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Basaltic agglomerate from near Weldborough

by R. S. Bottrill

Abstract

A sample of basaltic agglomerate was examined by thin section, mineral separation, X-ray diffraction, and whole-rock analysis. The rock was probably a basaltic agglomerate, in the alkali basalt/basanite field, but has been almost completely altered to kaolinite, hematite, and anatase. No zircon, spinel or sapphire were observed. An unidentified phosphate is present.

INTRODUCTION

A sample of rock, registered with the Department as G400351, was collected by Mr K. Morrison of Totteny P/L on EL 48/87 from near Weldborough (578600 mE, 5434000 mN). This examination is part of a study to determine the source of sapphires, spinel and zircon in the area (Morrison, 1988). This is by analogy with similar gemstone assemblages in New South Wales, thought to be derived from tuff and agglomerate at the base of basalt sequences (Department of Mineral Resources, NSW, 1987). The rock was described as a basaltic agglomerate on the basis of outcrop appearance, and the study was commissioned to confirm the identification and determine the content (if any) of gem minerals.

HAND SPECIMEN DESCRIPTION

The rock is very fine grained, soft and clayey in texture, with a mottled red-yellow colour. The larger yellow to pale grey clasts (to several centimetres) are irregular in shape and show a weak banding, suggestive of moderately flattened pumice. The cherry-red matrix is homogenous in texture, with fine yellow specks (to a few millimetres) but no obvious banding or foliation.

THIN SECTION DESCRIPTION

The matrix of the rock is cherry-red in colour and almost opaque, indicating extensive hematisation. Numerous small kaolinite patches (to about 0.3 mm) resemble shards or pore-filling of a ropey lava. Weathered phenocrysts, represented by quite abundant yellowish clay pseudomorphs to about 0.5 mm, mostly resemble olivine, but some may have been pyroxene.

The clasts appear to be blocks of pumiceous lava, now largely replaced by kaolinite. They are similar in texture to the matrix, but usually with more abundant crystals.

Representative photomicrographs are shown in Plates 1 and 2.

X-RAY DIFFRACTION

Both the matrix and clasts were analysed by X-ray diffraction to confirm the mineralogy; as expected the clasts were mainly kaolinite and the matrix kaolinite and fine-grained hematite. Anatase is present throughout both parts of the rock, and traces of other clays may be present.

Charts for the red and yellow parts of the rock are enclosed (fig. 1 and 2). The samples were run under Ni-filtered Cu radiation at 500 cps.

HEAVY MINERAL SEPARATION

Part of the sample was crushed, and a silt to fine sand fraction sieved and separated with tetrabromoethane. The heavy fraction was passed through a magnetic separator, resulting in a non-magnetic and a slightly magnetic fraction. The more magnetic fraction is mainly hematite, while the non-magnetic fraction is very small and contains a mixture of fine-grained minerals, including kaolinite, hematite, anatase, and an unidentified phosphate. Electron microprobe analysis indicates that the phosphate contains Al>Ca>Ba>REE, and it is probably a barian crandallite, but admixtures of kaolinite and hematite preclude accurate identification. This mineral is related to the phosphate[probably florenceite, $CeAl_3(PO_4)_2(OH)_6$] found in kaolinite underlying basalt at Legerwood (R. S. Bottrill, unpublished data). The Ce content in the whole-rock analysis (see below) may reside in this mineral. No spinels, zircon or sapphires were observed.

CHEMISTRY

The rock was analysed by X-ray fluorescence for major and some trace elements (Table 1). The analysis can be recalculated to about 70 wt% kaolinite, 22% hematite, 5% anatase, and a few percent of unidentified phosphates (?crandallite). This is in good agreement with the XRD and thin section work.

The sample, when plotted on the Zr/TiO_2–Nb/Y diagram of Winchester and Floyd (1977) (fig. 3), lies on the border of the alkali basalt and basanite/nephelinite fields. The Ce and Ga contents, used by Winchester and Floyd (1977), do not appear to be definitive for this rock. Ce is rather high, and may have been remobilised into the crandallite-type phosphate noted above.

