a crystal of dolomite which is in contact with the Canada Balsam is selected and centred. The refractive index of the Canada Balsam is about 1.54 and this value falls between ω and ϵ for nearly all members of the dolomite-ankerite family. The crystal is oriented with the optical axis horizontal and north-south. In this position the transmitted ray has the index of ϵ which is lower than balsam. Rotation of the outer east-west axis changes this index in the direction of ω. As the rotation is made the Becke line is observed, and where the indices of the crystal and the balsam agree, the angle of rotation is noted. Errors in orientation are minimized by selecting only grains for which readings are obtainable by rotating the outer east-west axis in both directions. This angle of rotation is related to the refractive indices of the crystal, and therefore can be used as a direct measure of chemical composition.

Figure I is a curve relating this angle of rotation to the chemical composition of members of the dolomite-ankerite series. The points in this curve were calculated from data published by Eisenhuth (1902), Emmons (1943), Smyth & Dunham (1947), and Winchell (1951), page 114.

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DIRECT COLOUR PRINTS FROM POLISHED AND THIN SECTIONS

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Light passed through polaroids set at transmission right-angles has long been used for the study and identification of sectioned mineral in rocks. True photographic reproductions of the subtle interference colours produced has been difficult to achieve because of the many variables in the process. The usual art requires the two-stage production of a colour film transparency from which colour prints are made. The sensitivity of colour film and paper doubles the difficulty of obtaining a true colour balance by two processes. With the following method, colour prints can be made directly, and one process is eliminated, a significant advantage.

Apparatus and Materials Used

Microscope fitted with polarizing equipment and camera with cut-film holder.

Bausch and Lomb Tri-Simplex projector, adapted for use.

Ansco Printon paper.

Ansco Printon developing kit.

Ansco gelatin filters.

Process

A. Polished sections. Polished sections, mounted and prepared in the usual way, are placed on the stage of the microscope and oriented with polarized light. Focusing is done on ground glass on the camera at the level of the cut-film holder. Each batch of colour printing paper comes provided with instructions for the necessary colour correction filters for that emulsion batch and so the required gelatin filters are placed in the light path. The colour printing paper is inserted in the cut-film holder in the darkroom and the holder is placed on the camera. Several trial exposure times are made by using holder slide as a light barrier. The slide is pulled out about $\frac{1}{2}$ in. at a time, with exposures ranging in a bracket (usually between $\frac{1}{2}$ and 2 minutes). The slide is then replaced and the holder removed to the darkroom for the usual processing. This is carried out at 68–70°F by adhering strictly to the procedure outlined with the developing kit for consistent results. Briefly the process consists of a 1st development, shortstop and wash in the dark, 2nd or reversal exposure, colour development, shortstop, wash, bleach, wash, fix, wash, dry, requiring about 65 minutes to the final wash.

From examination of the test piece, two things are determined; approximate exposure time and suitability of the filters for colour balance of the emulsion and the light-optics system. Since addition or subtraction of filters will alter the exposure time, the colour balance is adjusted first. Experience has shown that most light-optics systems tend to throw a blue-red light so that usually magenta filters are removed and cyan (blue) and yellow filters are added to compensate. The nearer one can get to a light source of 3000°K colour temperature, the less compensation required. Details for colour compensation are supplied with the photographic materials.

With the compensating filters now in place, a second test is made using the same technique. The exposure bracket is now narrowed considerably, based on the first trial. It should be remembered that the Printon process is a reversal process so that if the print is dark, *more* initial exposure will be required. Once a true colour reproduction has been achieved for a particular light-optics system, the filter arrangement is then examined to determine (by elimination of the filters recommended for the emulsion batch) the filters required for the particular system. This arrangement can then be used for future work and usually eliminates the necessity of the colour balance step.

B. Thin sections. Thin sections mounted on microscope slides can be treated similarly on the microscope. However, the limitation of camera size reflects in the size of the finished print. With the projector, 12.5X enlargements of 8 in.×10 in. can be made simply by projecting vertically to table level using the 12.5X objective and no tube or eyepiece. Smaller prints may be made by raising the easel and larger prints by projecting horizontally, making use of the swivel head. Greater or less magnification may be obtained by using standard or accessory optics.

Since the colour printing paper must be handled under "black" conditions during exposure and first development, it is necessary to operate in the darkroom and to adapt the projector for this work. In order to eliminate stray light, a simple covering for the projector head is made from a cardboard carton. The open end is slipped over the projector head and the flaps are brought together under the stage, with a small hole cut out for the lens opening.

The section and polaroids are adjusted so that the area required is projected onto an ordinary enlarger easel containing a piece of paper the thickness of Printon for initial focusing. Compensating filters are placed over the section and the carton installed over the projector head. This leaves the focusing adjustment free for final focusing. If focusing or examination times are prolonged, an extra piece of heat-absorbing glass should be used between the light source and the section to prevent cracking of the Canada balsam or separation of the section from the slide.

In the dark, a test piece is exposed using standard enlarging technique and processed. Colour balance and exposure are adjusted as outlined previously and then the final print is made.

The author expresses his appreciation to Dr. A. R. Graham and D. Monteith of this laboratory for sample preparation and assistance.

EDITOR'S NOTE. Mr. Bowley's manuscript was accompanied by two photographs of polished sections and two of thin sections. Since the paper describes a process for obtaining colour photographs the illustrations were intended to illustrate the process and the quality of the result rather than any special features of particular minerals. It seemed to the editor that the excellent colour photographs would probably suffer somewhat in quality during the steps necessary to produce a colour plate and therefore the high cost of colour plates did not seem justified. It is hoped that this omission will not detract from the author's purpose in bringing to our attention this simplified method of producing accurate colour photographs of mineralogical materials.

EUDIALYTE AND EUCOLITE IN CANADA

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Introduction

Eudialyte and a related mineral eucolite have been identified from two widely separated areas in Canada.

Mineralogy texts define eudialyte as a silicate of sodium, calcium, iron and zirconium with hydroxyl and chlorine. Eucolite is considered to be a variety with cerium and manganese. There appears, however, to be considerable uncertainty as to the chemistry of the two minerals, and indications are that they are chemically similar with rare earths and manganese being common to both. The only consistent difference the writer could find was in the optic sign, eudialyte being uniaxial positive and eucolite uniaxial negative.

The indices of refraction vary from 1.593 to 1.634 and the birefringence ranges from 0.000 to 0.010. The colours vary from yellow to pale pink, red and brown, the specific gravity from 2.8 to 3.1 and the hardness from 5 to 6. Eudialyte and eucolite are usually found in soda-rich syenite rocks.

Western Quebec

A sample of syenite rock, containing vivid pink granular aggregates of a vitreous silicate mineral was submitted for identification by Dr. W. A. Jones, Chief Geologist of Hollinger Consolidated Gold Mines. The sample was taken from an area in Pontiac County, Quebec, near the Ontario border.

A qualitative spectrographic analysis indicated that the chief constituents of the pink mineral were sodium, calcium, zirconium, silicon and yttrium with lesser amounts of cerium, manganese, iron and titanium. Optically the mineral was found to be uniaxial negative with weak birefringence of first order grey. The refractive indices were close to 1.611. A specific gravity measurement gave 2.81.