

45/25
DM353/57

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Report on

CROCIDOLITE ASBESTOS OCCURRENCES NE. ATRABA WOOLSHED
SEGS. 155, 156, 161, 162, 173, 174. NE. ATRABA, CO. RALSON
(N.F. Driver & R. Richard)

by

A.D. Crawford
Geologist

REGIONAL MAPPING SECTION
GEOLOGICAL SURVEY

CONTENTS

Abstract

1. Introduction
2. Previous Reports
3. Topography
4. General Geology
5. Asbestos
6. Conclusion & Recommendation

Appendix-Extracts from Petrological Report
by M.J. Buchholz.

FLAP REFERENCE

<u>No.</u>	<u>Title</u>	<u>Scale</u>
57-260	Crocidolite Asbestos Prospect North of Hawker	500 ft. = 1 inch

MICROFILMED

H.O. Report No. Refer 45/25
G.O. Report No. Refer 756

30th July, 1957.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Report on

CROCIDOLITE ASBESTOS OCCURRENCES N.E. ARKABA WOLCHED

SECS. 155, 156, 161, 162, 173, 174. HD. ARKABA, CO. MASON

(E.F. Driver & R. Rickard)

ABSTRACT

An area south-west of Arkaba Wolched, 10 miles north of Hawker, shows extensive and generally low grade crocidolite mineralisation of Proterozoic dolomitic limestones, associated with diorite occurrences. True crocidolite is too rare for the area to be of economic value as a source of asbestos.

1. INTRODUCTION

On 22/2/57 Mr. E.F. Driver, of 11, The Avenue, Medindie, S.A., requested a geological survey of an asbestos claim on Sections 162 & 174 Hd. Arkaba, about 10 miles north of Hawker. The claim, held jointly with Mr. R. Rickard, was discussed by the two claim-holders with Mr. G.P. Whitten and the writer on 5/3/57, when it became evident that Sec. 162 was also involved.

The written request stated that the area "has very good showings of high and medium grade asbestos, together with other minerals." No samples were produced by the claim holders. They stated that eight 40-acre claims had been pegged south-west of Arkaba Wolched in hilly rugged country.

It was agreed that the writer should make a preliminary inspection of the area and a reconnaissance survey was carried out on 5-7th March. This showed some slight asbestos mineralisation in the vicinity of the claims, which were poorly defined. Thin seams of crocidolite were discovered about half a mile west of the claimed area. After further discussion with Mr. Rickard he and the writer made a further visit to the area and made a more extensive survey and a detailed examination of the claims.

It should be noted that as a result of this Mr. Rickard decided to re-peg the claims, as at present they are inaccurately laid out and do not in fact cover 40 acres each. No claims are

therefore shown on the map, scale 500 ft. to 1 in., which accompanies this report. Two bulk samples of asbestos-bearing material were submitted to P. & D. Branch, Thebarton, for examination. These are being reported on separately by that Branch, but comments by Mr. P.R. Hockley are incorporated below. Extracts from a petrological report by E.J. Bucknell are appended.

2. PREVIOUS REPORTS

Crocidolite asbestos has been recorded previously from this vicinity:

Min. Rev. 16, 1912, pp. 44-45. Note by N. Jones, Insp. Mines.

Min. Rev. 50, 1929, p. 60 Short report by R.L. Jack,
Dep. Govt. Geologist.

Min. Rev. 56, 1932, p. 67 1st Report on asbestos in W.A.
by J.A. Pearson, Insp. Mines,
pp. 62-68.

The latter is a summary only.

The gist of these reports is that in 1912 a search licence holding covered 2 sq. miles in the vicinity. Workings existed on Sec. 162, about one mile north-east of Red Chim Cell. A single vertical shaft had been sunk to 53 ft. and there were several open cuts. The shaft showed "decomposed clay slates and sandstone with a great number of seams of asbestos", running in various directions. From the bottom of the shaft a drive was cut south-east for 40 ft., with asbestos-bearing rock for the first 10 ft. and the last 9 ft.

The 1912 report further stated that asbestos seams were visible over a stretch of 50 ft. in Saltwater Creek, half a mile north-east, and in Woolshed Creek, 2 miles north-east.

