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DEPARTMENT OF MINES
SOUTH AUSTRALIA

# PITCHBLENDE PROSPECTS AT THE SHAMROCK MINE, YUDNAMUTANA MINING DISTRICT

by

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# C O N T E N T S



ASSOCIATED PLAN 55-207

## I. SUMMARY

A significant discovery of pitchblende mineralization was made recently by Departmental prospectors at the abandoned workings of the Shamrock Mine, Yudnamutana Copper Mining District. The deposit comprises two separate well-defined lodes in a spotted schist bordering the actinolitic marble belt of the Terrensian Series, Adelaide System. The lodes, identified respectively as the Shaft Prospect and the Valley Prospect, lie along a shear zone in the southern limb of a tightly folded and overturned syncline. Radiometric assays of channel samples range from 2 to 26 lbs. $U_3O_8$ per ton and indicate a probable average grade of about 8 lbs. $U_3O_8$ per ton. Subsurface exploration by conventional mining methods is recommended.

## II. INTRODUCTION

In June 1955, J. Johnson, Technical Assistant, and H. Campana, Senior Prospector, Department of Mines, Discovered high radioactivity and evidence of good-grade uranium mineralization at the Shamrock Mine, while making a systematic radiometric investigation of the long-abandoned mine workings in the Yudnamutana Copper Mining District. With further prospecting in the vicinity, another uraniferous lode, structurally related to the first, was also located. In late June these two uranium prospects and the surrounding area were mapped, and several samples were cut in preparation for further exploratory work.

## III. LOCATION AND ACCESS

The Shamrock Mine and Uranium Prospects are located about 91 miles east of Copley and 21 miles east of Umberatana Station, in the Yudnamutana Mining District (see Location Map). Existing tracks provide the only means of access by motor in the region. These tracks are negotiable in many parts by four-wheel-drive vehicles only.

The Shamrock Mine is the easternmost in the Yudnamutana District and is, therefore, one of the most remote and difficult of access. It can be approached by motor only from the west;

rugged highlands to the east and south are accessible only on foot. The track to the Shamrock workings is progressively rougher as the mine is approached, and under present conditions is passable by Land Rover only to about a quarter mile from the mine. For about one mile before the mine is reached, the track is difficult even for Land Rover transportation, and larger, heavier vehicles would encounter additional hazards. Transportation to an immediate exploration site at the Valley Prospect would necessitate heavy road construction for about a quarter mile.

## IV. TOPOGRAPHY

The Shamrock Uranium Prospects are situated along a westward-flowing tributary creek in the headwater area of the Yudnamutana Gorge watershed. This drainage is dry most of the time, but, because of exceptionally heavy rainfall over the past several months, many of the creeks are now flowing and will probably continue to flow for a few more weeks.

In the vicinity of the prospects the topography is moderately rugged, with deep, steep-sided drainage valleys, rounded hills, and relief measuring up to about 200 feet. The mine is bounded on the east and south by the rugged quartzitic and crystalline highlands, including Freeling Heights, which rise several hundred feet in relief. To the north and west, away from the Shamrock area, dissection is less pronounced and the country is more open.

## V. GEOLOGIC SETTING

The uranium prospects occur in a schistoss zone bordering on the strongly folded and steeply inclined belt of calcsilicates, which include actinolitic and tremolitic marbles of the Torrensian Series, Adelaide System (Proterozoic). This belt and marginal zones of schist, quartzite, calcareous slates, and tillite comprise a center of mineralization; most known copper deposits in the Yudnamutana District occur in the favorable zone. The entire belt is strongly dragfolded and sheared, and moderately recrystallized as a result of the close folding.

The principal structural feature in the Shamrock area

is a tight synclinal fold, which trends northwest-southeast and plunges steeply to the west. The uraniferous lodes lie in a shear zone along the southern limb of this fold. Shearing stress during or subsequent to folding produced rupture zones which served as channelways for the introduction of mineralizing solutions. Schistosity and bedding trend rather uniformly northwest-southeast, with an average strike of N 70° W, and are vertical or steeply inclined to the south, suggesting a slight overturning.

