American Mineralogist, Volume 83, pages 1367–1368, 1998

ERRATA

TEM investigations on K-Ca feldspar inclusions in a Bøggild plagioclase, by Takeshi Hoshi and Tokuhei Tagai, Mineralogical Institute, Graduate School of Science, University of Tokyo, Hongo, Bunkyo-ku, Tokyo 113, Japan, from *American Mineralogist*, v. 82, 1073–1078, 1997.

We stated that potassium-calcium feldspar inclusions in a Bøggild plagioclase from Ylämma, Finland, consist of two regions: a rim region exhibiting a lamellae structure and a core region without any distinct textures. We concluded that the rim region consists of alternating lamellae of anorthite and potassium feldspar. However because of small differences in lattice constants between potassium feldspar, anorthite, and Bøggild plagioclase, moiré fringes could be generated at the boundaries between each phase. In recent research, it is clear that the contrast at the rim regions was changing by tilting the specimens (Fig. 1). Therefore, the microtexture in the rim regions is more correctly described as moiré fringes.

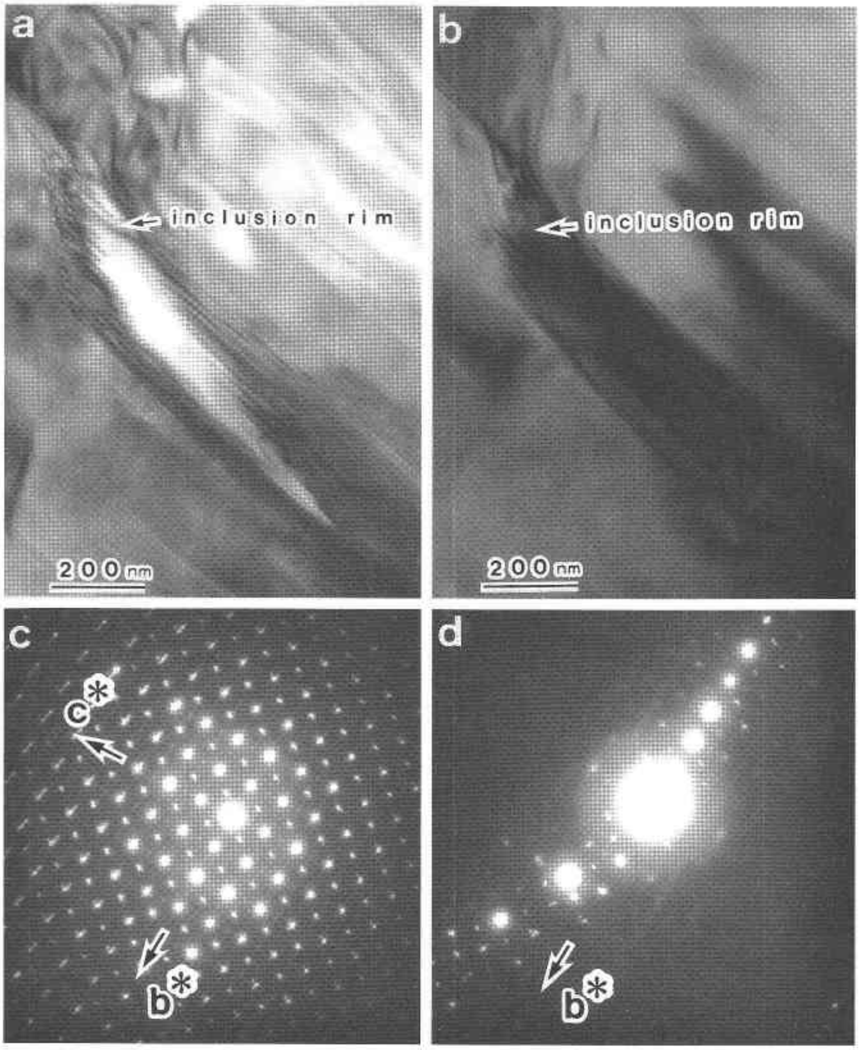

FIGURE 1. Transmission electron micrographs. (**a**) potassium-calcium feldspar inclusion observed with the incident beam parallel to [100]. Fringes are observed in the rim region of inclusion. (**b**) The specimen is tilted approximately normal to b*, but tilted by ~4°. Fringes in the rim region almost disappear. (**c, d**) Selected area electron diffraction patterns obtained from inclusions with matrix observed in (**a**) and (**b**), respectively.

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Selective preservation of melt inclusions in igneous phenocrysts, by Stephen Tait, Laboratoire de Dynamique des Systèmes Géologiques, Institut de Physique du Globe 4, Place Jussieu, 75252 Paris, France, *American Mineralogist,* v. 77, 146–155, 1992.

This note provides a correction to calculations presented in the above paper which aimed to analyze the stresses around and the failure of melt or fluid inclusions in host crystals that are transported by the flow of magma from a higher to a lower pressure. The boundary conditions stated in that paper incorrectly described the reference state of zero elastic deformation of the system (inclusion plus host crystal). In spite of the quantitative error in the original derivation, the main conclusions of the paper are not affected .