Jack's 1929 report stated that "nothing had been done for many years and the shaft was inaccessible". It added that the asbestos is associated with dolomitic limestones, both arenaceous and argillaceous, striking NE-SW and dipping south-east, which occupy a considerable proportion of Secs. 153, 156, 162 & 173, but that the occurrence of crocidolite is irregular. Jack's conclusions

were that

- " (i) the workings do not expose quite as great a proportion of crocidolite as those in Bright (i.e. the major known crocidolite occurrence in S.A., in the Robertstown Area)
- (ii) the type of asbestos and the conditions of occurrence are identical with that at Bright.
- (iii) the patches of asbestos occur not in the rocky limestone outcrops, but in the soil-covered areas between the outcrops, and must be sought by trenching.
- (iv) there is a large area in which there is every likelihood of other patches being discovered."

3. TOPOGRAPHY

The area covered by this report extends from a line extending east from Red Whin Well to the Hawker-Wilpena road northwards to Fern Fern Creek and its tributary Woolshed Creek (see inset on main plan). It covers parts of Secs. 155, 156, 161, 162, 173 & 174, Hd. Aratuba.

The area as a whole is hilly. On the east side, parallel to the road, is an almost flat stretch about a quarter of a mile wide. On the west side, the area around the confluence of Saltwater Creek (see plan) & Fern Fern Creek is low and flat and extends southwards into Sec. 156. Between these two flat areas is a group of hills which is closely intersected by numerous creeks. In the southern half of the area there is a marked pattern of northerly-flowing creeks and here the hills are smooth and rounded. In the northern half drainage is dendritic, the creeks have steeper and shorter courses, and the hills are a little higher and are rugged, with numerous rock outcrops. This northern area is fairly well timbered; the southern area is almost devoid of trees.

Southwards there is undulating country. Northwards the hills become higher and more rugged. To the west lie the foothills of Elder's Range and to the east the ground rises steadily to the foot of the Chace Range.

4. GENERAL GEOLOGY

The area is one of Proterozoic rocks. To the north an anticlinal zone of Marinoan and Sturtian sediments lies between Wilpena Pound and Elder's Range. The anticlinal axis occupies low ground and runs approximately NW-SE but swings south immediately east of the area being described, so that the latter is entirely within a westerly-dipping limb of this major anticline.

The rocks in the area form three main divisions

3. Upper slates
2. Dolomitic limestones
1. Lower slates

These may be the equivalent of part of the Tapley Hill Slates (1), the Brighton Limestone (2) and part of the Purple Slates (3) of the Sturtian-Marinoan type Section near Adelaide. Their relation to the sequences in the Wilpena area described by Dawson ("The Wilpena Pound Formation & Underlying Proterozoic sediments, Trans. Roy. Soc. S.A., vol. 65, p. 295, 1941) is not clear in detail but they appear to be equivalent to beds in the lowest part of the series he describes.

4.1 The lower slates outcrop in the eastern, flat belt where they have a consistent westerly dip. Their widest outcrop, in the south, is over a distance along the dip of approx. 2100 feet and as the dip is constant at 70° they are approximately 2600 ft. thick (and as they extend down sequence east of the area considered, they are presumably much thicker). In the north they appear to be dipping much less steeply, at 35-45 degrees.

These beds are flaggy or blocky grey or green-grey argillites, locally slightly gritty. In the south they become harder and slightly coarser grained towards the top and grade up into banded argillaceous dolomitic limestones, forming a thin transition zone between the lower slates and the overlying dolomitic limestones. These transition beds occupy an area on

the eastern slopes of the hills. In the north no such zone has been detected; there is an abrupt change in Woolshed Creek and the junction is apparently faulted.

4.2. Dolomitic limestones outcrop in the hilly central area.

They appear to be conformable with both the underlying and overlying beds. No sequence within the outcrop has been determined. In the south, outcrops are limited. In the north, numerous outcrops exist but dips and strikes are very variable and much of the outcropping rock has become masked by kukar. Three main types of dolomitic limestone exist.

- (a) Hard banded crystalline argillaceous limestone with bands of grey clayey matter and buff or pink crystalline dolomite and calcite;
- (b) massive unbedded cream dolomitic limestone with intraformational conglomerates;
- (c) yellow crumbly unbedded dolomitic limestone

Types (a) & (b) weather very characteristically. There seems to be no consistent disposition of these three types, which appear to represent different phases of dolomitization. There is a great variation in dip and strike, often extreme over small areas, which may be the result either of slumping soon after deposition or crumpling during or immediately after dolomitization. The latter is more probable as no true slump structures were seen.

In the central part of the outcrop there is definite folding (see plan) and a system of folds approximately parallel to the strike is suggested. Insufficient time was available to confirm this by comparably detailed mapping to the north and south, but it seems probable that these folds die out southwards, where a steady westerly dip exists, and become intensified northwards, where prominent eastward-facing scarps occur west of the main road in the vicinity of Arkaba H.S.