The area comprising the uranium prospects is underlain by spotted schist, with lesser interbedded silicified, hornfelsic, and phyllitic, sediments (see Geolgic Plan). This schist is composed predominantly of biotite and amphiboles, actinolite or hornblende, and grades from black to green depending on the relative content of these minerals. It commonly has a spotted structure, caused by rounded, poorly formed porphyroblasts of light gray minerals, which have been tentatively identified as scapolite and cordierite by A.W.G. Whittle, Departmental Petrologist, This schist represents a low to medium grade of metamorphism under moderate stress.

The schist grades into the silicified, hornfelsic, and phyllitic beds, which show a minimum of metamorphic effects and have retained some of their original sedimentary characteristics. These interbeds traverse the area irregularly, are strongly limonite-stained, and stand out in relief. The hornfels is dark gray, commonly spotted, dense fine-grained, slightly recrystallized in places, and generally thick-bedded to massive though somewhat schistose locally. The phyllite is fine-grained, micaceous, and light gray on a fresh surface. Both are silicified or associated with vein quartz in places.

A "reef" of highly fractured quartzite striking N45° W, transverse to the structural trend in the area, is the only other rock unit within the map. This quartzite appears to be sheared off at the southern end but continues to the northwest.

A quarter of a mile beyond the map limits, minor copper-uranium mineralization was noted in the quartzite and along its contact with the country rock. The quartzite is probably of

hydrothermal origin, resulting from silicification along a fracture zone. There are abundant evidences of silicification on a lesser scale throughout the area.

## VI. PITCHBLENDE-BEARING LODES

The Shamrock prospects consist of two separate well-defined lodes, which are structurally related. One is located at the abandoned Shamrock workings, where uranium is associated with copper in the mine lode, and is identified as the Shaft prospect; the other is located about 800 feet to the northwest, along the structural trend in the area, in the bottom of a drainage valley, and is identified as the Valley Prospect (see plans). Although occurring along the same rupture system, the two lodes are not similar in surface appearance. The Shaft Prospect is more typically a lode shear, whereas the Valley Prospect is probably a fissure vein deposit. At this writing, no information is available on the mineralogy of the lodes, particularly the relationships between pitchblende and gangue minerals.

The structural relations between the two lodes suggest a possible extension of mineralization in the intervening area or along the line of shearing beyond the map limits. At the Shaft Prospect, uranium mineralization of unknown quantities continues northwest from the lode under a covered area, as evidenced by appreciable radioactivity in a prospecting pit some 120 feet from the lode. Elsewhere along the projection of the line of shearing, shear structures are located, but there is no indication of associated uranium. (In some such localities radiometric methods are of little use because of rubble and soil cover which could obscure radioactivity in the underlying bedrock.

Shaft Prospect: The original discovery of uranium in the Shamrock area was made while checking the mine dumps for radioactivity. The lode was last worked for copper many years ago, and existing installations consist of two shafts and a collapsed stope (see plan of workings). According to J. Ridgway (Mining Review No. 80), the No. 1 Shaft was sunk to a depth of 80 feet, and a drive was made along a 2½ foot lode at the 30 foot level. The No. 2

Shaft is in contry rock, and no information is available regarding the extent of underground workings. At present, the No. 1 Shaft is collapsed, and the No. 2 Shaft is open but in water at a depth of about 30 feet.

At the surface and in the collapsed stope, the lode has sharp boundaries with the wall rock schist. It trends N 68°W and is essentially vertical. Thickness ranges from 2 to 3 feet, and uranium mineralization has been extended along the strike for about 40 feet to the west by shallow costeaning for channel samples. Mineralizarion appears to terminate abruptly to the east, and the lode pinches out along the costeans to the west. Some indication of the possible vertical extent of uranium mineralization is provided in the dump material, which is weakly to moderately radioactive and contains significant quantities of torbernite.

From the surface the lode is highly weathered to a depth of about 2 feet. The lode material ranges from a dense, hard, massive-appearing, actinolite-biotite rock in the central richest part, highly colored with malachite and uranium yellow ochres, to a radioactive spotted greenschist in the marginal parts, similar in appearance to the wallrock but much more dense. Pitchblende relicts have been identified in the surface, gossany material.

