Global-COE Frontier Seminar

The rhythm of arc magmatism?
Insights from ignimbrite flare-ups and supervolcanism.

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Date & Time : 13:10 - 14:10 on Thursday, July 16, 2009
Place : Earth Science Bldg. 5F #503 COE Seminar Room
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Abstract:

Ignimbrite flare-ups and their associated supervolcanoes record the development of major batholith-scale crustal magmatic systems that form the foundations of the continental crust. Flare-ups have occurred in all tectonic settings throughout most of the phanerozoic, and a primary cause and effect relationship between an elevated mantle power input and magmatism is well established. In arcs, ?flare-ups? punctuate the normal or steady state mantle flux that characterizes typical arc magmatism and appear to be the drive for the construction of cordilleran batholiths and large silicic volcanic fields. Understanding such flare-ups are thus a critical part of understanding arc magmatism.

With particular reference to the Central Andes, I will show that flare-ups have a characteristic space-time-volume pattern. They last on the order of 10 m.y., magmatism starts off slow and diffuse, and then focuses and accelerates to rates an order of magnitude greater than normal arc rates, and then diminishes rapidly to background (pre-flare-up) levels. Eruptions are organized into distinct pulses, separated by periods of minimal activity. We understand these patterns to be the natural response of the continental crust to a transient excursion of elevated mantle power that sets in motion a series of feedbacks between magma production and intrusion, crustal temperature and mechanical strength. Modulation of the mantle signal in the crust produces an episodic plutonic and volcanic record.

I will promote the view that arcs operate in two main modes; a ?normal? or ?steady-state? mode characterized by low mantle flux manifested by the building of andesitic composite cones and a high flux ?flare-up? mode that is characterized by ignimbrite flare-ups and supervolcanism. The switch between these two modes is fundamentally controlled by a change in mantle power input in response to a major change in the lithosphere-mantle-slab architecture.