Table 1. *Whole rock analysis (XRF) of Weldborough basalt*

Reg. No.	88494
SiO_2	32.02%
TiO_2	4.63%
Al_2O_3	27.71%
Fe_2O_3	21.87%
MnO	0.04%
MgO	0.25%
CaO	0.64%
Na_2O	0.07%
K_2O	0.05%
P_2O_5	0.96%
L.O.I.	11.0%
Zr	420 g/t (ppm)
Y	36 g/t (ppm)
Nb	110 g/t (ppm)
Ce	210 g/t (ppm)
Ga	29 g/t (ppm)

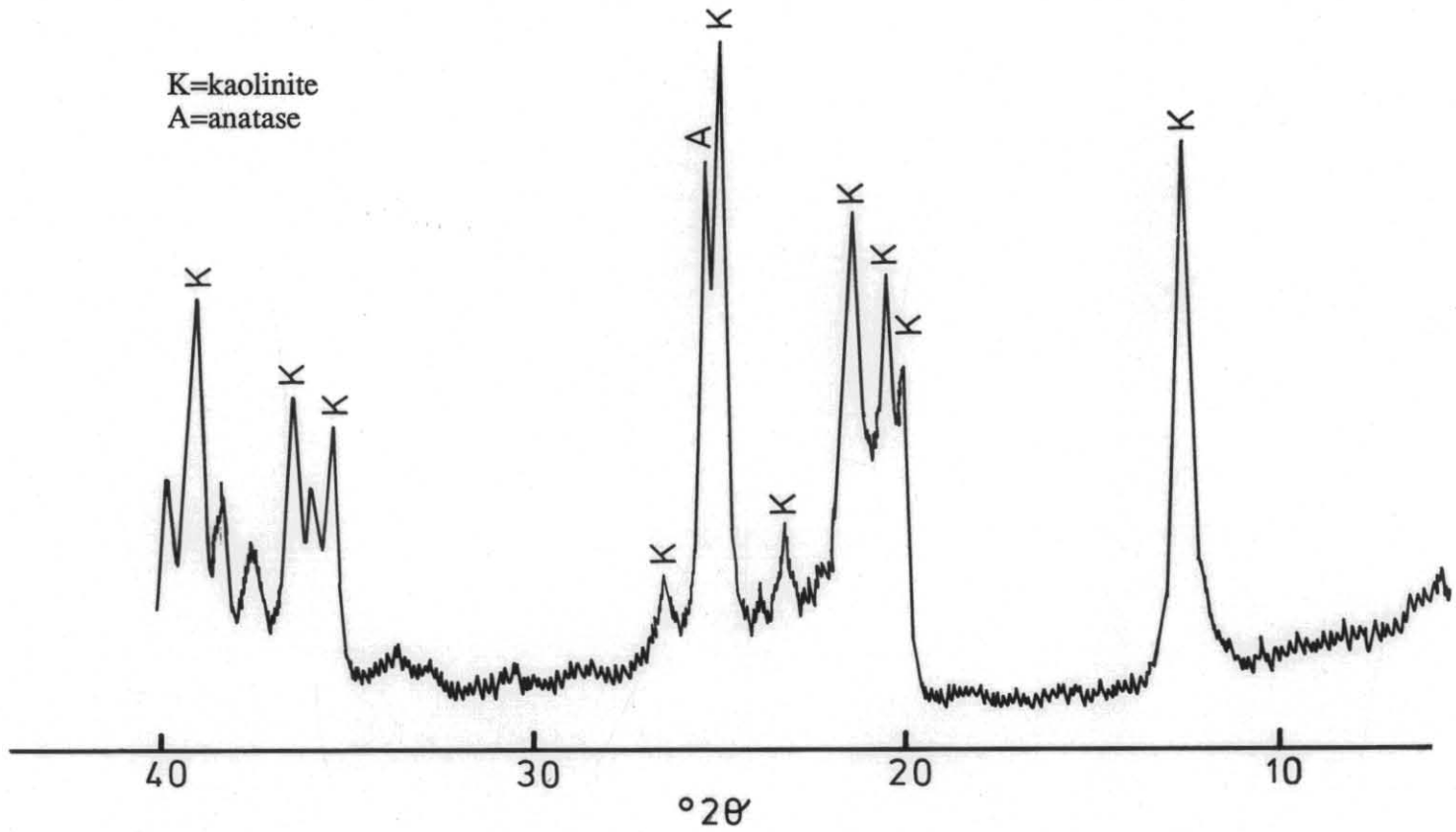
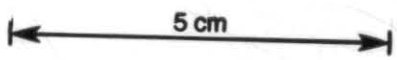