Valley Prospect: This lode lies about 800 feet northwest of the Shaft Prospect in the bottom of a creek valley. The lode is semi-lenticular in shape, strikes N70°W, an orientation similar to that of the Shaft Prospect, and probably dips steeply. The lode is characterized by a high content of vein quartz, which makes up about 60 percent of the mineral content, and abundant coarse radiating needles of actinolite. The entire lode is extremely hard and apparently recrystallized. The quartz occurs in large homogeneous masses, and is also finely associated with the actinolite throughout the remainder of the lode. Irregular-shaped pitchblende grains and blebs range from microspopic in size up to individual masses 1 inch in diameter and clearly visible megascopically. Because of its position in a drainage which contains running water

periodically, no weathered capping has formed and the included minerals are mostly fresh in appearances.

In outcrop the lode can be traced intermittently over a maximum distance of about 140 feet along and across the valley (see plan). The main body is 40 feet long and average 3 feet in width. To the east it lenses and forms thin veinlets up to several inches thick, which terminate in a radioactive greenschist 40 feet east of the main body. To the west the lode outcrop is terminated abruptly by water and boulders in the creek bed but can be expected to extend in that direction for a few feet. Further west, in the creek bed and along the opposite valley wall, the lode also tapers and branches into small veins up to about 1 foot in thickness.

The lode contacts and the degree of radioactivity in the green schist wallrock show that the effects of uraniferous mineralizing solutions are not restricted to the limits of the main body but extend well into the wall rock across the strike. The north contact of the lode is even and regular, but the south contact is irregular and indicates a higher degree of wallrock alteration and possible replacement conditions.

Nothing is known regarding the persistence of the Valley lode to depth. The lode lies in a deeply eroded area, and there is a strong possibility that a large proportion of the original lode has been removed by erosion.

## VII. RADIOMETRIC DATA AND ASSAYS

The accompanying plans show the general extent and relative intensities of radioactivity in the vicinity of the lodes and throughout the surrounding areas. A La Roe Scintillation Detector, Model FV-6S, was used in measuring radioactivity, Intensity is given in milli-Roentgens per hour. For comparative purposes in the Shamrock area, .5 mR/hr., or 1500 c/s, roughly indicates the presence of .20% $U_3O_8$ mineralization, at least in minor amounts.

Radioactivity along both lodes is extremely high, exceeding 5mR/hr., but drops off rapidly away from the lodes. Background radioactivity from the biotite-actinolite schist underlying the area is abnormally high, .1 to .2 mR/hr., or up to

several times normal background elsewhere, probably because the effects of uranium mineralization have been far-reaching in small amounts over much of the area. This is evidenced by the presence of high radioactivity locally along fractures, bedding planes, and planes of schistosity in the hornfelses, phyllites, and schists. These openings afforded permeable routes for weakly uraniferous mineralizing solutions. In such occurrences, radioactivity ranges up to 4 mR/hr., but is restricted to narrow zones along individual fractures or planes of schistosity and is negligible in the bordering rock. Samples of these fracture fillings were taken in the zone of high radioactivity immediately south of the quartzite "reef" (see Geological Plan). One, a limonite-stained phyllitic sediment (Sample U4/7536) assayed .315% $U_3O_8$ (7.1 lbs./ton) radiometrically; another, a quartzitic-hornfelsic sediment (Sample U4/7537) in which the radioactivity is concentrated in limonite incrustations, assayed .38% $U_3O_8$ (8.5 lbs/ton).

