MINERALOGICAL MAGAZINE

VOLUME 55 NUMBER 379 SEPTEMBER 1991

Mineral Textures

D. A. POLYA AND G. T. R. DROOP

Geology Department, University of Manchester, Oxford Road, Manchester M13 9PL

THE papers published in this part-volume of *Mineralogical Magazine* are a selection of the 42 oral and poster presentations made at the Mineral Textures meeting held at the University of Manchester on 3–4 September 1990. One of the aims of this meeting was to draw together researchers studying a wide spectrum of natural and experimental systems and using different techniques and approaches. To this end, the meeting was largely successful, attracting presentations on metamorphic, igneous, hydrothermal and diagenetic systems with contributions on SIMS, TEM, cathodoluminescence and more conventional imaging, electron channelling, use of isotopes, high-temperature–pressure experimental studies as well as theoretical modelling of texture development.

The keynote addresses at the Mineral Textures meeting were delivered by Paul Barton Jr. and William Carlson; the texts are included in this part-volume. BARTON provides an historic perspective of the study of ore mineral textures, discusses some of the general principles and techniques and illustrates with examples including: the use of hydrothermal mineral textures as indicators of relative degree of saturation; mineral stratigraphy and geopedal features; post-depositional textures, such as chalcopyrite disease. Barton stresses the opportunities available to determining process histories by critically appraising mineral textures. CARLSON presents theoretical computer simulations of diffusion-controlled porphyroblast growth in metamorphic rock in order to study the effect of competition for nutrients on grain sizes and distributions. Textural criteria are established for distinguishing between interface- and diffusion-controlled crystallisation, and these are applied to natural schist specimens from New Mexico.

The potential of SIMS (ion microprobe) imaging techniques is stressed by ELPHICK, GRAHAM, WALKER and HOLNESS, who, after briefly reviewing the principles, give superbly illustrated examples of how the techniques can be used to assist experimental studies of diffusion, mineral–fluid exchange and total equilibration. LLOYD, SCHMIDT, MAINPRICE and PRIOR review the use of SEM techniques (particularly electron channelling) in determining crystallographic orientation in rocks. Four examples of applications are considered: crystal structure representation, epitaxial nucleation of Al_2SiO_5 polymorphs, crystallographic fabrics of quartzites, and the determination of physical properties (e.g. seismic velocities) from bulk rock texture. With the aid of back-scattered electron imaging, YARDLEY, ROCHELLE, BARNICOAT and LLOYD describe oscillatory zoning in metamorphic minerals (prehnite and clinopyroxene) from contrasting metasomatic environments. They argue that oscillatory zoning is probably a characteristic feature of infiltration metasomatism and may be used to recognise the products of this process outside the vein environment. WORDEN, DROOP and CHAMPNESS use TEM to study the mechanism of the antigorite breakdown reaction in the Bergell Aureole, nothern Italy. They demonstrate that the rate-controlling nucleation of product talc was facilitated by adopting an orientation relationship with antigorite.

RICE and MITCHELL examine the relationship between the development of cleavage domes and textural sector zoning in metamorphic porphyroblasts. They conclude that both features result from crystal growth normal to porphyroblast crystal faces. In the contribution on intracrystalline textures of silicate minerals, VAN

Mineralogical Magazine, September 1991, Vol. 55, pp. 301–302

ROERMUND and LARDEAUX use TEM to study antiphase domains in omphacite and propose a model to explain how domain sizes can be modified after formation.

A variety of ore mineral texture studies are included here: MORE, VAUGHAN and ASHWORTH use TEM as well as cathodoluminescence to study banded sphalerites from the North Pennine orefield. They identify deformation-induced microstructures, distinguishable from primary growth-related textures. GASPAR and PINTO illustrate some of the complex, fine-grained sulphide textures from the recently developed Neves Corvo massive sulphide deposit. The textures formed by late copper-rich hydrothermal solutions are recorded. NIMFOPOLOUS and PATTRICK describe some previously poorly characterised low-temperature hydrothermal and karst-infill mineral textures from the manganese mineralisation near Kato Nevrokope, northern Greece. FOXFORD, NICHOLSON and POLYA relate the distribution of hydrothermal vein mineral textures at the Panasqueira deposit, central Portugal, to structural models of vein evolution. They note that although crack-seal textures generally precede coarser cavity-fill at any given location, these textures formed contemporaneously in different locations at different stages of vein development. FARMER, SEARL and HALLS present a detailed cathodoluminescence study of hydrothermally precipitated cassiterite from the Cornubian orefield. They identify trace elements either activating or quenching luminescence. Cassiterites formed in tectonically-induced and hydraulic fractures are characterised texturally.

FINCH describes the application of cathodoluminescence imaging to the study of replacement textures of feldspathoids and feldspars in peralkaline syenites from southern Greenland. The origin of monomineralic magnetite layers in the Upper Zone of the Bushveld Complex is discussed by BUTCHER and MERKLE in the light of textural observations on subjacent anorthosites, which are believed to preserve the cumulus grain size of the magnetite crystals before annealing. In a second Bushveld contribution, EALES, MAIER and TEIGLER describe plagioclase inclusions within cumulus olivine and bronzite grains in certain Lower and Critical Zone pyroxenites. The existence of plagioclase in melts prior to separation of ultramafic cumulates is used to support a model in which primitive liquid is injected periodically into the magma chamber.

We would like to thank all those who helped organise the Mineral Textures meeting. Thanks go to Dr. Andrew Clark, Principal Editor of *Mineralogical Magazine,* Helen Smith and Mr. Kevin Murphy, Editorial Assistants, and to all the referees who provided expeditious reviews. Financial support was provided by the Mineralogical Society and the Geological Society. We are grateful to CAMECA CAMBEX UK Ltd and to SOMINCOR for financially supporting the printing costs of specific pages of colour plates in this volume.