

**ARCHEAN ROCKS OF THE TOBACCO ROOT
MOUNTAINS, MONTANA:
WORKSHOP**

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Montana Archean Rocks Workshop

Report

H. Robert Burger, Smith College

The goal of the Montana Archean Rocks Project is to clarify the relationship between two diverse assemblages of Archean rocks exposed in the Tobacco Root Mountains of Montana - the Indian Creek Metamorphic Suite and the Spuhler Peak Formation. The Indian Creek Metamorphic Suite consists of quartzofeldspathic gneiss, hornblende gneiss, dolomitic marble, aluminous schists, quartzite, and iron formation. The Spuhler Peak Formation consists of amphibolite, hornblende-plagioclase gneiss, anthophyllite/gedrite-garnet-plagioclase gneiss, sillimanite schist, and quartzite. Burger (1966, 1967, 1969) interpreted the contact between these two assemblages as a fault based on the observation that the Spuhler Peak apparently truncates the large, regionally developed folds in the Indian Creek rocks and what he perceived as different metamorphic histories in the two groups of rocks. Gillmeister (1971), however, interpreted the contact as an unconformity and believes that the SPF overlies both the ICMS and the PMMS.

In order to meet the goal of this research endeavor, project participants undertook a wide variety of studies. Because all of the individual projects contribute to the whole, and as a number of projects are dependent on information from others, we decided a workshop devoted to a discussion of progress and directions for further study was in order. Accordingly, ten students from seven Keck schools took part in the Montana Archean Rocks Workshop. Project faculty are Robert Burger and John Brady (Smith) and Jack Cheney (Amherst). Tekla Harms from Amherst College also attended the workshop and contributed a number of valuable insights and comments.

Prior to the workshop Robert Burger assembled an overview of the Archean rocks in the Tobacco Roots that emphasized the goals of this Keck project and put together an extensive bibliography. Both documents, plus other relevant articles, were distributed to all who attended the workshop. Students were asked to prepare a 20 minute presentation that summarized their progress to date and detailed the remaining work they planned to do.

Workshop participants assembled Friday evening, January 14, at Smith College. This time was spent to get reacquainted, to view slides of the Tobacco Roots from the summer, and to indulge in some high-quality pizza.

Saturday was devoted to student presentations and to detailed comments and suggestions concerning what was known and what needed to be investigated.

Due to several unique mineral assemblages in Spuhler Peak rocks, LeAndra Archuleta and William Peck are working on petrologic and geochemical studies in the hopes of obtaining geothermometry and geobarometry constraints as well as protolith constraints. LeAndra described her findings concerning SPF rocks, particularly the reaction relations in Al-rich enclaves and pressure-temperature estimates based on geothermometry. William described preliminary results based on chemistry of the orthoamphibole rocks and compared numerous plots of the data with known rock types in an effort to more closely characterize SPF assemblages, their original tectonic setting, and possible hydrothermal alteration.

Lisa Jacob and Toby King are involved in a detailed study of contact relationships between the SPF and the ICMS. Toby King talked about his work with structural relations at the

SPF-ICMS contact in the Branham Lakes area, particularly with sheath fold generation. He also provided information on his work to obtain $^{40}\text{Ar}/^{39}\text{Ar}$ ages. Lisa presented several plots of her chemical data from metabasites and quartzofeldspathic gneisses. At present these data do not permit a distinction between a sedimentary and igneous origin for the gneisses. She also discussed some preliminary geothermometry results for the metabasites.

Robin Fisher and Pamela Cady are comparing the mineralogy and metamorphic history in rocks of similar bulk compositions from each rock suite (ICMS and SPF). Robin described garnet-bearing pelitic rocks from the two units emphasizing her petrographic observations, especially of the garnets.

Pam is working on amphibolites and detailed the mineralogy of her samples from thin section analysis. She also described her planned approach to distinguish between meta-igneous and meta-sedimentary amphibolites when her chemical data is available.

Chris Poulsen, Kara Tierney, and Josh Lowell are taking a detailed look at rock types in the SPF in the three areas of best exposure in order to characterize as fully as possible this unique assemblage of lithologies. Chris presented whole rock geochemical data on amphibolites and discussed the possibility that their protoliths were komatiitic lavas. Josh Lowell detailed his structural analysis of SPF relations in the Noble Lake area. Josh also described many fascinating textures present in thin sections of these rocks and noted how he plans to incorporate trace element analysis and geothermometry to unravel the meaning of these textures. Finally, Kara Tierney talked about her detailed investigations of zoned garnets in SPF rocks from the Indian Creek area and described intergrowths of different amphiboles in several samples. Kara also presented her plans to pursue more detailed compositional studies of the interesting zoned and intergrowth textures as well as geothermometric work.

Jennifer Sincock is focusing on a "disturbed" zone of intense folding within the SPF that may represent a zone of concentrated shear during emplacement of thrust slices. She presented the current state of her structural analysis and has differentiated three periods of folding in these rocks. Jen is also looking at ultramafic intrusions in this area and described the status of this work.

The presentations and discussions concluded very late Saturday afternoon after which all adjourned to a group dinner for further discussions and reminiscing. The group reassembled Sunday morning for continued discussion. A number of practical matters were discussed at this time including plans for sharing data and progress, the structure of the Keck Symposium, creating slides and diagrams for everyone's thesis and poster or oral presentation. At about noon everyone departed for their home campus. Everyone agreed that this time together was invaluable in providing help, gathering a good deal of advice, sharing data, and generating excitement and anticipating for the results to come.

ORIGIN OF INTERLAYERED GABBROIC, DIORITIC,
AND GRANITIC ROCKS
ON MOUNT DESERT ISLAND, MAINE

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