4.3 Upper Slates outcrop on the low ground in the western part of the area. These resemble the lower slates. They are well exposed near Red Chim Well and in the tributary between the well and the old shaft.

4.4 Scattered occurrences of a basic intrusive rock are confined to the dolomitic limestones outcrop. Samples of this have been examined by M.J. Bucknell (petrologist) and are described as diorite. There are four occurrences, the main being at 3-Tree Peak. All show a dark green rock which was described in the field as an amphibolite. Hornblende is present in all samples, which vary in grain size but are otherwise very similar. This dyke rock appears to be associated with the crocidolite mineralisation (see below).

5. ASBESTOS

Asbestos occurs in the area principally as crocidolite. No other form was noted in the field, but in one sample M.J. Bucknell recorded tremolite.

The degree of mineralisation is low. True fibrous crocidolite has been found in situ only at the following localities (shown in red on the plan).

(a) The old shaft (now fallen in; crocidolite noted in dumps and open cuts, in narrow seams). "A" on the plan.

(b) in Saltwater Creek where three seams occur about 1800 ft. north-north-east of the old shaft at point "B" on the plan.

(c) in a shallow creek at point "C" on the plan, where six narrow (2" - 5") sub-vertical seams of short-fibre crocidolite occur in powdery and crystalline gypsum and clay overlying thin argillaceous dolomitic limestones, over an extent of 100 yards

(d) about 1000 feet north of 3-Tree Peak at point "D" on the plan. Here crocidolite is intimately associated with the dyke rock.

True crocidolite presumably occurred at the edit approximately 800 ft. north-east of the old shaft but none was seen.

Elsewhere there are numerous scattered occurrences of a blue "incipient crocidolite" which are shown in blue on the plan. A bulk sample of this material, from area "D", where it occurs with true crocidolite, has been sent to R. & D. Branch, Thebarton, for examination, together with a bulk sample of the true crocidolite from area "C".

No written report on these samples has yet been received, but the writer has been informed verbally by Mr. P.R. Hockley that the low grade material (i.e. the "incipient crocidolite") is commercially useless, and that the high grade material (that from area "C") is comparable with Robertstown crocidolite and, in respect of fibre-length, slightly superior. Unfortunately such high grade material is very restricted in its occurrence. Apart from the area which has already been mined, the only occurrence which seems of possible economic value is that discovered by the writer at "C" and even there the quantity of crocidolite likely to be available is small. No accurate estimate is possible without costeaning.

6. CONCLUSION & RECOMMENDATION

The area shows widespread but generally low grade crocidolite mineralisation, with scattered and very restricted occurrences of true crocidolite at the surface. The true crocidolite is commercially useful and comparable with the Robertstown crocidolite. No estimate of quantity can be made, but surface evidence suggests that only a small quantity of true crocidolite is available at shallow depths. In view of the distance from Adelaide and the small surface occurrences, costeaning is not recommended. The deposits seem unlikely to be of economic value in present conditions.

ARC:AGE
30th July, 1957.

..... *A.R. Crawford*
(A.R. Crawford)
GEOLOGIST
REGIONAL MAPPING SECTION

EXTRACTS FROM PETROLOGICAL REPORT BY M.J. BUCKNELL

ARC 363 Basic Dyke, 100 yds. S.W. of Crawford's crocidolite show.
P 142/57 - A diorite, with about 50% andesine, 35% amphibole and 5% opaques.

The andesine occurs as equant grains and short laths, 0.3 mm. up to 0.7 mm. for the longest laths. 20% sericitization has occurred. Polysynthetic twinning is rudimentary or absent, sometimes occurring in small patches in the crystals. The amphibole is more irregular in shape and apparently interstitial to the feldspar. It consists of pale hornblende, partly replaced by a blue alkaline (glaucofane) variety with low birefringence. Average grain diameter is about 0.4 mm.

Irregular opaque grains 0.15 - 0.3 mm. in diameter occur as well as layer composite masses of brownish calcareous matter and opaque grains.

ARC 369 Crawford's crocidolite show (Area "C") P 146/57 - Short-fibred crocidolite, some of the fibres fairly clean, but some intimately associated with gypsum. The specimen also contains much well crystallised gypsum.

ARC 403 Crocidolite Seam No. 1, Salt Water Creek (Area "B") P 149/57 - The asbestos is a normal crocidolite, but consists of very short fibres intimately associated with quartz, feldspar, and sericitic material. Calcareous matter is also present.

