UR1976-04



# 1976/4. An occurrence of turquoise and wavellite, Arthur River area.

*W.L. Matthews*

The Forestry Commission has exposed a zone containing abundant seams of turquoise and occasional small zones of wavellite in a road metal quarry south of the Arthur River [CQ349443].

## GEOLOGY

The rocks in the area generally consist of interbedded dark pyritic siltstone, banded siltstone and fine sandstone of partly turbiditic origin. These sediments are open folded and strike north-east and are intruded by north-east trending dolerite dykes which are often deeply weathered. The sediments are probably upper Precambrian in age. Older Precambrian rocks occur east of the area while more massive sandstone and quartzite overlain by dolomite occurs to the west.

The quarry has been developed on the side of a low hill in mainly dark banded pyritic siltstone dipping south-east at about 40°. The rock is closely jointed, probably due to a fault which passes through the quarry and also partly as a result of folding.

## NATURE OF OCCURRENCE OF TURQUOISE AND WAVELLITE

The turquoise has been deposited along joint surfaces usually as thin seams and scales but occasionally in seams 2-3 mm thick with local pockets up to one centimetre. It is green to bluish-green in colour with occasional seams of sky blue material. It has an earthy texture. A thin section description is appended. Chemical tests show the mineral to be a phosphate while an X-ray diffraction analysis gave the main peaks expected for turquoise (fig. 1). The results of chemical analysis are given in Table 1.

*Table 1. CHEMICAL ANALYSIS OF TURQUOISE SPECIMEN*

| | per cent | Calculated percentages | |
|---|---|---|---|
| Fe | 5.2 | $Fe_2O_3$ | 7.4 |
| Al | 15.6 | $Al_2O_3$ | 29.5 |
| P | 13.7 | $P_2O_5$ | 31.4 |
| Cu | 6.0 | CuO | 7.5 |
| Acid insoluble | 2.3 | Acid insoluble | 2.3 |
| $SiO_2$ | 1.7 | $SiO_2$ | 1.7 |
| Loss on ignition | 19.9 | Loss on ignition | 19.9 |
| | | Total | 99.7 |

The percentages calculated from the analysed constituents suggests that all important elements in the mineral have been determined, although some iron may be present as ferrous rather than ferric iron. Palache *et al.* (1951) gives the following percentages for the various constituents of turquoise:

| | |
|---|---|
| $P_2O_5$ | 34.12 |
| $Al_2O_3$ | 36.94 |
| CuO | 9.57 |
| $H_2O$ | 19.47 |

with a resultant formula of $CuAl_6(PO_4)_4 \cdot (OH)_8 \cdot 4H_2O$. Iron may replace aluminium probably in a solid solution series of compositions, the other end member being chalcosiderite [$CuFe_6(PO_4)_4 \cdot (OH)_8 \cdot 4H_2O$]. Ferrous iron may also replace copper so that the analyses of naturally occurring samples given in

