted on the permit, this area should undergo further investigation. It may be advisable to transport a portable drill by helicopter to the location and drill, especially in the slumped shale area to the east.

None of the other outcrops had any significant indications of sulfur. Traces of native sulfur were noted where runoff water had concentrated sulfur indigenous to the shale in pockets and backwaters. Some sulfurous odours were noted in some of the slumped areas when freshly broken with a hammer. These sulfur indications do not appear to be any more than the normal concentrations of sulfur in the Cretaceous beds, which is fairly well established. The Station 4DC showing is unique in that the concentration of sulfur is greater due to the spring.

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### Recommendations

The origin of the sulfur deposits in the area has been discussed in the Sproule report and it is beyond the scope of this report to expand on this further.

The value of a shallow core hole project, with periodic random shotholes dug without any leads, is questioned. Because of the deep vegetal cover on the areas away from the river, it would be necessary to drill to a considerable depth to reach bedrock. Perhaps if further photogeological studies provided additional leads to anomalies, or if some other untried method of exploration, such as infrared photographs, came up with definite leads then a core hole program around the anomalies may be warranted.

As far as access to the area should more work be desired, the helicopter appears to provide the most satisfactory method of transport. There are several seismic trails leading into the permit, but travel on them appears to be restricted to winter or by foot, horse, or muskey vehicle in summer.

Another possible method of transport would be by boat if an experienced boatman were available. In that case then slightly higher water conditions may be preferred to prevent danger from exposed rocks. A river traverse would allow access to some of the outcrops which could not be reached from the helicopter because the lack of suitable landing places.

As stated previously some of the helicopter landing spots may be submerged in high water conditions if further work were undertaken by that method and crossing the river on foot would be very hazardous or impossible.

In brief, this study has indicated that there do not appear to be any sulfur deposits of commercial quality on the permit. Further work should probably be held in abeyance until some breakthrough occurs, either due to work by other companies or if some new exploration tool presents itself for locating sulfur deposits.

D. T. Cosgrove, P. Geol.

STATION DESCRIPTIONS

(Locations marked on map, photomosaic and photos)

STATION 1DC

A small outcrop at river level on the north side of the river 3/4 mile southwest of the mouth of Clements Creek. This is a slumped outcrop of grey shale with traces of a yellowish substance. This appears to be the northeasternmost outcrop on the permit. No traces of sulfur or sulfurous odours were noted here, other than the slight sulfur (?) coating.

Sample 1DC. No analysis made.

STATION 2DC

On the north side of the river 1 - 1/4 mile downstream from the mouth of Corey Creek. This is an outcrop of deeply weathered "mushy" grey shale with white calcite and some gypsum coating. No odour or sulfur showings were seen here.

Sample 2DC No analysis made.

STATION 3DC

This location is 300 yards upstream from Station 2DC. This is a much fresher outcrop than that at 2 DC. From the bottom up the beds are: 5 feet of splintery weathering dark grey shale with a very slight yellowish coating. This bed is overlain by 3 feet of sandstone, fine to coarse grained, salt and pepper, with feldspar and abundant ferruginous material. The sand is typical Cretaceous. Some dark grey carbonaceous shale streaks are present. This bed is overlain by 5 feet of light to medium grey splintery weathering shale. There were no sulfur indications at this station, except the possible sulfur coating which is in minute amounts.

Sample 3DC No analysis made.

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STATION 4DC (Same as Sproule locality C-1). (See photographs this report).

This location is situated on the northwest bank of the river at a bend in the river 1 - 3/4 mile downstream from the mouth of Corey Creek. This is a fairly large outcrop about 50 feet high and 350 feet long of mainly dark grey shale with common ironstone lenses and some concretions. There is a large area of slumped shale to the northeast of the fresh outcrop.

A small cool spring emerges near the northeast end of the outcrop, about ten feet above river level. There was a heavy frothy yellow sulfurous slime in the water and deposited along the edges of the spring path. A fairly strong sulfurous odour emitted from the water.

There is an iron rich rusty brown and yellow (due to sulfur) weathering shaly bed 12 inches thick about 5 feet above the spring. The shale is dark grey with a fairly heavy powdery yellow sulfur coating on it and a strong sulfur odour to a fresh break. This bed extends about 30 feet to the northeast and 40 feet to the southwest before lensing out. Sample 4DC was taken from this bed.