The simplified geometry assumed is that of a spherical inclusion of radius R_i, containing arbitrary proportions of silicate melt and a gas phase, at the center of a spherical, elastic host crystal of radius R_0 (see Fig. 1a of the original paper for definition sketch). The volatile species is taken to be soluble in, and in thermodynamic equilibrium with, the melt. The inclusion is assumed to form at some initial pressure P_0, at which the inclusion/host system is unstressed in the sense that both the pressure inside the inclusion (P_{int}) and the pressure in the magma outside the crystal (P_{ext}) are equal to P_0. After the crystal has been brought to a lower pressure by the movement of magma, P_{int} is greater than P_{ext} by an amount ΔP that is balanced by elastic stresses in the host.

There is a typographic error in the original Equation 2 for the radial displacement u_r as a function of radial distance r, which should read:

$$u_r = C_1 r + \frac{C_2}{r^2} \qquad (2)$$

The reference state can be correctly accounted for by writing Equation 3 as:

$$\sigma_{\rho\rho} = 3\,C_1\,\beta_c - \frac{4C_2\mu_c}{r^3} - P_0 \qquad (3a)$$

$$\sigma_{\theta\theta} = \sigma_{\phi\phi} = 3\,C_1\,\beta_c - \frac{2C_2\mu_c}{r^3} - P_0 \qquad (3b)$$

where $\sigma_{\rho\rho}$ is the radial and $\sigma_{\theta\theta}$, $\sigma_{\phi\phi}$ are the tangential stress components in the elastic host crystal, and β_c and μ_c are its bulk and shear moduli. One sign was inverted in the original Equation 4 that should read:

$$\sigma_{\rho\rho} = -P_{\text{int}}, \text{ at } r = R_i \qquad (4a)$$

$$\sigma_{\rho\rho} = -P_{\text{ext}}, \text{ at } r = R_0 \qquad (4b)$$

The new result for the fractional change in volume of the inclusion is:

$$\frac{\Delta V}{V_0} = \frac{1}{[(R_0/R_i)^3 - 1]}\left[\frac{1}{\beta_c} + \frac{3(R_0/R_i)^3}{4\mu_c}\right]\Delta P + \frac{(P_0 - P_{\text{ext}})}{\beta_c} \qquad (5)$$

The correction to the result originally given is the last term on the right hand side. The result for the magnitude of the tangential stresses at $r = R_i$, now reads:

$$\sigma_{\theta\theta} = \sigma_{\phi\phi} = -P_{\text{int}} + \frac{3\Delta P}{2}\,[1 - (R_i/R_0)^3] \qquad (6)$$

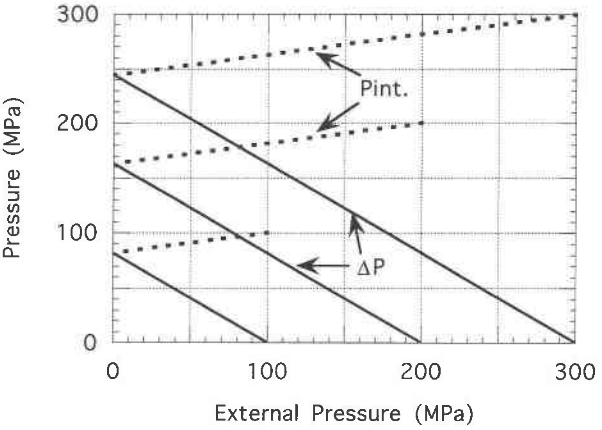

FIGURE 1. Evolution of the pressure inside the inclusion (dashed line) and that of the difference between the pressure inside the inclusion and that outside the host (solid line) as a function of the pressure outside the host. Three different values of intial pressure are shown; 100, 200, and 300 MPa.

These corrections make a small quantitative difference to the results. This is shown by re-calculation, for the simple case of a pure mafic melt inclusion with no volatiles, of the evolution of pressure inside the inclusion and of ΔP, using Equation 15 of the original paper combined with the new Equation 5. The results (Fig. 1) can be compared directly with the original Figure 2a. Consider, for example, the case of $P_0 = 200$ MPa; whereas in the original Figure 2a the inclusion is shown as having decompressed to approximately $P_{\text{int}} = 175$ MPa when $P_{\text{ext}} = 1$ atm. Figure 1 shows that the correct value for P_{int} in this case is just over 160 MPa. The quantitative correction is thus relatively small and the qualitative form of the graph is identical to that previously published. However, the corrected equations should be used in any further calculations.

Melt inclusions are thus able to decompress more than was originally concluded. But one key result remains the same: that the stresses developed at the surfaces of inclusions in many cases, perhaps even the majority of cases, would be expected to cause mechanical failure of the host crystals. A more complete analysis of the failure process, perhaps including kinetic factors may be needed to understand adequately how inclusions often survive eruption.

The author apologizes for any confusion that this mistake may have caused for those interested in the results of the calculations.

ACKNOWLEDGMENTS

I thank Youxue Zhang for raising and discussing these points and Harry Green and an anonymous reviewer for their comments.