GEOGRAPHIC VARIATION OF RARE EARTH FRACTIONATIONS IN PLUTONIC ROCKS ACROSS THE PENINSULAR RANGES BATHOLITH, SOUTHERN CALIFORNIA.

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Rare earth element patterns of plutonic rocks (chondrite-normalized) across the Peninsular Ranges batholith vary systematically west to east, corresponding to the low axis and structural trends and parallel to known tectonic and volcanic complexes. We infer that the rare earth element REE fractionation in the Peninsular Ranges is controlled by the interaction of the batholith with the surrounding crust. The rare earth element patterns of the intrusive rocks in the western region are characterized by slight REE enrichment relative to the heavy REE. In contrast, the eastern region is characterized by REE depletion. The slope of patterns at any geographic location is largely independent of rock type. However, locally, certain silica-undersaturated and undersaturated gabbros may show divergent trends. The relative fractionation among the middle and heavy REE indicates that the pattern formation process is observed major phases such as hornblende and plagioclase are not important in producing the basic geographic trends. They may be reflected in more local lithologic variations. The pronounced geographic fractionation in REE character correlates strongly with Sr concentration, suggesting a common mechanism for their origin. The systematic nature of these fractionations, their correlation with previously reported Sr isotopic data, and their lack of correlation with known plate tectonics are again significant for understanding the processes that may have influenced the REE fractionation of these rocks.

In general, the REE patterns of the intrusive rocks in the western region are characterized by slight REE enrichment relative to the heavy REE. In contrast, the eastern region is characterized by REE depletion. The slope of patterns at any geographic location is largely independent of rock type. However, locally, certain silico-undersaturated and undersaturated gabbros may show divergent trends. The relative fractionation among the middle and heavy REE indicates that the pattern formation process is observed major phases such as hornblende and plagioclase are not important in producing the basic geographic trends. They may be reflected in more local lithologic variations. The pronounced geographic fractionation in REE character correlates strongly with Sr concentration, suggesting a common mechanism for their origin. The systematic nature of these fractionations, their correlation with previously reported Sr isotopic data, and their lack of correlation with known plate tectonics are again significant for understanding the processes that may have influenced the REE fractionation of these rocks.

THE FINGER BAY PLUTON, ADAK, ALASKA AND MAGNETIC EVOLUTION OF THE ALEUTIAN ARC.

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As a part of a study of patterns of petrogenetic evolution in the Aleutian arc, magnetic rocks of differing ages from Adak Island have been investigated. The results of the two analyses (1) Finger Bay sediments and volcanics and (2) early plutonic episodes in the arc. Major and large ion lithophile elements of Finger Bay Pluton, which range from gabbro to syenite in composition (14B-400 admiration), are consistent with differentiation by crystal fractionation. The principal minerals are clinopyroxene (Wo45En55; Fa000Fe97), sodium plagioclase (An20 to An74), and magnetite. Obsidian magnetic layer is present in the gabbro. Lower greenhouse metamorphism has been reported in both plutonic and country rocks, and has resulted in alteration of mafic phases (augite, olivine, biotite, and other hyperbasites) to chlorite, actinolite, and opaques. Seven analyses sampled Sr/87Sr ratios of 0.709-0.713, which correlate with Sr isotopic data and the lack of correlation with known plate tectonics. The Finger Bay sediments against significant crustal contamination with ancient crustal components. These features appear to originate in heterogeneous deep-seated sources, with sampling leading to the selective activation of a convergent plate boundary.

RUBIDIUM-STROMIUM FRACTIONATION DOMAINS IN THE PENINSULAR RANGES BATHOLITH AND THEIR IMPLICATIONS FOR MAGMATIC ARC EVOLUTION.

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The northern 600 km of this Cretaceous batholith, comprised of hundreds of diverse plutons, appears to consist of 12-15 domains. Each domain is a region where rocks of all types (within our limited sampling) show a regular linear correlation of Rb and Sr concentrations. This regularity displays different concentration levels and a different slope, is accompanied by a distinct set of isotopic variations in each domain. The domain theory does not disrupt the remarkable zonation of Sr ratios in the batholith (Early and Silver, 1972). No Independent field or petrographic recognition of the Rb-Sr characteristics of each domain is evident. Very similar rocks occur in adjacent domains. Domains are constrained or equated to NNW, up to 200 km long and 30 km wide, parallel to regional tectonic grain. Each domain is interpreted as a region of magma sampled or differentiated, within a major crustal reservoir possessing characteristic trace element levels and Sr isotopic properties. An apparent age of reservoir formation and isolation prior to domain development is implicate an apparent initial Sr ratio at the time of reservoir isolation can be derived for each domain. There is no strong correlation of Rb-Sr isochron ages and Sr isotopic ratios. Mixing systems involving older crustal granite with primitive mantle seem precluded. We identify similar domains in the Rb-Sr systematics of other batholithic and volcanic complexes. We infer these domains to be fundamental loci of chemistry and energy, from which magmatic arcs are constructed.

Trace Elements and Isotopes I

Madison, Thursday 0900H

F. A. Frey (Massachusetts Institute of Technology) and A. Hofmann (Department of Terrestrial Magnetism, Presiding)

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RARE EARTH ELEMENT EVIDENCE FOR DIFFERENTIATION IN A PLUTONIC IDIOGENOUS ROCK

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Instrumental neutron activation analysis of rare earth element (REE) abundances in the Tupper-sarenane facies from the Adirondack Mountains indicates that the mangerite body is internally differentiated. A lower mafic-rich portion of the mangerite has lower REE abundances and positive europium (Eu) anomalies whereas an upper quartz-rich portion has higher total REE abundances and negative Eu anomalies. Between these two units a thin zone of mangerite has intermediate REE abundances and zero Eu anomalies. At the base of the mangerite a thin zone of intermediate REE abundances and zero Eu anomalies plus another Eu anomaly is present. The REE pattern classification of the mangerite as mangerite is not concomitant with the adjacent Adirondack granites.

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RARE EARTH ELEMENT EVIDENCE FOR COMAGMATISM IN THE REVINGTON MOUNTAINS, MONTANA

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Instrumental neutron activation analysis of rare earth element (REE) abundances in the Adirondack Mountains indicates that the granite probably represents comagmatism from which the Mangerite mangerite accumulated. The granite occurs within the granodioritic and mangerite massif in a localized, very large differentiated magma body. The high total REE abundance suggests that the mangerite granites and the Adirondack granites represent strongly differentiated light rare earth, possibly as a result of the parental magma compared to the heavy rare earth (Yb to Lu). The total REE abundance of this granite is considerably higher than the average REE abundance of the mangerite and granites and is among the highest ever recorded for any rock. The granite is iron, potassium, and rubidium rich and is strongly depleted in strontium and strontium. The strong depletion of both europium and strontium suggests that considerable plagioclase crystallization before the granite residue solidified.