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Cal Poly Geology Professor and Student Present Findings on Ancient Earth Crust

SAN LUIS OBISPO – Cal Poly Geology Professor Scott Johnston and student Kenjo Agustsson spent the summer of 2009 on the chilly slopes of Greenland, delving into the roots of ancient mountains to study the history and makeup of the Earth's crust.

In October, they presented their research findings at the 2011 Meeting of the Geological Society of America. The four-day event in Minneapolis drew some 6,300 scientists. The trek to Greenland in 2009 and the October trip to Minneapolis were funded by a grant from the National Science Foundation.

Johnston's research, presented at the conference, focused on finding out more about the chemical composition and stability in the deepest layers of the Earth's crust.

Johnston chose Greenland for his research, because it is home to the remnants of the western half of a giant mountain range created 400 million years ago when the tectonic plates underlying Europe and North America collided.

"The lower crust may have a different composition than people today think it does, in part because of the burial of crust during the continental collision," Johnston said.

The resulting ancient mountain range was similar to the Himalayas – which today are the Earth's highest mountains. The formation of the Atlantic Ocean split the range in two, and weathered it away over millions of years.

During the split, some of the rocks originally formed and molded by the pressure beneath the ancient mountain range were thrust to the Earth's surface. Today, these rocks can be found and studied in Greenland and Norway.

During their research trip to Greenland, Johnston and Agustsson collected rock samples and documented the spatial relationships between different types of rocks. They found many rock samples with minerals including garnet and kyanite. The minerals indicate that the rocks were formed at great depths beneath the Earth's surface.

The rock samples also offered ample evidence of the high temperatures beneath the ancient mountains that caused the rocks to partially melt. The melting formed lighter layers within the "lower crustal" rocks, the professor said.

Crust layers with melted rock coursing through them will be weaker and less stable, affecting all the layers above, including the Earth's surface, Johnston said.

“The rocks with melts in them are much, much weaker than rocks with no melt areas,” Johnston explained. “We’re trying to find out exactly when those melts formed and how long that melt/weakness was there under the Earth’s crust. We need to find out more about how the melt layers form, and where they are.”

Agustsson, a senior majoring in Earth Sciences and minoring in Geology, presented the results of his study of the composition, age and source of the rocks from the ancient mountain range. He graduates in December and plans to go to graduate school to earn a master’s degree in Geology. The hands-on research in Greenland and formal presentation in Minneapolis exposed him to real-world research and the life of a geologist, he said.

Johnston plans to continue his research into the Earth’s deepest layers. In the coming years, he’ll be continuing his work on the Greenland rocks as well as starting more local projects, including investigating the Nacimiento Fault along California’s Central Coast.

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