ARC 404 Crocidolite Seam No. 2, Salt Water Creek (Area "B") P 150/57 - The crocidolite has a mean refractive index perpendicular to the fibres of 1.665, and is pleochroic from violet to green-blue. The fibres are short. It is intimately associated with calcite and some crocidolite has been in the act of formation from an amorphous mass.

ARC 405 Blue Seam, Saltwater Creek (Area "B") P 151/57 - The dark blue material consists of crocidolite, which is so intimately associated with ultrafine calcite that it is not possible to determine its optical properties. There is also some alkali-plagioclase and a little biotite. The smaller pale blue patches contain much purer crocidolite, in fibres up to 2 mm. long. The mean refractive index is 1.665; pleochroic from violet to bluish-green and biaxial negative with small to moderate optic angle. There is much chocolate-coloured amorphous matter, presumably ferruginous, as spots or along fibres. Much of the crocidolite shows only poor development of the fibrous texture.

The pink-coloured adjacent rock consists of slightly sericitized orthoclase feldspar, with abundant minute opaque grains, ferruginous matter and calcite.

White "spots" in the crocidolite consist of orthoclase and calcareous matter, with accessory opaque grains and traces of rutile.

ARC 406 Blue & Pink Crocidolite limestone, Salt Water Creek (Area "B") P. 152/57 - A dark blue fibrous, almost isotropic substance believed to be incipient crocidolite, is interstitial to equant grains of dolomite and orthoclase and perthitic feldspar. Elsewhere an acicular mass of soda-amphibole crystals replaces the incipient crocidolite; they are set in a dark groundmass containing analcite. A few prismatic feldspar crystals are arranged roughly parallel to the fibres of the crocidolite in which they are floating - but often the fibres are free of included crystals. Grain size of feldspar and dolomite is 0.04 - 0.15 mm. There are also some actinolite grains and some fluorite and analcite.

The pink grains contain feldspar grains (0.03 mm.) and analcite, with ferruginous matter occurring mainly in parallel bands. Fluorite also occurs.

ARC 409 White Rotted Rock, near Crawford's crocidolite show. P 155/57 - The material is gypsum, with slight local staining due to iron oxides.

ARC 417 Dyke and incipient crocidolite (Area "B") P 162/57 - The dark incrustation, presumably part of the dyke, has orthoclase feldspar, with biotite, short acicular and prismatic crystals of both tremolite and crocidolite, opaque grains, dolomite, ferruginous matter, and traces of rutile. The crocidolite is pleochroic; green-blue-violet-colourless; the R.I. (1.67-1.68) is slightly higher than usual.

The blue patches have short fibre asbestos fairly free of impurities. The crocidolite is biaxial negative with medium optic angle. The Refractive Index and pleochroism is as follows:

	R.I.	Absorption colour
Z	1.670	Colourless
Y	1.665	Indigo blue
X	1.655	Green-blue

There is much tremolite associated with the crocidolite, and it appears often to occur at the centre of bundles of fibres, suggesting that the crocidolite is derived from it. There are small amounts of ultrafine calcite.

The host rock for the asbestos patches is a slightly sericitized orthoclase, with dolomite and some ferruginous matter; the feldspar has abundant opaque inclusions.

ARC 418 Limestone with Crocidolite Seams (Area "B") P 163/57 - Crocidolite is disseminated in thin veins in a brown-coloured matrix containing orthoclase, calcite, dolomite, quartz, and ferruginous matter. The crocidolite is in all stages of development from dolomite, by way of a non-fibrous alkaline tremolitic mineral, (pleochroic from colourless to mauve-blue), associated with abundant calcite.

Broader bands with somewhat cleaner crocidolite occur in a decayed, partly sericitized feldspar with abundant calcite; The crocidolite has a mean Refractive Index of 1.655 and birefringence colours are very low by anomalous blue. It is mostly non-fibrous, and pleochroic from very pale green to very

pale violet. Much is still intimately associated with calcite.

ANC 419 Caprock from near Bulk Sample (Area "D") P 164/57

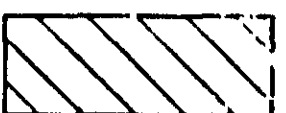
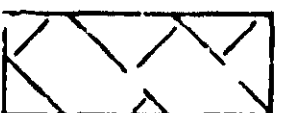
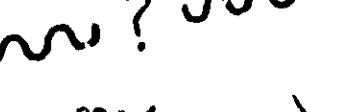
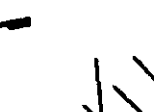
- Greisite is here associated with much opaque matter and calcite, some ferruginous matter and traces of rutile. The white incrustation is dolomite.

