UMWANDLUNGSVERHALTEN UND KORNWACHSTUM IN NANOKRISTALLINEN ALUMINIUMSILIKAT-FASERN

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Kommerzielle Aluminiumsilikat-Fasern mullitischer Zusammensetzung (70 Gew.% Al_2O_3, 28 Gew.% SiO_2, 2 Gew.% B_2O_3, 3M-Nextel 440) werden zum Brandschutz und zur thermischen Isolation z.B. von Flugzeugtriebwerken und von Elektroden beim Elektroschmelzen eingesetzt. In neuerer Zeit werden solche Fasern auch zur Verstärkung von keramischen Matrices bei der Herstellung von Verbundwerkstoffen verwendet.

Bedingt durch den Produktionsprozeß der Fasern aus einem Gel bestehen diese aus Nanometer großen γ-Al_2O_3-Partikeln (10 - 20 nm) und einer koexistierenden SiO_2-reichen Glasphase. Die Größe der γ-Al_2O_3-Kristallite bleibt beim Tempern bis 1100° C nahezu konstant. Zwischen 1100° und 1200° C wandelt sich das Phasengemisch aus γ-Al_2O_3 + SiO_2 in Mullit um. Die neugebildeten Mullitkristalle sind wesentlich grobkörniger (50 - 150 nm) als die bei den niedrigeren Temperaturen vorliegenden γ-Al_2O_3-Kristallite. Die neugebildeten Mullite wachsen im Temperaturinterval zwischen 1200° und 1400° C nur langsam bei gleichzeitiger Polygonalisierung der Kristalle. Oberhalb etwa 1500° C setzt intensive Kornvergröberung mit sekundärem Kristallwachstum ein. Das temperaturindizierte Umwandlungs- und Kornwachstumsverhalten hat tiefgreifende Auswirkungen auf die mechanischen Eigenschaften der Aluminiumsilikat-Fasern.

EVIDENCE FOR MAGMA MINGLING WITHIN AZTEC WASH PLUTON, ELDORADO MOUNTAINS, NEVADA

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The 15.7 Ma ($^{40}Ar/^{39}Ar$ biotite age) Aztec Wash Pluton is located in the central Eldorado Mountains of the Colorado River extensional corridor in southern Nevada. This area is a principal focus of studies of continental extension and magmatism.

Over 50 % of the pluton is made up almost entirely of very felsic, homogeneous medium grained granite (~ 72 wt.% SiO_2). The rest of the pluton is very heterogeneous and comprises diverse rocks ranging from very mafic gabbros to felsic granites similar to the main granite. Within these heterogeneous zones the granites grade to porphyries with very fine grained groundmasses and common mantled (rapakivi) feldspar phenocrysts. Fine grained (quenched) texture and pillow forms of many of the mafic rocks, crenulate contacts between mafic and felsic rocks, and disequilibrium textures of adjacent mafic, felsic and intermediate rocks provide strong evidence for two distinct coexisting magmas and their mingling.

The most common mafic rocks (diabases and diorites with ~ 54 wt.% SiO_2) have high incompatible element concentrations (e.g. K_2O ~ 3 wt.%, Ba ~ 1600 ppm, light rare earth elements 350 x chondrite) and enriched isotopic compositions (ϵ_{Nd} of -7.5, $^{87}Sr/^{86}Sr$ of 0.708). The granite is more potassic (ca. 5 wt.% K_2O), but it has comparable or lower concentrations of most incompatible elements, and shows ϵ_{Nd} values of -10 and $^{87}Sr/^{86}Sr$ of 0.710. The fact that rocks with about 60 - 65 wt.% SiO_2 are rare indicates that mixing between the two extremes occurred only to a limited extent. The difficulty of mixing magmas with very different properties may have prevented more widespread hybridization and favored involvement of somewhat fractionated mafic magmas (e.g. BARBARIN & DIDIER, 1992; SPARKS & MARSHALL, 1986). We suggest that both of the initial magmas were therefore modified by both closed and open system differentiation processes such as fractional crystallization as indicated by the observed petrographic, elemental and isotopic variability of the pluton.

