Thompson District-Yellow Cat Area:

Location:

The Yellow Cat area of the Thompson district is located on the northeast limb of the Salt Valley anticline in central Grand County approximately 24 miles north of Moab (plate 1). The district covers an area of approximately 20 square miles but with the most productive part of the district confined to a central area of about 5 square miles. The area is about 9 miles long and 2.5 to 4 miles wide and straddles the boundary between T 22 N. and T 23 N. and R. 22-23 E. The main part of the district extends from the Silver Moon prospect on the west to the Flat Top No. 1 mine on the east (figure A).

Production:

The Yellow Cat area has been mined successively for radium (1911-1923), vanadium (1939-1944), and uranium-vanadium (post 1948) (Cannon, 1964). Production during 1911-1923 was probably low tonnage but extremely high grade-only 50,000 tons was mined from the entire Colorado Plateau during this period and probably less than 10% was from the Yellow Cat area. Two estimates are available for production during the period 1939 to 1946; Chenoweth (1981) estimates that 10,600 st @2.79% V_2O_5 was produced prior to 1946 and Cannon (1964) estimates that 16,000 st at an unspecified grade was mined between 1939 and 1944. Very little, if any, of the contained uranium was recovered.

Various estimates have been made for uranium-vanadium production from the Thompson district and are given below. Over 95% of the Thompson district production was from the Yellow Cat area so the district production estimates are very close to production from the Yellow Cat area alone:

Short tons mined	Period	%U_3O_8	% V_2O_5	U_3O_8 pounds	V_2O_5 pounds	Source
106,177	1911-1967	0.25%		526,683		Cohenour, 1969
106,000	1911-1973	0.249%	0.708%	527,000	1,500,000	Utah Geo. Surv. 1974
135,000 st	1911-1978	0.21%	1.16%	571,000	3,132,000	Thamm and others, 1981

The estimate of Thamm and others is thought to be the best estimate; the numbers for uranium production are consistent with the other estimates and the vanadium grades are reasonable considering the U:V ratio of the deposits. The low vanadium estimate from the Utah Geological Survey is probably in error; most of the production likely to the Uravan mill which recovered vanadium but some may have gone to the Moab mill, which did not install a vanadium circuit until 1976. The post-1978 production is probably minor; only during 1980-81 was any production reported for Grand County.

Major mines include: Little Pittsburg No. 1 (700 st, 3820# U_3O_8, 12,300# V_2O_5), School Section 2 [Nickerson State Lease] (19,385# U_3O_8, 15,407# V_2O_5 -low V, likely incomplete), Ringtail Shaft (65,074# U_3O_8, 47,258# V_2O_5 -low V, likely incomplete), Blackjack [Blackstone 5] (likely significant production but no records-may have been included with Blackstone incline); Blackstone Incline (72,288# U_3O_8, 173,490# V_2O_5 est.), Allor 12 (likely moderate production but no records), Parko 25 (likely moderate production but no records); Parco mines (39,000 st, 156,000# U3O8 est., 668,000# V_2O_5 est.), AEC Group 2 [Telluride 3] (likely moderate production but no records), Telluride (1,315 st, 5,837# U_3O_8, 32,759# V_2O_5 [I]), Black Ape (3,939#U_3O_8 , 24,800# V_2O_5 est.), Memphis mines (likely moderate production but no records), Johns Incline (12,924# U_3O_8, 77,500# V_2O_5 est.), Parco 23 (Estimated at 6,000 st, 25,000# U_3O_8, 100,000# V_2O_5 from reserves given in Cannon, 1964), Rube (likely moderate production but unknown), Cactus Rat-Mineral Treasure (57,842#U_3O_8, 310,300# V_2O_5 est.), McCoy (Red Vanadium) (30,861# U_3O_8, 220,000# V_2O_5 est.),Windy Point-Juniper (3,149# U_3O_8, 19,000# V_2O_5 est. [I]), and Flat Top No. 1 (3,866# U_3O_8 ,23,000# V_2O_5 est.).

Many of the mines, particularly those in the southwest part of the area, consist of numerous short adits, inclines, shallow shafts, and small surface pits in a small area. It is not unusual to have 5 to 10 openings of various types and sizes assigned to a particular mine or mine area. For example, the Pasco mine consists of approximately 18 adits, 4 shafts, 3 inclines, and numerous surface prospect pits in an area 1000 feet long by 500 feet wide. Because several mine areas may be present in a single claim group with each particular mine area consisting of a great number of openings, it is difficult to accurately assign production to a particular mine. Production from single claim groups were often reported together even though the production came from widely separated areas, and many individual mines reported production under many different names and companies. The production estimates given above are best estimates based on available data and should be considered as showing relative sizes of the mines rather than absolute production. Production records for many, particularly the older, near surface mines, are not available (no records) or are incomplete (denoted by [I]).