Lode Samples: Assays of channel samples taken across the lodes are as follows (see plans for sample locations):

| Sample No. | Type | Location | $\%eU_3O_8$ | $\%U_3O_8$ | lbs/ton |
|---|---|---|---|---|---|
| U4/7531 | 1½' Channel (Lode center, high grade) | Shaft | .91 | .965 | 21.6 |
| U4/7532 | 2' Channel | Shaft | .12 | .11 | 2.5 |
| U4/7533 | 3' Channel | Shaft | .10 | .085 | 1.9 |
| U4/7534 | 5' Channel | Shaft | .21 | .20 | 4.5 |
| U4/7538 | 4' Channel | Valley | 1.155 | | 25.9 |
| U4/7539 | 3' Channel (Wallrock) | Valley | .265 | | 5.9 |

An earlier sample from the Valley lode, a series of chips taken irregularly across the lode, assayed .69% $eU_3O_8$ .70% $U_3O_8$, or 15.7 lbs/ton.

The hardness of the quartz-actinolite lode material in the Valley lode precluded the possibility of obtaining by hand methods, even with diamond tipped sampling tools, a series of samples that would represent accurately the $U_3O_8$ value of the entire lode. The two samples from this prospect listed above suggest a higher grade than from the Shaft Prospect and that some of the wallrock schist is sufficiently mineralized to be mineable.

## VIII. CONCLUSIONS AND RECOMMENDATIONS

Preliminary geologic and radiometric investigations at the Shamrock Uranium Prospects have revealed a well-defined mineral structure as a guide for subsurface exploration and a promising grade of pitchblende-type uranium mineralization. From surface indications the Valley Prospect is more significant as a potential orebody but also poses more serious problems in access. Both prospects constitute an important uranium discovery.

The principal obstacle to exploratory or developmental work is remoteness and poor accessibility. Heavy equipment could be moved to the vicinity of the prospects with only moderate difficulty, but considerable road construction and repair would be necessary for access to immediate sites at the lodes.

Sinking on the lodes by normal mining techniques would necessitate pneumatic drill equipment, including an air compressor, which would be adequate for initial operations. In addition, a large-capacity water pump would probably be needed in subsurface work at the Valley Prospect.

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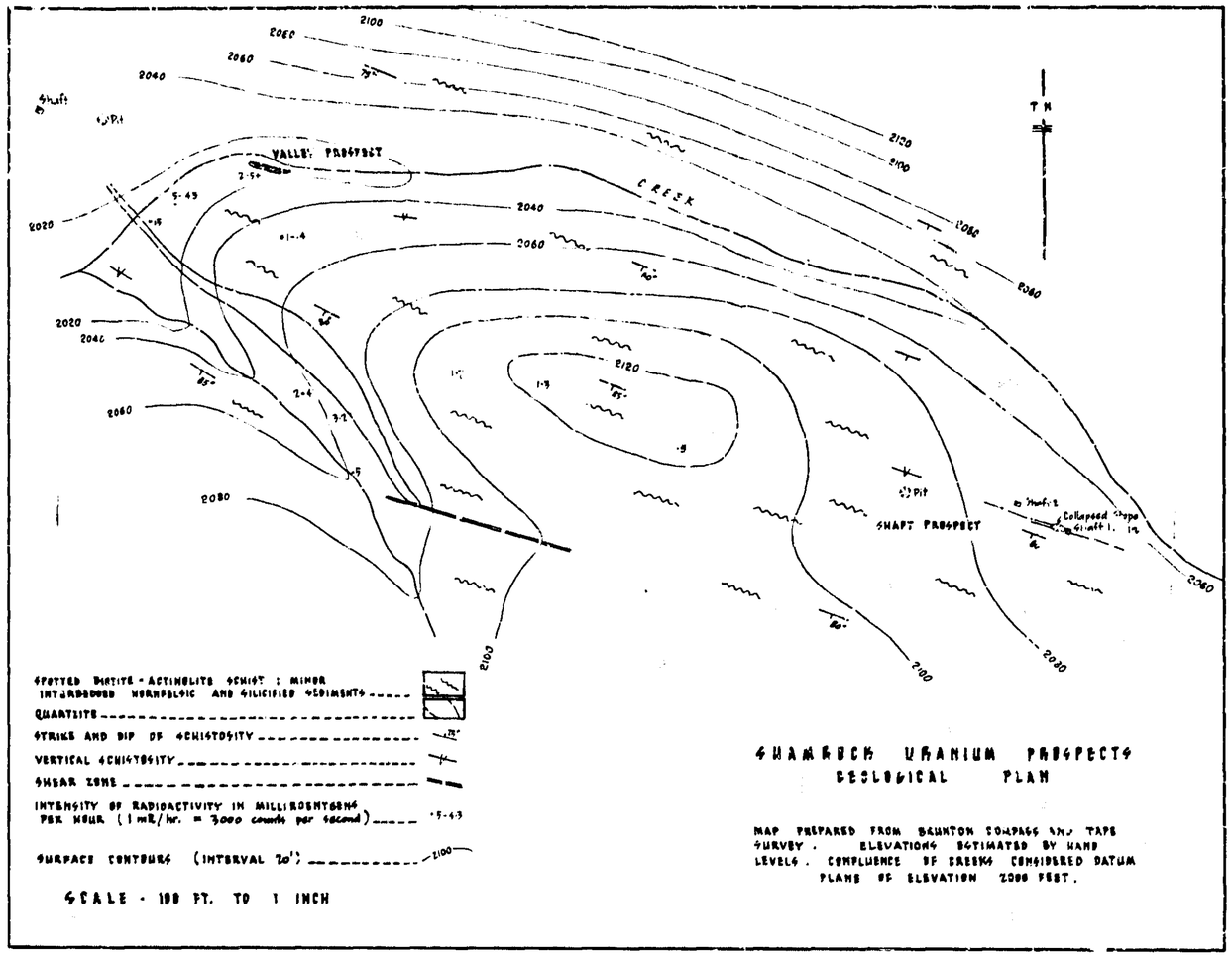


