

A Modified Staining Technique for Carbonates in Thin Section

POTASSIUM ferricyanide and alizarin red *S* are frequently used as stains for distinguishing between carbonate minerals. Potassium ferricyanide in acid solution produces Turnbull's blue with ferrous iron and it used to be thought that dolomite could be distinguished from calcite on the basis that dolomite alone contained ferrous iron. Recently this has been shown to be incorrect¹, and it is now known that any carbonate mineral containing small quantities of ferrous iron will stain with potassium ferricyanide providing the carbonate can be made to react with an acid medium. Recent work^{2,3} shows that alizarin red *S* in solution is probably the best method of distinguishing between the common carbonates.

Boiling, 30 per cent sodium hydroxide solution, as used by Freidman² for staining blocks and chips, has been found unsuitable for staining thin sections, as the mounting medium (Lakeside 70, Canada balsam) tends to dissolve. A weak hydrochloric acid solution does not attack the mounting medium. I have obtained satisfactory results with the procedure described here. A concentration of 3 per cent hydrochloric acid, or greater, at room temperature dissolves away the more soluble carbonates and hence is undesirable. At room temperature alizarin red *S* is most selective as a stain in a concentration of hydrochloric acid which falls between 1 per cent and 2 per cent. At the 1.5 per cent plus level the thickness of the thin section is greatly reduced and the staining becomes pale. At lower concentrations, the stain becomes so thick that it obscures the fine detail of the thin section. An important feature of the stain at the 1–2 per cent acid concentration is that with calcite a surface parallel to the *C*-axis is more deeply stained than one normal to that axis. This is important in fabric analysis where optic orientation patterns are required.

The potassium ferricyanide stain is successful over a range of acid concentrations, and as this solution is mixed with the alizarin red *S* solution the same acid concentration (1–2 per cent) is used. At room temperature, at these low concentrations, potassium ferricyanide does not react with siderite.

Distilled water must be used for making up all solutions and for washing off surplus stain from the thin sections after each stage of the procedure. Much more reliable results are obtained if the thin section to be stained is etched first (stage I of procedure). This pre-staining etch removes all grinding dust from the carbonate surface and is carried out for at least 10 and not more than 15 sec using 1.5 per cent hydrochloric acid. The etched section is then immersed in an acidified mixture of the two stains

(stage II). Each stain works independently, and there is no mutual interference. If the now partially stained section is immersed in an acidified solution of alizarin red *S* for a few seconds the colour differentiation of the carbonates is increased further, but it is important not to leave the section longer than 15 sec in the solution (stage III). After rapid but careful washing of the section in distilled water it is important to dry the stained surface as quickly as possible because the stain is relatively soluble in water. It is important not to touch the stained surface when drying as it is purely a surface precipitate and is easily rubbed off. To preserve and protect the now dried stain, during mounting or remounting, a layer of 'Durofix' is painted on to the surface with a soft camel-hair brush. The 'Durofix' is diluted with amyl acetate, in the ratio 'Durofix' : amyl acetate = 1 : 3, which readily evaporates, and when this layer is completely dry it has a refractive index very close to 1.54.

The details and consecutive stages of the procedure are shown in Table 1.

The distinction between dolomite and calcite, of which most ancient limestones are composed, is of considerable importance in limestone petrology. The modified staining technique described not only gives positive colour differentiation of these two important carbonate minerals but also, because of their different solubility in hydrochloric acid, gives a difference of thickness in thin section. Calcite is etched to approximately 15 μ thickness while dolomite remains at 30 μ thickness; this difference is readily observable with polarized light.

J. A. D. DICKSON

Department of Geology,
Queen Mary College, London, E.1.

¹ Evamy, B. D., *Sedimentol.*, 2, 164 (1963).

² Freidman, G. M., *J. Sediment. Petrol.*, 29, 87 (1959).

³ Warne, S. S. J., *J. Sediment. Petrol.*, 32, 29 (1962).

METALLURGY

Identification of a Beta-Tungsten Phase in Tungsten-Rhenium Alloys

PHASE diagram equilibrium studies in the binary tungsten-rhenium system show the presence of two phases over the range 0–65 wt. per cent rhenium at 1,500°C (ref. 1). A terminal solid solution having a body-centred cubic structure exists from 0 to about 27 wt. per cent rhenium, and a phase having a tetragonal sigma-type structure is found in the composition range 43–65 wt. per cent rhenium. In this investigation, alloys containing 13–45 wt. per cent rhenium prepared by vapour deposition

Table 1

Procedure		Time	Carbonate	Result
Stage I	Etching 1.5% HCl	10–15 sec	Calcite Ferroan calcite	Considerable etch
			Dolomite Ferroan dolomite	Negligible etch
Stage II	Staining* 0.2 g A.R.S. per 100 c.c. 1.5% HCl 2.0 g P.F. per 100 c.c. 1.5% HCl Mixed in ratio A.R.S. : P.F. = 3 : 2	30–45 sec	Calcite	Very pale pink—red depending on optical orientation
			Ferroan calcite	Very pale pink—red Pale blue—dark blue Two superimposed give Mauve—purple—royal blue
			Dolomite	No colour
			Ferroan dolomite	Pale—deep turquoise depending on ferrous content
Stage III	Staining 0.2 g A.R.S. per 100 c.c. 1.5% HCl	10–15 sec	Calcite Ferroan calcite	Very pale pink—red
			Dolomite Ferroan dolomite	No colour

* A.R.S. = Alizarin red *S*. P.F. = Potassium ferricyanide