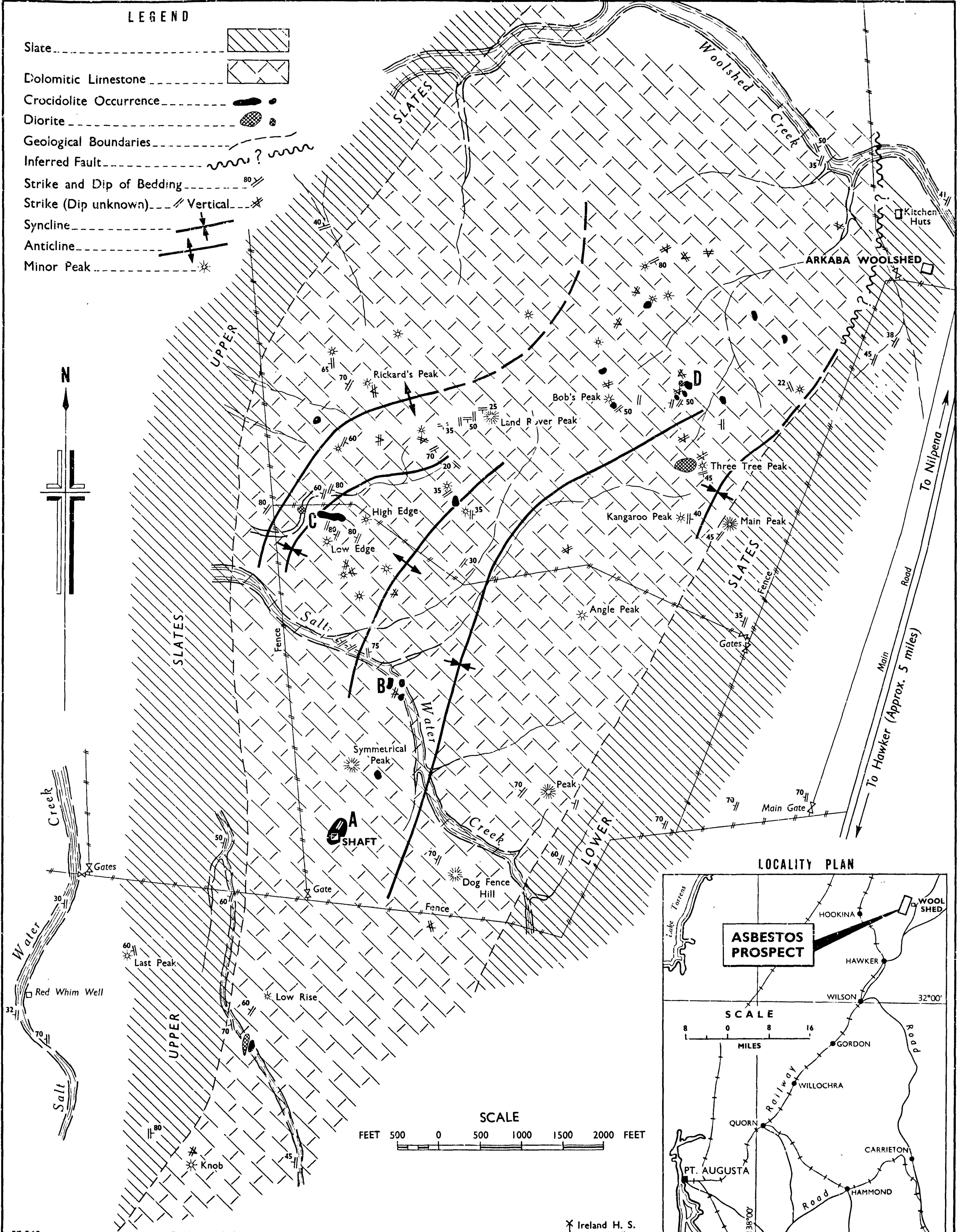
Examined by: M.J. Bucknell

13/5/57

A.W. Whittle
CHIEF MINERALOGIST AND
PETROLOGIST

LEGEND

- Slate 
- Dolomitic Limestone 
- Crocidolite Occurrence 
- Diorite 
- Geological Boundaries 
- Inferred Fault 
- Strike and Dip of Bedding  80°
- Strike (Dip unknown)  Vertical
- Syncline 
- Anticline 
- Minor Peak 



LOCALITY PLAN