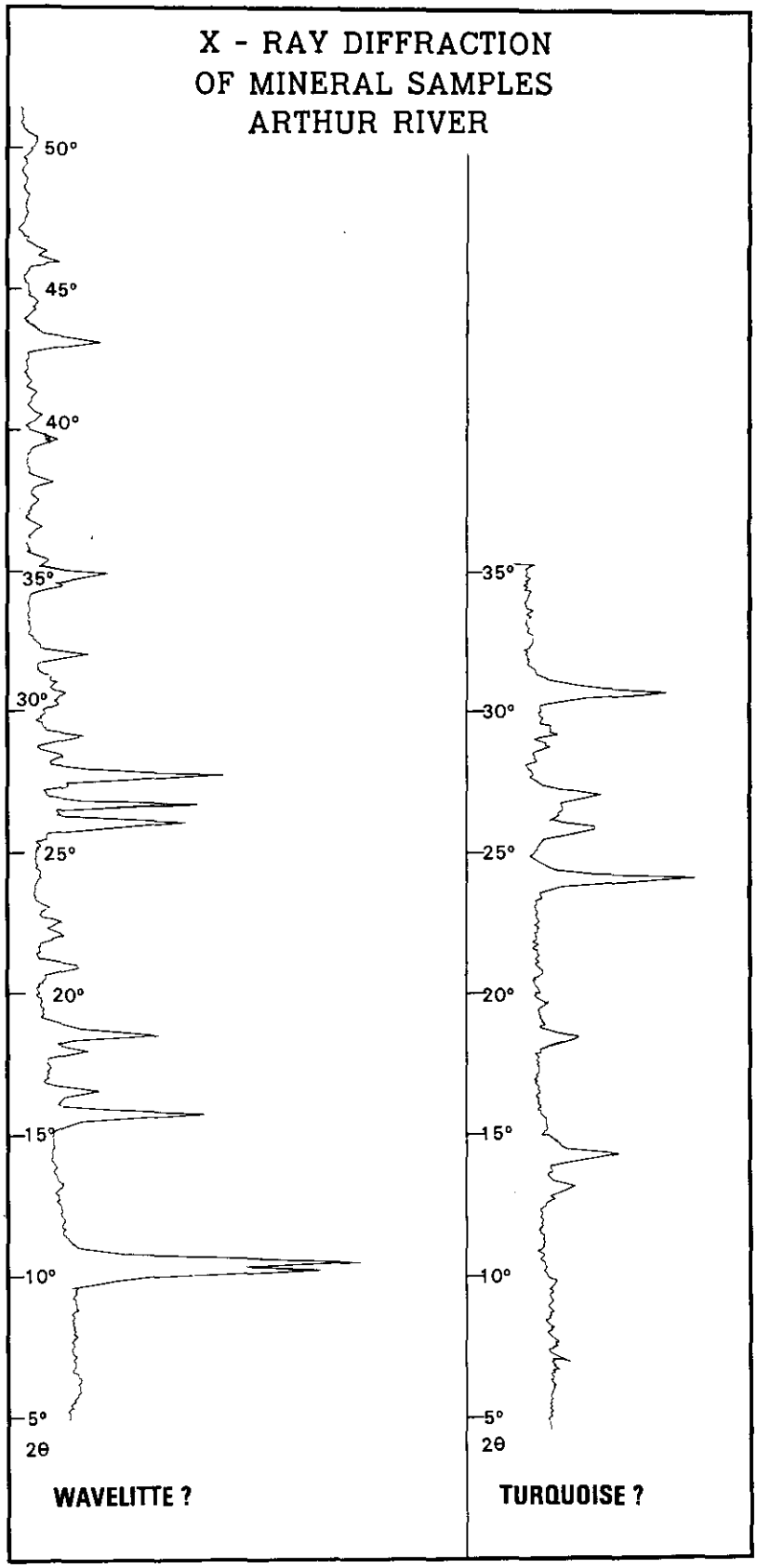
X - RAY DIFFRACTION
OF MINERAL SAMPLES
ARTHUR RIVER
50°
45°
40°
35°
30°
25°
20°
15°
10°
5°
2θ
WAVELITTE ?
35°
30°
25°
20°
15°
10°
5°
2θ
TURQUOISE ?

Figure 1.

5 cm

Palache *et al.* for turquoise may show a fairly wide variation in composition, with the turquoise end of the series being more common. The analysed sample is regarded as turquoise because the percentage of aluminium is greater than iron.

The wavellite also occurs in joints but is less common than the turquoise. It occurs as brownish rosettes of radiating crystals about 2 mm in diameter. Chemical tests indicated that the mineral is a phosphate while X-ray diffraction analysis produced the intensity peaks usually associated with wavellite (fig. 2) together with some additional peaks indicating the occurrence of some other mineral in the sample tested (probably quartz).

Some of the pyrite in the sediments has a 'peacock' sheen on the crystal surfaces and a chemical analysis of a sample of rock containing such pyrite indicated a copper content of 0.13%. A polished section description is appended.

ACKNOWLEDGMENTS

Preliminary identification of the turquoise and chemical tests were made by G. Everard and for wavellite by G. Green. X-ray diffraction analysis was carried out by D. Matthews. Chemical analyses were made by the Department of Mines laboratory, Launceston.

REFERENCE

PALACHE, C.; BERMAN, H.; FRONDELL, C. 1951. *The System of Mineralogy of James Dwight Dana and Edward Salisbury Dana*. 7th ed. Vol. II. Wiley : New York.

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# APPENDIX 1

## Description of specimens, Arthur River area.

*G.B. Everard*

*Specimen 1*

Thin veins of pyrite crystals up to about 2 mm across in indurated black shale or mudstone.

In polished section the specimen contains crystals of pyrite covered with minute pits. Where occasionally the pits are large enough for the insertion of a steel needle they seem to contain a softer more brittle mineral, apparently chalcopyrite. This may account for the small percentage of copper found in analysis.

*Specimen 2*

Fine-grained blue material with a slight greenish tinge, occurring as thin irregular veins and small nodular masses in a pale grey siliceous mudstone.

On heating the material decrepitates violently and flies to pieces, darkening and giving off moisture. It is slightly soluble in nitric acid and the solution reacts for phosphate.

In thin section the mineral is pale brown to neutral; it is faintly pleochroic and has colloform and banded structures. The refractive index is 1.57-1.58.

Under crossed nicols it is microcrystalline with a distinct birefringence and the whole is a network of fine cracks related to the crystallinity but somewhat coarser.

The mineral is turquoise but has some anomalous properties, particularly the refringence.