The 12 inch bed is overlain by approximately 15 feet of shale which is in turn overlain by an 8 inch thick bed of ferruginous, concretionary, in part silty, shale. This 8 inch bed is quite silty at its base. It weathers rusty brown with a coating of yellow sulfur and has a strong sulfurous odour to a fresh break. Sample 4DC-A, which is quite silty, was taken from this bed. This bed appears to extend for a fairly good distance to the southwest before lensing out.

Overlying the 8 inch sulfurous bed is about 7 feet of shale. Above the shale is a 3 inch thick bed of dark grey ferruginous shale, with a slight sulfurous coating. The lense has a slight sulfurous odour to a fresh break. The bed thickens to the southwest to approximately 8 inches thick, but was inaccessible because of the steep cliff there. The bed can be seen in the cliff to a distance of about 150 feet to the southwest, with the prominent rusty coloration due to the iron content. Sample 4DC-B, a limonitic (?) dark grey shale with a slight sulfur coating, was taken from this bed.

The 3 inch thick bed is overlain by about 20 feet of shale, with no apparent sulfur. The soil at the cliff top shows no indications of sulfur.

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Northeast of the spring outcrops of shale are present for about 75 feet, with traces of a sulfur coating being present. East of the outcrop is a large slumped area, made up of a mixture of shale and soil. At the east extremity of the slump area the soil is damp and mushy. There appears to be some calcite and possible gypsum deposits and possible traces of sulfur on dry surfaces. At the base of the bank just above the stream, at the east end of the slump area, traces of powdery sulfur were noted in dry areas. No sulfurous odours could be detected in the slump area.

Sample 4DC Analyzed 7.9% sulfur.

Sample 4DC-A Analyzed 10.2% sulfur.

Sample 4DC-B Analyzed 5.8% sulfur.

#### STATION 5DC

This is large outcrop of shale on the west bank of the river. A monotonous section of dark grey micromicaceous shale is present, approximately 60 feet thick. No arenaceous material was noted. Traces of ferruginous material were present. On some dried exposed surfaces traces of possible sulfur were present. The east end of the outcrop is damp and slumped. Vague sulfurous odours were detected in the slump area, but no sulfur was seen. The amount of sulfur present is probably no more than the average native content of these Cretaceous beds.

Sample 5DC No analysis made.

#### STATION 6DC

This is a slumped area of shale and soil on the west bank of the stream, just inside the permit boundary. No fresh outcrops were present. No traces of sulfur or sulfurous odours were detected here.

Sample 6DC No analysis made.

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STATION 7DC

This outcrop, the southermost one on the permit, is located on the northwest side of the river. A high shale bluff, exposing approximately 70 feet of monotonous dark grey micromicaceous chippy weathering shale, is present here. No silts were noted here. In the upper portion of the bluff near the eastern end a small runoff creek is present. A prominent concretionary rusty brown weathering band is present near the creek. East of the outcrop at river level rusty brown weathering concretions were found. They contained abundant well preserved ammonites of Cretaceous age. Traces of carbonaceous material were also noted in the concretions. The concretionary blocks were not found in place, however they do not appear to have been transported far. They may have weathered out from shale beds at river level which are now covered by soil. The concretionary lenses resemble those found at the top of the bluff, but no fossils were found there. No sulfur traces or sulfurous odours could be detected at this station.

Beds of shale resembling those at this station are present at scattered points downstream as far as the Highway 58 bridge, but they were not examined on the ground.

Sample 7DC (rock) No analysis made.