The different elemental and isotopic compositions of the two discrete magmas require distinctly different source materials. The relatively low SiO_2 content (~ 54 wt.%) and relatively high Mg # (0.6) of the mafic magma require a subcrustal origin which was not primary. We suggest that the magma either was strongly contaminated by the crust or originated from highly enriched mantle. The later is favored by the authors. The problem of distinguishing between crustal contamination and an enriched mantle source as the cause of enriched mafic magma compositions is widely debated worldwide and in the Mojave Province (e.g. FARMER et al., 1989). The isotopic composition of the granite is intermediate between the local ancient crust and the mafic rocks, and therefore indicates hybridization of the crust by mafic magma. It is unclear whether the mixing ocurred at deeper levels in this magmatic system via MASH-like processes (melting, assimilation, storage and homogenization; HILDRETH & MOORBATH, 1988) or during earlier mid-Tertiary or Mesozoic magmatism.

Based on the facts mentioned above we propose the following petrogenetic model for Aztec Wash Pluton (see Fig. 1):

(a) At 15.7 Ma, continuing influx of mafic magma induced melting of hybridized crust and produced granitic magma that ascended into the shallow crust (< ca. 5 km, based on hornblende geobarometry, fine grained texture and the presence of miarolitic cavities) to form the Aztec Wash magma chamber.

(b) Following partial solidification of the granite, mafic magma generated largely from enriched lithospheric mantle intruded the chamber in N-S zones due to E-W extension and mingled with the still partially molten (or remelted) granite. Limited mixing between fractionated magma and granite occurred.

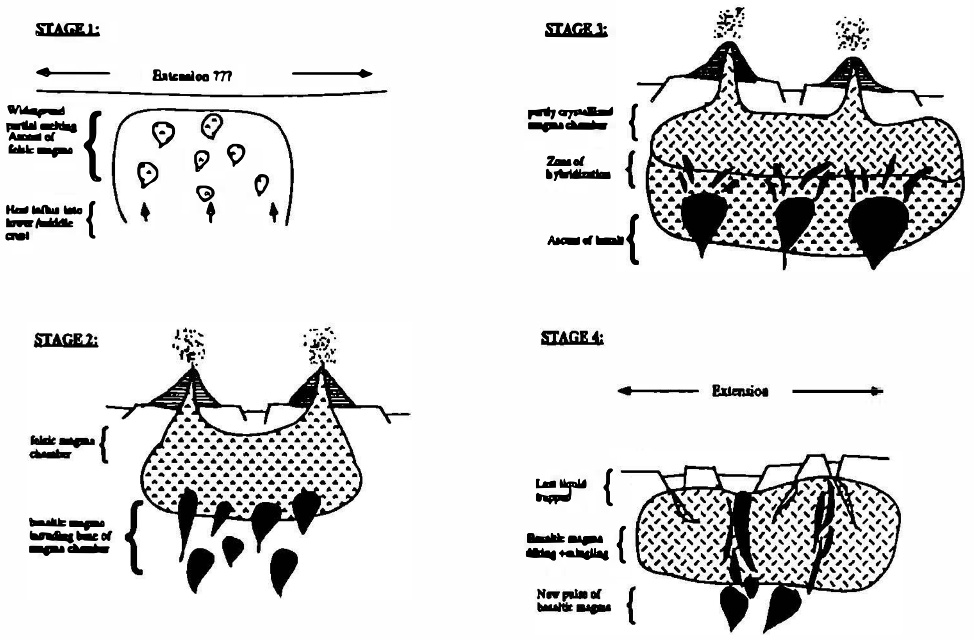

Fig. 1: Petrogenetic Model proposed for Aztec Wash Pluton.

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GEOPHYSIK UND SAUERSTOFFISOTOPIE EINIGER GRANITOIDE DES SÜDBÖHMISCHEN MASSIVS

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Die mehrphasige Intrusionsfolge im südlichen Anteil des Südböhmischen Granitmassivs spiegelt sich in den Sauerstoffisotopenverhältnissen, den magnetischen