Permitted mines (all currently archived) include the Cactus Rat (Atlas Minerals); Section 32 and Blackstone (Homer Davis); Blackjack (Parco North area) and DCMI mine (sec. 9, T. 23 S., R. 21 E.) (Day Mining Company), and Cougar No. 1 (Telluride area) (NBS Mining).

Reserves:

No formal reserves are known in the area, but significant lower grade ore is probably present in many of the larger mines. Butler and Fisher (1978) estimated reserves in the Thompson district at 21,300 short tons containing 125,600 pounds U_3O_8 and 640,000 pounds V_2O_5 as of 1971 and the Utah Geological Survey estimated "reserves" remaining in existing mines in theYellowcat area at 3,575 tons @ 0.17% U_3O_8 and 1.21% V_2O_5 as of 1974. Some, but not all, of these of these reserves were mined between 1971 and 1978. Doelling (verbal communication, May 2004) believes that much ore remains in the old workings particularly in the Johns Incline mine. Other mines with remaining ore include School Section 2, Ringtail Shaft, Blackjack (Blackstone 5), and possibly also in the Allor 12, Juniper, and "Cactus West" areas.

Ore Deposits:

Uranium-vanadium deposits in the Yellow Cat area occur as relatively continuous, tabular and roll-type ore bodies and as isolated mineralized logs surrounded by a halo or aureole of lower grade ore. Tabular bodies are most common but roll type deposits are relatively common. Stokes and Mobley (1954) reported that the roll-type bodies were larger and higher grade but their conclusion was based mostly on the oxidized deposits around the Parco mine before the large, tabular deposits in the northwestern part of the district had been developed. Both tabular and roll-type ore bodies occur together with roll-type ore bodies grading into tabular bodies along bedding or unconformities. According to Stokes (1952) roll-type ore bodies has sharp contacts but the boundaries of tabular bodies are more gradational with limits determined by assay cut-offs. The size of individual ore bodies ranges from a few short tons to several thousand tons but often cluster with several "ore pods" within an area 400 to 800 feet long by 250 to 300 feet wide. Stokes and Mobley (1954) reported that the roll-type bodies were larger and higher grade than the tabular deposits.

Roll-type ore bodies are typically C- or S-shaped (S-shaped apparently more common), but may be extremely irregular with multiple combinations of C- and S-shaped bodies (see cross sections in Stokes 1952). Roll-type ore bodies are 3 to 15 feet high, 2 to greater than 6 feet wide and up to 900 feet long. Rolls are often grouped with multiple rolls occurring together either adjacent to each other or "along strike". The rolls generally follow paleo-current directions or channel trends. Grade is highly variable along trend with higher grade zones separated by lower grade areas.

Tabular ore bodies are generally parallel to bedding or unconformities, have highly irregular shapes, and exhibit a sporadic grade distribution with complex interfingering of high and low grade areas. Ore body margins are less well defined than in roll type deposits. Ore bodies are from several inches to over 16 feet thick with an average thickness of 3 feet and with lateral dimensions ranging from small pods 5 by 15 feet to large bodies 200-250 feet wide by 1400 or more feet long (Stokes and Mobley 1954).

The major deposits are confined to the Salt Wash Member of the Morrison Formation but some very minor prospects are developed in sandstones in the lower part of the Brushy Basin. In the Yellow Cat area the Salt Wash is approximately 260 feet thick and consist of interbedded mudstone and lenticular, sandstone-conglomeratic sandstone. Overall the member contains almost equal amounts of sandstone and mudstone/siltstone. The sandstone and conglomerate beds are 10 to over 50 feet thick and are separated by layers of mudstone of variable thickness. The sandstones consist of numerous overlapping and coalescing sandstone lenses deposited by aggrading streams in a floodplain environment. Stokes (1952) believed that most sandstones were deposited by relatively straight, low sinuosity, streams; most likely a braided stream environment. Although individual sandstone lenses can rarely be traced for more than a mile, the sandstone lenses are concentrated into "channels" characterized by (1) a higher percentage of sandstone lenses than in surrounding areas and (2) a relatively consistent paleocurrent direction (Stokes, 1952). None of the earlier reports investigators gave any information on "channel widths", but based on the distribution of mines and prospects favorable zones are 3,000 to 7,000 feet wide, similar to that in other Salt Wash districts.

