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**NSF Award Abstract**  
**- #0207761**

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

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**Program Manager** Sonia Esperanca  
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**Investigator** Craig C. Lundstrom  
lundstro@uiuc.edu (Principal  
Investigator current)  
Frank J. Tepley (Co-Principal  
Investigator current)

**Sponsor** U of Ill Urbana-Champaign  
801 South Wright Street  
Champaign, IL 61820

217/333-2186

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## **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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