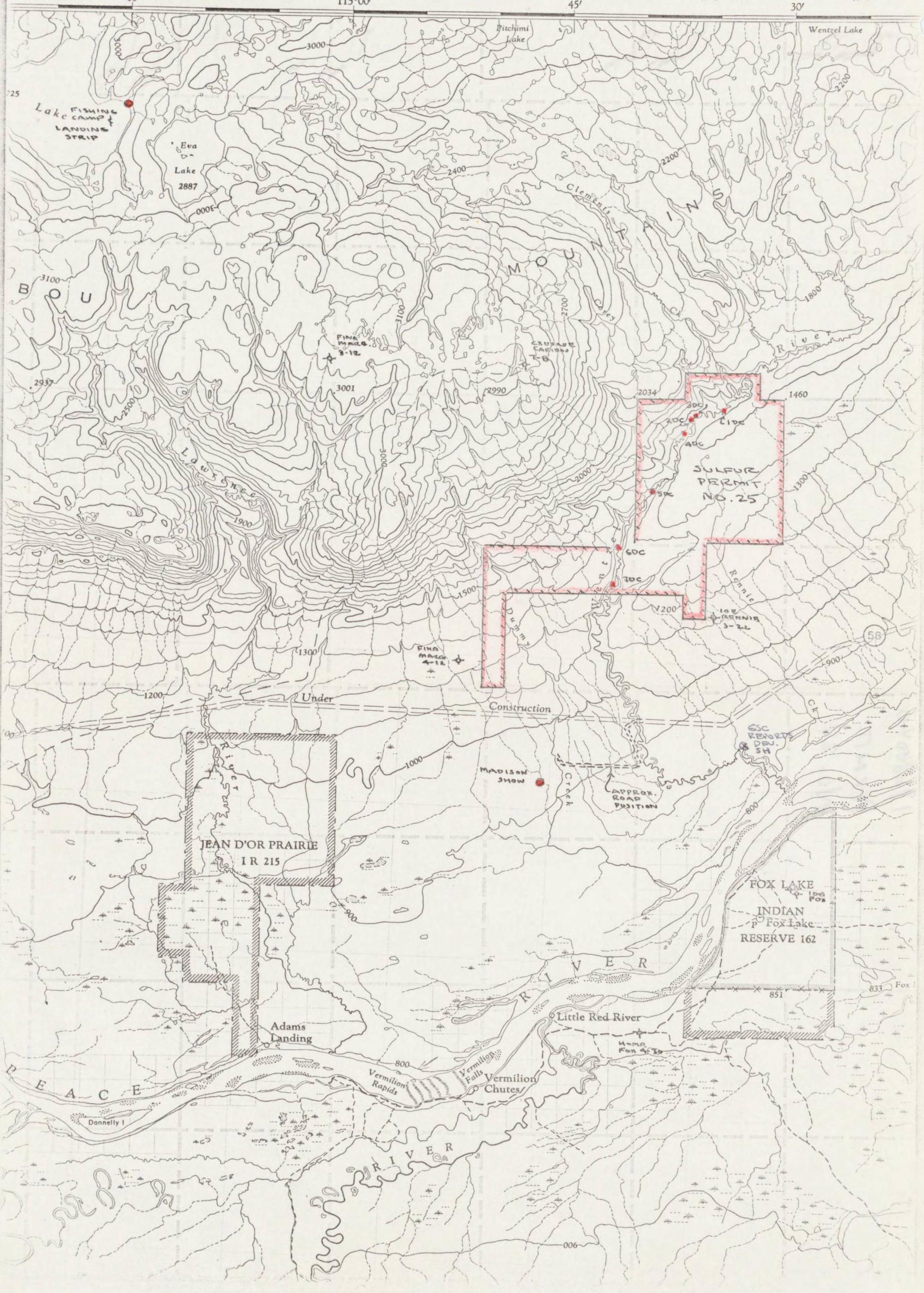
Sample 7DC (Fossils)

MADISON DEPOSIT (Sec. 16-110-5W5)

See report for description of this locality. The sample was taken from the richest bed found at the deposit.

Sample "MAD" Analyzed 88.9% sulfur.

R 8 15' R 7 115°00' R 6 45' R 5 30' R 4 R 3





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## Certificate of Analysis

REPORT NO.  
CAL 65

Sample(s) from Don Cosgrove  
Date: September 9/68

SAMPLE NO.	GOLD Troy ounces per ton	SILVER Troy ounces per ton	% Elemental S.	%	%	%
4 DC A			10.2			
4 DC B			5.8			
4 DC			7.9			
MAD			88.9			

PULPS RETAINED 3 MONTHS  
REJECTS RETAINED 1 MONTH

SIGNED \_\_\_\_\_