Four major sandstone horizons are recognized: (1) a lower massive sandstone with a th clay zone (unconformity [?]) near the base (30-60 feet thick; 50-60 feet above base of Salt Wa Mbr); (2) a medium-fine grained impure sandstone (30-60 feet thick-occurs appx. 20-25 ft abo lower sandstone); (3) an upper cross-bedded conglomeratic sandstone with abundant gray pebbles (10-25 feet thick-occurs 6 to 15 ft above sandstone 2) and (4) an uppermost conglomerate sandstone with abundant red and green chert pebbles (5-15 feet thick-occurs at t of Salt Wash Mbr). In addition some thin, discontinuous sandstone beds are present in the bas 50-60 feet of the Salt Wash Member interbedded with mudstone and siltstone.

Many of the uranium deposits are in the lower sandstone horizon and with many thin deposits occurring at the stratigraphic level of the clay zone. This lower horizon contains most the deposits near Yellow Cat including the Parco mines, AEC 1 and 3, and Parko 23 deposits i the main part of the district and the Black Ape and Memphis deposits in the graben to the soutl Few deposits occur in the middle impure sandstone horizon. The upper conglomeratic sandsto horizon contains deposits in the Little Pittsburg 3 & 4, Telluride No 3, and Flat Top No. 1 area The Johns Incline, Parko 23, and Blackstone Incline deposits may also be in this horizon conglomerate. The uppermost conglomerate horizon contains the Ringtail Shaft, Blackjack Incline, School Section 32, Cactus Rat, and McCoy-Red Vanadium deposits. The Little Pittsburg No. 1 and several small occurrences southwest of this mine are probably in discontinuous sandstones in the basal siltstone-mudstone unit.

Most deposits are in coarse to medium grained sandstone, but are also present in silicec pebble conglomerate in the upper and uppermost sandstone-conglomerate horizons. Mudstone and siltstones are generally barren except where in contact with ore-bearing sandstone. According to Stokes and Mobley (1954) the deposits generally occur in the thicker, more continuous sandstones with the larger deposits are usually within the center of the channels usually within the lower third of the sandstone lens. However, a high percentage of deposits, including the deposits in the Red Vanadium, Tellluride 3, and Flat Top No. 1 areas occur alonş the lateral margins of sandstone lenses adjacent to shale and mudstone. The host sandstones ar white to gray. Shales and mudstones are predominately red, but are altered to blue-green near the ore deposits. Roll-type deposits generally follow paleocurrent directions and channel trend but the tabular deposits are often at angles to these trends. Mineralization trends for deposits ir the upper sandstone and uppermost sandstone-conglomerate are generally at angles of 20 to 40 to the channel trend. This feature is common for many Morrison hosted deposits including thos in the La Sal and La Sal Creek areas. The tabular bodies at the Ringtail shaft, School Section 3 Cactus Rat mines and Flat Top No. 1 all show this and could possible represent cross-scours or

The Salt Wash channels generally trend east to northeast and reportedly are relatively straight with few meanders. Current direction based on numerous cross-bedding measurement showed two main trends; a strong maxima trending N50-60°E with subsidiary trend at S85-90E However, the paleocurrent directions show much variability and change in orientation along trend and between different sandstone horizons. An evaluation of plate 2 of Stokes (1952) sho that each of the three major sandstone horizons shows a slightly different "channel" trend (Figu B)

Uppermost sandstone-conglomerate: Trends N45-50°E but curves to N75-80°E to due E ±20 as go to east

Upper sandstone: Generally trends N 10-20 E in the south but curves to N20-25°0E as go to north

Main sandstone: Generally trends N 70-85 E but with occasional meander bends (west and south of Yellow Cat camp site