Figure 1. *XRD chart of yellow clast (K=kaolinite, A=anatase)*



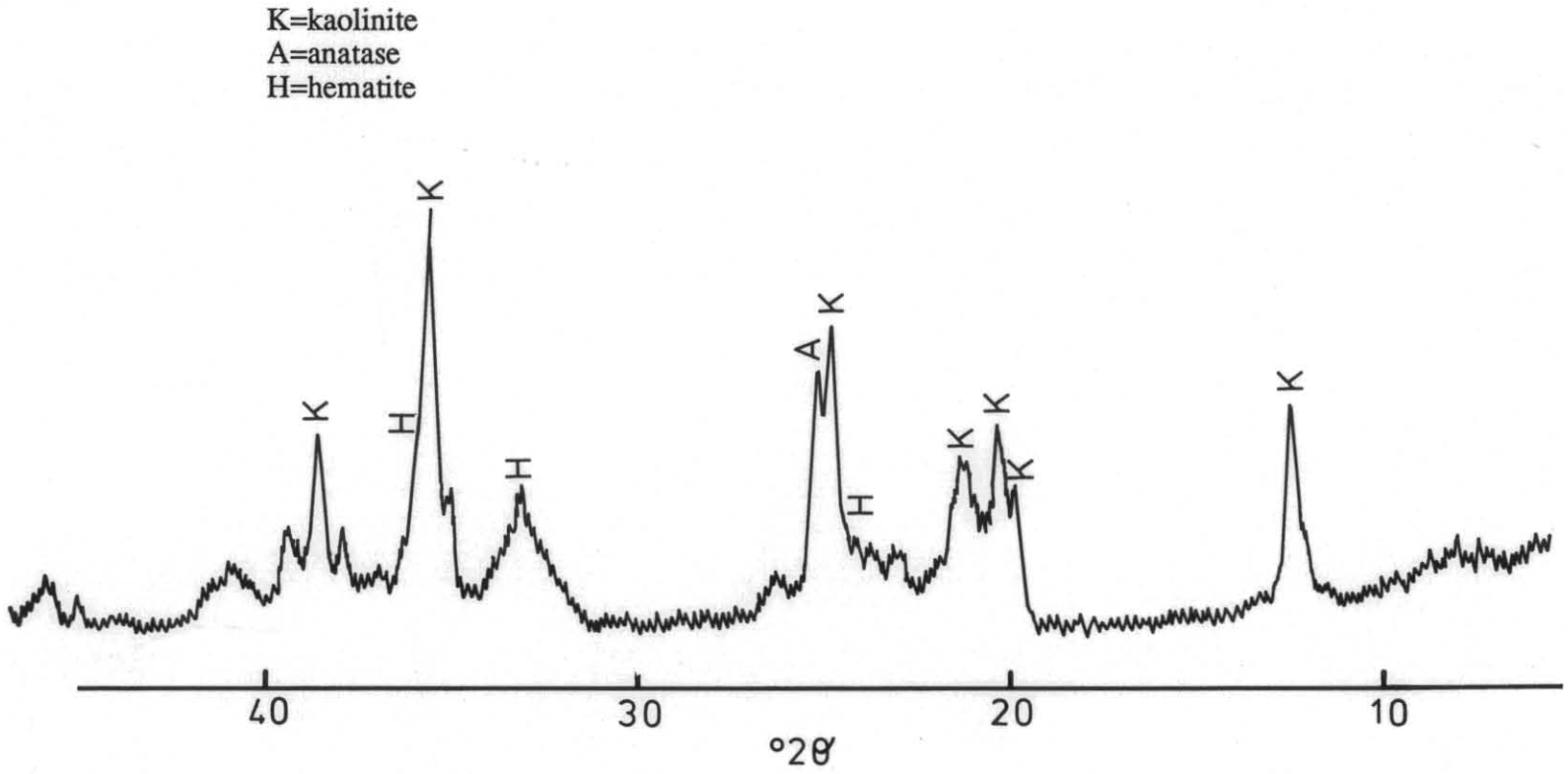
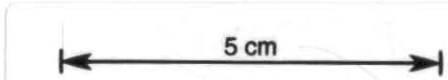