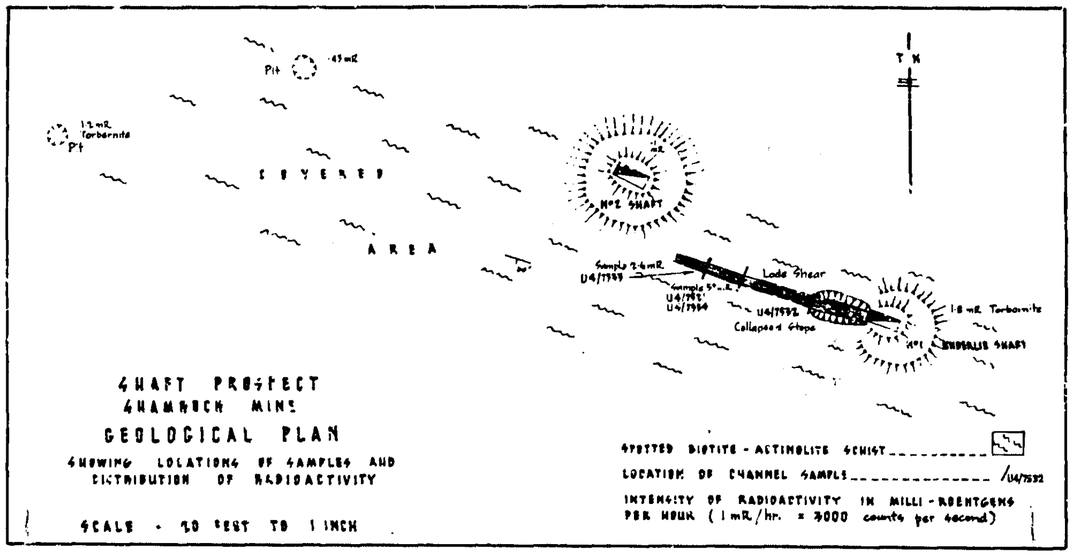


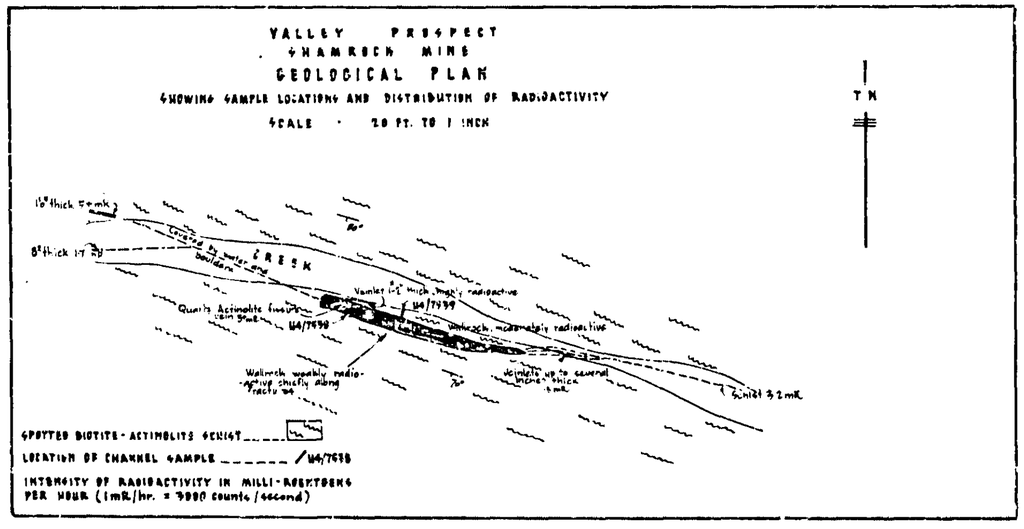


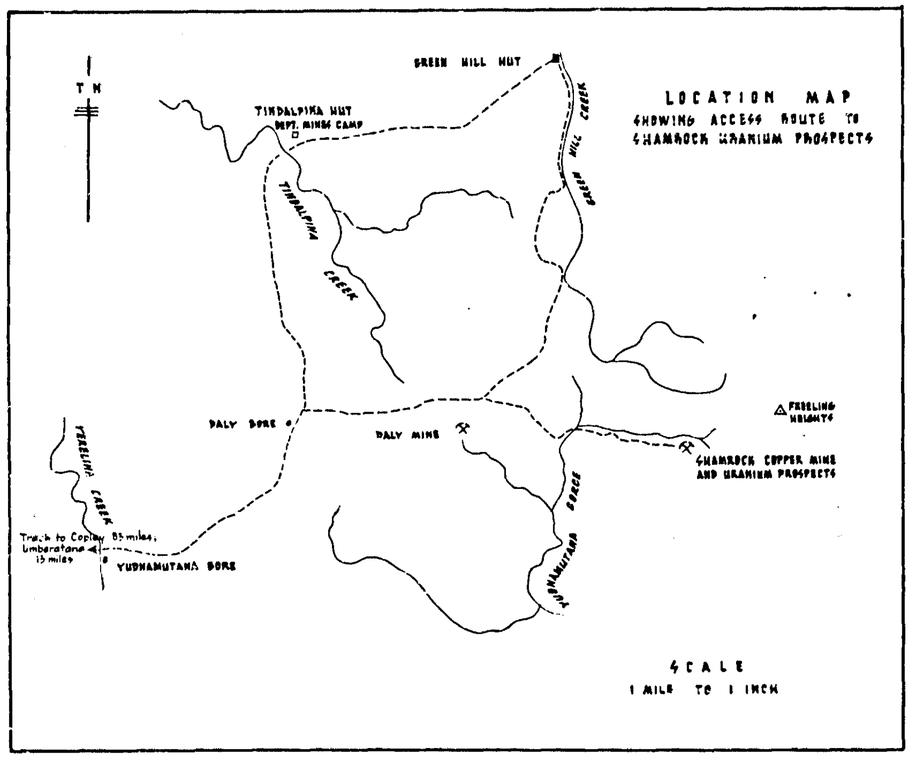


TO ACCOMPANY REPORT BY W.C.WOODMANSEE JULY 1955

S.A. DEPARTMENT OF MINES

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| Associated Drawing | No. | No. | Amendment | Init. | Date | Req. No. D.M. Compiled from | SHAMROCK URANIUM PROSPECTS GEOLOGICAL AND LOCALITY PLANS | Approved / Director of Mines | Passed | Drn. Tcd. Ckd. Init. | Scale: VARIOUS 55·207 Cd Date 19.7.55 |