Cyclicity in Cordilleran orogenic systems and the role of arc magmatism

MIHAI N. DUCEA, PETER DECELLES, PAUL KAPP
AND GEORGE ZANDT

University of Arizona, Department of Geosciences, Tucson, AZ, 85721, USA (ducea@email.arizona.edu)

Cordilleran orogenic systems, such as the modern Andes, form in continental lithosphere along strongly convergent plate margins shared with subducting oceanic plates and are characterized by outboard arc-trench complexes and inboard belts of thrust faults. Cordilleran systems are controlled by processes associated with the subducting oceanic plate, as revealed by the basic principles of plate tectonics theory. The standard model, however, does not account for cyclical trends in upper plate magma flux and composition, retroarc shortening and extension, surface uplift, and gravitational foundering of dense arc roots. Multidisciplinary datasets from the western American Cordilleras suggest a 30-50 million year cycle of upper plate processes that operate in feedback relationships. In a typical cycle, melt-fertile retroarc lithosphere is underthrust beneath the arc at rates corresponding to shortening rates in the retroarc thrust belt, fueling episodic high flux magmatism in the arc and coevally generating dense melt residues. These residues reach critical mass and founder into the mantle, relieving a growing space problem beneath the arc and setting the stage for renewal of the cycle. This unifying model explains a number of otherwise enigmatic geological phenomena in the crust of Cordilleran orogenic systems.

Synergistic effects of siderophores and small organics at manganese oxide surfaces

OWEN W. DUCKWORTH[1]* AND LAUREN B. SAAL[2]

[1]Department of Soil Science, North Carolina State University, Raleigh, NC 27695-7619, USA
(*correspondence: owen_duckworth@ncsu.edu)
[2]Department of Soil Science, North Carolina State University, Raleigh, NC 27695-7619, USA (lauren_saal@ncsu.edu)

Recent studies have revealed that siderophores, biogenic chelating agents that strongly complex ferric iron and other hard metals, may participate in a number chemical reactions at manganese oxide surfaces. For example, the siderophore desferrioxamine B (DFOB) promotes the dissolution of a variety of Mn oxides, resulting in the pH-dependent formation of reduced Mn(II) and the concomitant formation of oxidized DFOB, and Mn(III)HDFOB$^+$ [1]. As with iron (hydr)oxides [2], the rates of DFOB-promoted dissolution of δ-MnO$_2$, a layer type Mn(IV) oxide, are strongly influenced by the presence of low molecular mass organic acids, including oxalate and citrate. However, in the presence of DFOB, citrate dominantly increases the rate of Mn(III)HDFOB$^+$ complex formation while oxalate increases the rate of Mn(II) production, suggesting differing dissolution mechanisms. These results indicate that biological exudation of small organics in conjunction with siderophores may allow for the manipulation of dissolution products, including regulation of the formation of potentially reactive aqueous Mn(III)-complexes.

[1] Duckworth & Sposito (2007) *Chem. Geol.* **242**, 500-511.
[2] Reichard, Kretzschmar & Kraemer. (2007) *Geochim. Cosmochim. Acta* **71**, 5635-5650.