Figure 2. *XRD chart of red clast (K=kaolinite, A=anatase, H=hematite)*



DISCUSSION

The rock is a highly weathered alkali basalt or basanite/nephelinite. Textures indicate that it may have been an agglomerate, with pumice clasts in a fine tuffaceous matrix. Presumably the porous pumice was rapidly filled with kaolinite, preventing the inflow of later hematite-rich solutions (during Tertiary laterisation?). The anatase and crandallite-group mineral probably also formed at this stage. No spinel, corundum or zircon was noted, so this suggests that if this rock type is a source for these gemstones, then they are in very low abundance.

REFERENCES

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MORISSON, K. C. 1988. *Exploration Licence 48/87-Weldborough. Annual report : year 1 and final report.* Unpublished Report Totteny P/L. [TCR 88-2901]

WINCHESTER, J. A.; FLOYD, P.A. 1977. Geochemical discrimination of different magma series and their differentiation products using immobile elements. *Chem. Geol.* 20:235–343.

[29 March 1989]

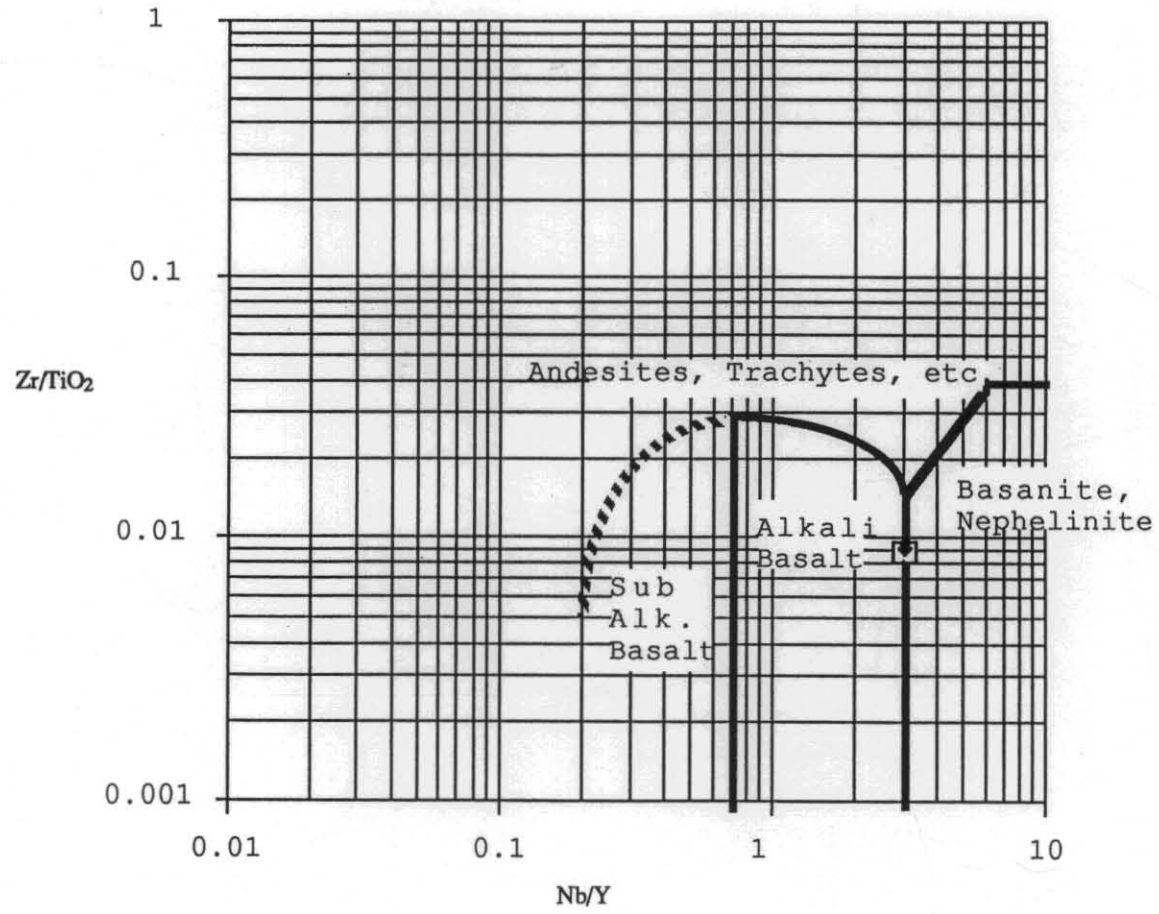

Figure 3. *Weldborough 'agglomerate' on Zr/TiO_2 –Nb/Y diagram with fields for volcanic rocks from Winchester and Floyd (1977). The analysis is marked by the small square.*

