Trace and rare-earth element altered and mineralized rocks in the Attepe Iron deposits (Feke-Adana, Southern Turkey)

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Hydrothermal-metasomatic iron ores consisting mainly of siderite, ankerite and hematite are located in the Lower to Middle Cambrian limestone marbles of the Eastern Taurus Belt. The siderite, ankerite and hematite ore and host rock samples from the deposits have been investigated for major and trace elements to evaluate the element mobility and mass transfer during fluid-rock interactions.

The (Fe+Mn) concentrations regularly increase, and the (Ca+Mg+TC) contents progressively decrease from the host rock through ankerite, siderite, and hematite ores with increasing chemical index of metasomatism (CIM) values. The host limestone exhibits a positive Eu anomaly (2 to 3.45) and negative Ce anomalies (0.59 to 0.96). This limestone has much lower REE contents (3.92 ppm) than the PAAS (184.77 ppm). The elements of Cr, Y, Tb, Ho, and Lu behaved as immobile. The altered (ankerite) and mineralized rocks (siderite and hematite) were enriched in Fe, Mn, Ba and depleted in Ca, Mg, Si, Al, K, Na, Ti, and P. The average REE contents of the ore samples (9.13 to 12.01 ppm, mean=10.44 ppm) are higher than those of the host rock, but significantly lower than in the PAAS. Most of the REE were mobilized and fractionated. The LREE were strongly depleted, and HREE were slightly enriched. MREE show different behaviors in different sample groups.

The (La/Lu)N ratios show a decreasing trend from the host rock to siderite, ankerite, and hematite ores with increasing HREE and decreasing LREE contents. The ore samples show positive Eu (1.61 to 8.86) anomalies and negative Ce anomalies (0.34 and 0.98). Three samples display positive Ce (1.06-1.09) anomalies. In the ore samples, HFSE such as Ti, Zr, and P were depleted, as were LILE, e.g. K, Th, U, Pb, La, and Ce and TRTE, e.g. Cu, Ni, and Zn, elements. The Ba and Sr demonstrate dissimilar behavior. Ba was enriched, while Sr was depleted.

Crystallographic control of sheet silicate dissolution

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We present an experimental and theoretical study of sheet silicate dissolution kinetics. Sheet silicates have a layered structure that significantly affects the dissolution mechanism and rates. Dissolution of mineral powders [1, 2] revealed a high variability in rates of 2-3 orders of magnitude, typically thought to reflect variation in basal to lateral surface area ratio. Although AFM studies also document the differential reactivity of basal and lateral faces [3, 4], the contributions of basal and lateral surfaces to total rate are not yet well understood. Our study focuses exclusively on the role that layered structure plays in the dissolution mechanism and the related variation in rates. We use vertical scanning interferometry to observe the dissolving mineral surface and measure dissolution rates. This approach allows us to obtain precise rates at specific faces (basal or lateral) over a large surface area. Our experimental results in concert with kinetic Monte Carlo simulations help to develop and test a theoretical model of sheet silicate dissolution kinetics.

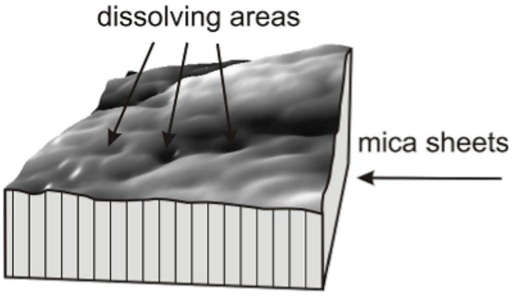

Figure 1: Dissolving mica edge face (VSI data).

[1] Acker & Bricker (1992) *GCA* **56**, 3073–3092. [2] Oelkers & others (2008) *GCA* **72**, 4948–4961. [3] Rufe & Hochella (1999) *Science* **285**, 874–876. [4] Bickmore & others (2001) *Am. Min.* **86**, 411–423.