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Plagioclase and hornblende response to temperature and pressure induced variations in open magmatic systems. The example of Caraci Volcano, Apuseni Mts.

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Multiple types of disequilibrium textures occur on labradorite and bytownite crystals from the 11.33-10.51 Ma eruptions of Caraci volcano. They are mixed at the scale of a thin section with hornblendes showing a variety of disequilibrium textures of their own.
(a) One type of sieve texture is conserved at the contact between labradorite cores and overgrowths of higher-An content (bytownite). They show slightly cuspate jigsaw-like contacts, where fine melt droplets are trapped. This is optically expressed as a “dusty” fine sieve texture that mimics the shape of the crystal.
(b) A second type of sieve texture covers the entire volume of An-rich crystals (bytownite), intersecting zones and twins and preserving the crystallographic shape. It has been observed on crystals with homogeneous and various An contents alike. It is optically expressed as a massive sieve texture.
(c) The third texture can sometimes be similar to the fine or massive sieves, but preserves preferentially oriented melt inclusions trapped in homogeneous An-rich plagioclase. They do not intersect twins.
(d) A fourth texture is conserved at the contact between successive An-rich and An-poor overgrowths. It is optically expressed as a continuous band of glass, trapped in the An-rich plagioclase at the contact with the lower-An overgrowth.
Hornblendes show progressive oxidation coupled with opacite rim formation, and sometimes resorption voids. Although opacite rims can develop independently, resorption textures are always accompanied by reaction rim formation.
Resorption processes compete with mass oxidation over melting or preserving the hornblende phenocrysts. Variations between the intensity of the two processes are often recorded in the same crystals, showing alternating periods where one or the other was dominant.
All these textures, coexisting in the same lavas, are typical for mixing processes. According to them, the mixing scenario and the thermo-chemical disequilibrium induced in the magma chamber can be reconstructed:
Labradorite and hornblende crystalize in equilibrium in a crustal magma chamber that is periodically subjected to intakes of hotter batches of melt. Prior to mixing, these batches undergo depressurization which induces bytownite melting, resulting in the development of massive sieves (b). As they intrude the magma chamber, transfer of heat leads to the melting of labradorite crystals and to the oxidation of hornblende, via oxy-hornblende reaction. In areas where temperature difference is high and heat transfer occurs fast, the intruding magma undercools and becomes suprasaturated in An, inducing fast skeletal growth of bytownite which develops oriented sieve texture (c). On the other hand, the faster and higher temperature rise that the native hornblendes are subjected to, inhibits oxy-hornblende reaction and promotes melting. Convection currents boosted by heat transfer have the potential of steering hornblende crystals away from and closer towards higher temperature areas, being responsible for the alternating mass oxidation – resorption periods. As re-equilibration takes place, bytownite overgrowths mantle previously melted labradorite crystals, resulting in the formation of fine sieves (a). Where bytownite is suddenly replaced by varieties with less An, especially when skeletal growth ceases, reaction between the two causes the melting of bytownite at the contact line (d).