5 cm

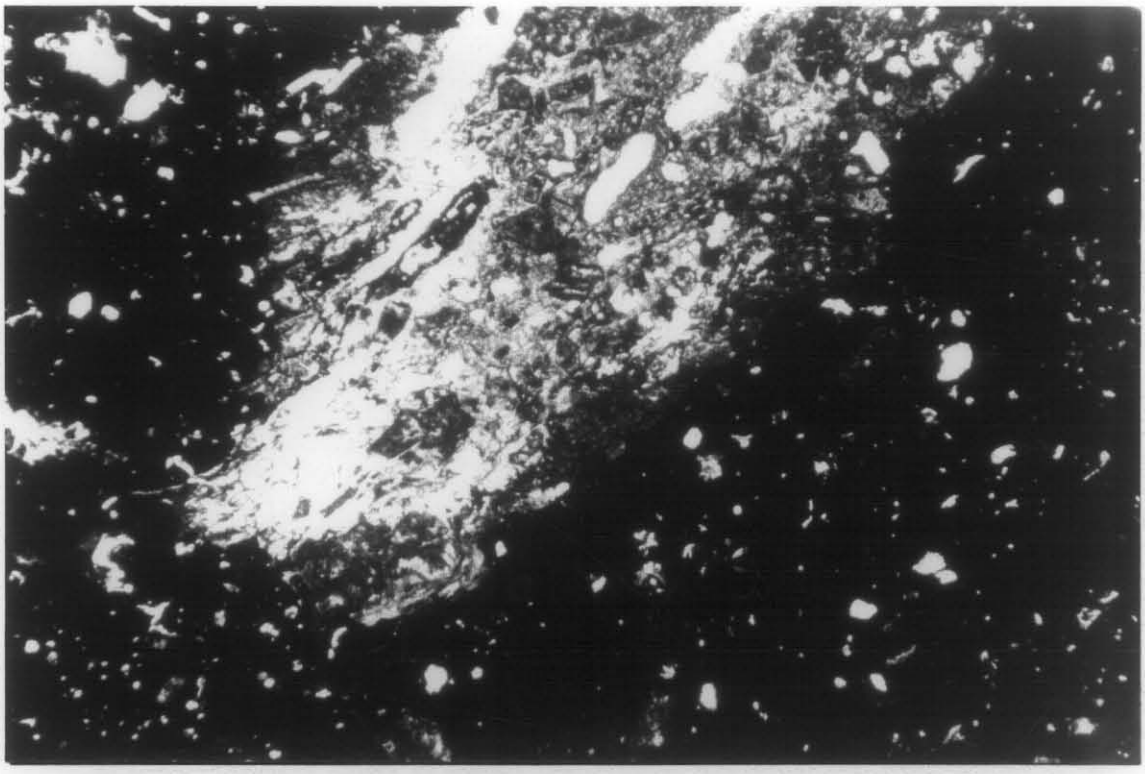

Plate 1. *Vesicular, crystal-rich clast in semi-opaque matrix. Most of white area is kaolinite and the black area is hematite-rich; crystals are grey. Plane