



AWSFL008-DS3

NSF Award Abstract
- #0207316

**Collaborative Research: Investigating the
Processes and Timescales of Andesite
Differentiation: A Comprehensive Petrological
and Geochemical Study of Arenal
Volcano, Costa Rica**

NSF Org EAR

Latest Amendment Date May 10, 2002

Award Number 0207316

Award Instrument Standard Grant

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EAR DIVISION OF EARTH
SCIENCES
GEO DIRECTORATE FOR
GEOSCIENCES

Start Date June 1, 2002

Expires May 31, 2004 (Estimated)

Expected Total Amount \$94089 (Estimated)

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Investigator current)

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907/474-7314

NSF Program 1573 PETROLOGY AND
GEOCHEMISTRY

**Field Application 0000099 Other Applications NEC
Program Reference Code 0000,9150,OTHR,**

Abstract

Collaborative Research: Investigating the processes and timescales of andesite differentiation: a comprehensive petrological and geochemical study of Arenal Volcano, Costa Rica

EAR-0207185; EAR-0207287; EAR-0207761;
EAR-0207316 PIs: Gill; Reagan; Tepley; Gardner

Arenal Volcano in Costa Rica is an excellent natural laboratory in which to test specific hypotheses regarding differentiation mechanisms and the timescales of magmatic processes and their relationship to eruptions. Our objective is to undertake a multi-pronged petrological and geochemical investigation to take advantage of existing data and models. The on-going eruption of Arenal volcano has undergone complex changes in eruptive behavior, and a crucial question is whether those changes relate to different magma storage conditions, such as varying depths and hence initial volatile contents, or to different degassing styles and rates. We will investigate this important issue through several techniques. We seek to determine the timescales of degassing, the residence times and ascent rate of degassed magmas, and the timescales of degassing-induced plagioclase crystallization. We will measure short-lived nuclides within the uranium decay series to constrain the timescales of magmatic processes as well as measure the long-lived isotopic compositions of whole rocks, and mineral separates and individual minerals in the case of Sr, to determine whether there is evidence for involvement of isotopically distinct components

during differentiation processes. Lastly, we will measure a suite of major- and trace-element concentrations to evaluate the secular change in Arenal lava composition. The data from these tests will help answer questions such as whether rates of differentiation depend on the depth and degree of crystallization and on the extent and character of degassing; whether crystal and magma residence times can be as short as days to months during near steady-state eruptions of andesite; whether within-eruption changes of magma composition are caused by open-system processes of fractional crystallization plus recharge or assimilation or both; and whether eruption styles are related to degassing history and magma residence time.

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