Mini-white paper proposal for a mini-focus site on specific volcanoes and plutons within a future MARGINS program.

We propose that one or two active volcanoes and plutons be targeted for multi-disciplinary study within a future MARGINS program. They could be anywhere but would be best if located within a focus site should one be part of the new program.

The idea is to enable an open-ended, multi-PI, multi-disciplinary, multi-year, multi-proposal project to tackle one or two specific volcanoes and 'complementary' plutons for a decade, in order to relate processes from slab through mantle, through crust, to eruption. The objective is to get people who might otherwise study such matters at different volcanoes and plutons, to subordinate the benefits they'd get by choosing a location best for their specific study in order to share the benefits of working together at the same place. We do not envision one big 3-year Collaborative Proposal of pre-selected PIs, but rather semi-random proposals by different groups over time that are informed by each others' results. This might create opportunity for USGS and university scientists to work together. Mail reviews and panels would decide what gets funded, but over time we might build up more overlapping information than the status quo produces.

For the volcano, we propose integrated study of processes from the slab to the surface, to the extent possible. The goal is to understand how magma forms, evolves, and erupts in volcano-specific detail. For example, amidst the along-strike heterogeneity of slab seismicity, slab surface and mantle wedge thermal structure, mantle flow pattern, depth to Moho, and crustal velocity structure in that arc, what are these characteristics beneath this particular volcano and what is their influence? Where is there evidence of melt lenses within the crust now? What is the geological and geochemical history of eruptions and intrusion, and can they be tracked in minerals or xenoliths? What is the history of crystal fractionation, mixing, and assimilation, and at what time scales? What controls eruptions and associated hazards? How do all of these interact?

For the pluton, the objective is to understand the physical and chemical processes and history of intrusion. What is the volume of one crustal accretion event, what controls where it occurs within the pluton, and how is it accommodated structurally? How does the pluton evolve through time? How is it related to its surrounding hydrothermal system? Most of all, how is the pluton connected to its roots and to the surface, and how does this relate to the rates of, and relative volume partitioning between, extrusion and intrusion in subduction zones?

For example, if there is an arc focus site, and if it were the Cascades this time, then one example of a scientifically rich and hazardous volcano might be Rainier. A complementary Cascade pluton might be the Tatoosh. There are many other examples and many potential criteria for choosing amongst them.

This level of specificity would enable a new set of topics to be targeted within MARGINS and would attract new investigators. Rather than continuing to address

generalized processes and forcing functions, it would shift some of the effort to specific examples where one can test generalized models, and explore crustal-level processes.

Obviously the active volcanoes and the plutons must be in different places and ages, no volcano or pluton applies to all, and even a decade of multi-PI study at a few hundred $K/y would not suffice to answer the questions above. They are vast and complex but central to how continental crust evolves, volcanic hazards, and the formation of hydrothermal ore deposits. Subsets of them can be studied through EAR ± OCE core-funded projects, but integrated study of the geology, petrology, geochemistry, geochronology, and geophysics of one example by many research groups requires a MARGINS-like structure. To us, integrated case studies seem necessary to achieve a quantum step in understanding these topics.

Selection of the volcano and pluton, and of the criteria for choosing them, would be made democratically by the scientific community at a workshop devoted to the topic. Criteria for the volcano might include: wide range of rock types; isotopic contrast with surroundings; recent volcanic activity to enable study of melt location and migration; availability of background and complementary information, perhaps including an ongoing monitoring program; and high level of public risk. If the future MARGINS program has an active arc segment focus site, then it might make the most sense to select an active volcano within that segment but that is not necessary.

Signed (as of 12/22/09)
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