polarised light, field of view 4.4×3.0 mm.*

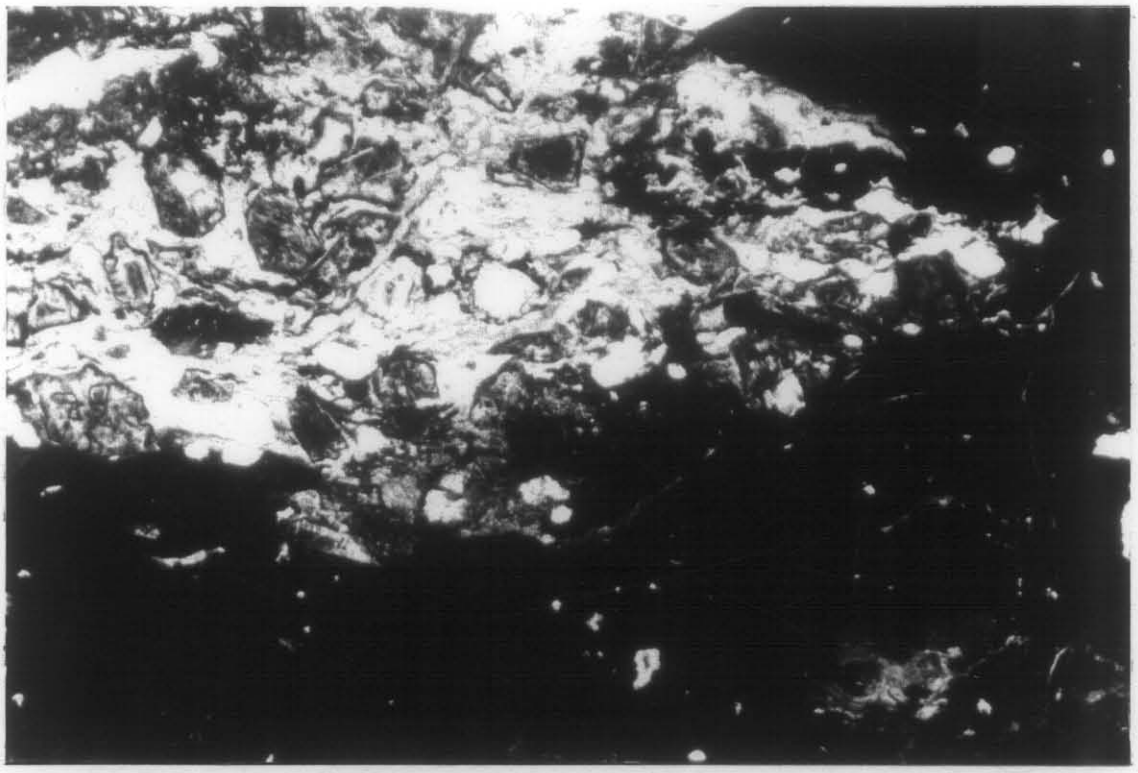

Plate 2. *Similar view to Plate 1, higher magnification, more crystal-rich. Plane polarised light, field of view 1.8×1.2 mm.*