

## SHORT COMMUNICATIONS

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### A method for preparing doubly polished thin sections suitable for microthermometric examination of fluid inclusions

MICROSCOPIC studies of fluid inclusions in minerals are best made on thin sections polished on both sides. Previous workers have used sections about 1 mm in thickness for routine studies (Roeder, 1976; Brumby and Shepherd, 1976), prepared using conventional polishing laps. However, as pointed out by Schwartzkopff *et al.* (1974) serious temperature gradients arise when sections of this thickness are examined using the heating and freezing stage, leading to anomalously high results for inclusion filling temperatures. For this reason, as well as for ease of microscopic observation, it is much better to use a thinner section. The optimum thickness clearly depends to some extent upon the size range and density of occurrence of the fluid inclusions: for inclusions in the common size range 5-30  $\mu\text{m}$ , for example, a section 60  $\mu\text{m}$  in thickness is appropriate. Sections thinner than this are very fragile when removed from their supporting glass slides and consequently difficult to transfer to and from the microscope stage.

The method outlined here has been in routine use for some time to produce high quality, doubly-polished sections 60  $\mu\text{m}$  in thickness, and has proved extremely satisfactory. Twenty-four finished sections can be prepared in three days. The polishing is performed using 'Vibromet' vibrating polishers, which utilize aluminium oxide slurries, a procedure that avoids the premature heating of the specimen that can be occasioned by the use of lead polishing laps, for example, and which can cause modification or even bursting of the fluid inclusions.

#### *Procedure for compact materials*

Slices about 4 mm in thickness are cut from the specimen using an ordinary diamond cutting wheel. This usually causes some shattering, false cleavage, and similar artifacts in the crystals adjacent to the cut surfaces and it is necessary gently to grind away  $\frac{1}{2}$  mm or more from each surface of the slice in order to avoid this modified zone in the final polished section. This is achieved by grinding the surface to be first polished, usually for about 45 minutes, with

600 grade carborundum on a 'Logitech' LP30 lapping machine. The other surface may also be briefly ground at this stage so as to make both surfaces of the slice more or less parallel.

The specimen is cleaned thoroughly with demineralized water in an ultrasonic cleaning bath and dried. It is then warmed and mounted, the thoroughly ground surface uppermost, on a glass slide using 'Lakeside 70' cement.

A batch of up to twenty-four specimens prepared in this way is then polished on 'Vibromet' polishing machines using, successively, 3  $\mu\text{m}$ , 1  $\mu\text{m}$ , and 0.3  $\mu\text{m}$  grades of polishing alumina suspended in ethylene glycol on 'Texmet' oil- and water-resistant lap material. In these machines, the abrasive surface vibrates, with variable frequency, in a short orbital motion, producing satisfactorily relief-free polish without heating and with minimal operator supervision. Polishing times naturally vary according to the materials polished, but generally amount to 3 or 4 hours on each grade of alumina.

When the first surfaces are satisfactorily polished, the sections are again washed and dried, warmed briefly to about 80 °C to soften the 'Lakeside' mounting resin, and re-mounted with the newly polished surfaces against the glass slides.

The sections are returned to the 'Logitech' lapping machine and the unpolished faces ground away to the final desired thickness (usually 60  $\mu\text{m}$ ).

After thorough cleaning and drying, the sections are returned to the 'Vibromet' laps and the second surface polished as before.

For the final microthermometric examination the slides are immersed in absolute alcohol for 1-3 days to dissolve the mounting resin, and the delicate doubly-polished sections cut up to provide small chips suitable for placing in the heating and freezing stage of the microscope.

#### *Procedure for friable materials*

Materials such as kaolinized granite and small quartz-tourmaline veins need thorough impregnation with epoxy resin before grinding and polishing.

In order to achieve adequate penetration of the resin, this is best done under vacuum.

The specimen and premixed resin ('Araldite' epoxy resin AY103 and hardener HY951, in the proportion 10:1) are separately warmed to 40 °C for about 10 minutes. The resin is then poured over the sample and the whole placed in a vacuum oven which, after about 3 minutes, is evacuated to about 100 mm Hg. With this treatment, air is usually drawn out of the specimen for about 30 seconds. The oven is then brought up to atmospheric pressure to eliminate bubbles formed on the surface of the resin. This sequence is repeated until no further air bubbles are expelled from the specimen: about five evacuation cycles are generally necessary. The epoxy resin tends to boil at pressures less than 100 mm Hg, causing frothing and the occlusion of minute gas bubbles within the specimens, and it is important to evacuate air under very modest vacuum conditions.

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## H<sub>2</sub>S-bearing fluid inclusions in baryte from the North Pole deposit, Western Australia

THIS paper reports on the cause of the distinctive odour of H<sub>2</sub>S when certain baryte samples from the North Pole deposit are fractured, crushed, or simply scratched with a steel file or needle.

The deposit, recently described by Dunlop (1976), is located in a sequence of Archean metabasalts and cherts in the eastern portion of the Pilbara Block. Baryte that emits an odour of H<sub>2</sub>S occurs in extensive chert/baryte horizons, which are locally disturbed to form structurally complex zones up to 15 m in width (the B and J orebodies). This baryte is typically dark grey/brown to almost black in colour and coarsely crystalline. In places where the baryte has been remobilized it is white or pale yellow in colour, occurs in veins, and lacks the distinctive odour of H<sub>2</sub>S. A study of representative baryte samples from this deposit using a combination of optical microscopy and mass spectrometry revealed that the H<sub>2</sub>S is a component of the abundant fluid inclusions in these barytes (fig. 1).

The fluid inclusions are usually less than 5 μm in size; too small for conventional heating and freezing stage studies. They are commonly spheroidal or rectangular in shape and occur either in planar or non-planar groupings or as more or less isolated cavities. It is not possible to distinguish between primary and secondary inclusions on the basis of their size, shape, and distribution. Three compositionally different fluid inclusion types were, however, recognized (Table I).

*Type I inclusions* contain an aqueous solution and often a small vapour bubble. The liquid to vapour ratio is highly variable and the inclusions are commonly necked.

*Type II inclusions* usually contain three fluid phases; an aqueous solution and an immiscible CO<sub>2</sub>-rich liquid which, in turn, contains a CO<sub>2</sub>-rich vapour bubble. Less commonly, only two fluid phases are present; aqueous solution and CO<sub>2</sub>-liquid. The amount of aqueous solution within