In oxidized deposits above the water table the principal uranium-vanadium minerals are carnotite, tyuyamunite, roscoelite, corvusite, and vanadium hydromica. These minerals are associated with gypsum, selenates and many secondary uranium-vanadium minerals such as hewettite, meta-hewettite, rossite, meta-rossite, and pascoite. Unoxidized deposits contain uraninite (pitchblende), coffinite, and montroseite associated with metallic sulfides and selenides. Several rare uranium minerals are present at the Cactus Rat deposit including rauvite, steigerite, and phosphuranylite. Some unoxidized ore was present at relatively shallow depth where the ore was protected from oxidation by impermeable shales (Juniper mine). Most of the mines in the central part of the area near the Yellow Cat campsite were oxidized, but the deeper ores accessed by shafts and inclines to the north (School Section 2, Blackstone incline, Ringtail shaft, etc) mined unoxidized ore. The ore minerals occur as void fillings, as coatings on detrital grains and as replacements of clay in thin seams, clay pebble conglomerates or galls and as replacement of carbonaceous material. According to Stokes (1952) the vanadium minerals occur homogeneously distributed throughout the sandstone, concentrated along bedding or as irregular spots or blebs. Yellow or brown limonite staining is prominent around most of the oxidized deposits likely from oxidation of primary iron sulfide and selenides.

Ore grades range from 0.05 to 5% U_3O_8 with an average grade of 0.25% U_3O_8 and 0.10 to over 15% V_2O_5 with an average grade of 2.0% V_2O_5 (Stokes and Mobley, 1954 for range; Cannon, 1964 for average). The average U:V ratio is estimated at 1:7 (Utah Geological Survey, 1974) Replacements of carbonaceous material may assay as high as 10 % U_3O_8. Stokes and Mobley (1954) reported that the smaller deposits are usually higher grade but gave no specifics. The deposits contain lesser, but anomalous amounts of selenium (10-700, avg.190 ppm), molybdenum (1-800 ppm, avg. 100 ppm), arsenic (30-1800 ppm, avg. 420 ppm) nickel (4-200 ppm, avg. 35 ppm), and cobalt (5-200 ppm, avg. 60 ppm). The association with anomalous selenium has been used successfully as a prospecting tool with Se-indicator plants such as Astragalus occurs over or adjacent to concealed deposits (Cannon, 1964)

Potential:

Although no known reserves are present the area has potential for uranium and vanadium production and discovery of additional reserves. Ore remains in many of the deeper mines in the northwestern part of the area in the Johns Incline, Ringtail, Blackjack, and School Section 2 areas. Most of these mines are flooded and would require pumping and rehabilitation. I guesstimate that 60-80,000 st @ 0.25% U_3O_8 and 1.5% V_2O_5 remains in and adjacent to these northern workings based on typical size of deposits in the area and past production.

Cannon (1964) identified a number of geologically favorable, near surface areas based on geobotanical prospecting and wide-spaced drilling. Some of these areas have been subsequently

drilled and developed but others are probably still untested. The favorable areas identified by Cannon are shown in figure C. There is also potential for continuation of the known favorable areas and trends to the north and northeast. Butler and Fisher (1978) estimate a resource of 260,000 st @ 0.225% U_3O_8 and 1.5% V_2O_5 for this area at depths of less than 1000 feet with most of the resource at depths of less than 500 feet. More specific favorable trends for this deeper mineralization are shown in figure C. Atlas Minerals did some drill testing for deeper deposits in 1980-82, but results are unavailable. Although geologically the favorable area continues even further the northeast the Moss Back Member becomes more deeply buried along the Sager Wash syncline and any deposit would be too deep.

The Yellow Cat area is ranked as having moderate potential. Most of the near surface deposits were small to moderate size, but several of the deeper, unoxidized deposits produced significant amounts of uranium (60,000 to 70,000 pounds U_3O_8). The ore contains moderate amounts of vanadium and can be treated at existing mills. Ore grade mineralization remains in many of the mines and moderate exploration potential exists to the north and east along favorable trends. Deposits would be at reasonable depths of 200 to 1,000 feet but would require pumping. Negative features include the remoteness of the area, the distance from existing mills and the lack of infrastructure.

Topographic Map Coverage:

Cisco SW 7.5' quadrangle
Mollie Hogens 7.5' quadrangle

Geologic Map Coverage:

Stokes, W.L., 1952, Uranium-vanadium deposits of the Thompson area, Grand County, Utah: Utah Geological and Mineral Survey Bulletin 46, plate 1

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Figure Captions:

Figure A Major mines and prospects, Yellow Cat area, Thompson district, Grand County, Utah

Figure B Major channel trends of lower, upper and uppermost sandstone horizons of Salt Wash Member of Morrison Formation, Yellow Cat area, Thompson district, Grand County, Utah

Figure C Potential exploration areas for uranium-vanadium deposits, Yellow Cat area, Thompson district, Grand County, Utah.