

Title III Grant Report

Dr. Genet I. Duke

September 28, 2007

PURPOSE: This document will report on research funded by a \$1,020 Title III grant awarded to the principal investigator in October of 2006.

STATEMENT OF CLARIFICATION: The original title of the grant proposal was “Identification of Sources of Cretaceous-Age Alkalic Igneous Rocks of Central Arkansas Using Radiogenic Isotope Techniques,” and the original amount requested was \$3,000. The actual funding allotted was not sufficient to accomplish the original intent of the research, which was to obtain isotopic analyses of samples from central Arkansas. Instead, the funds were used for travel associated with the Arkansas project itself, as well as a related project in Montana.

USE OF FUNDS:

- (1) \$927.71 was partially used in travel to the University of Massachusetts at Lowell, in June 2007, where I met with one of my collaborators for this project, Dr. G. Nelson Eby. I obtained not only powdered samples for isotope analyses, but thin sections for petrographic work. Discussions took place regarding the nature of the province, the choice of samples, previous work, and the goals of the project. I had expected to obtain my own thin sections with my own funding, but Dr. Eby lent

me his, as well as his geochemical data, which will be used in any final report in conjunction with the isotopic analyses which remain to be done.

- (2) The remainder of the funds (\$92.29) was spent on a portion of travel to Montana to collect kimberlite and carbonatite samples for associated research (description attached). Associated with this Montana project, samples were also obtained in Massachusetts at the laboratory of Dr. Anthony Mariano in June 2007.

PARTICIPANTS:

Principal investigator: Dr. Genet I. Duke

Co-investigator on Arkansas project: Dr. Nelson Eby

Co-investigators on Montana (Great Plains alkalic province) project: Dr. Carter Hearn, Jr. and Dr. Anthony Mariano.

IMPACT:

After sufficient funding is obtained to isotopically analyze the Arkansas samples, this project will result in one or two presentations, as well as a major peer-reviewed paper. It is hoped that undergraduate students will be able to accompany me to the Arkansas field area this December, between exams and commencement, for further sample collection.

The Montana (Great Plains) project is the beginning of the study, wherein ages, isotopes, and geochemistry will be obtained on the collected samples. Impact of Montana project will be one or two presentations and a paper to be submitted for publication.

Montana Geologic Field Research July 22-28, 2007 (abbreviated field notes):

Dr. Genet Ide Duke, P.I.

Guided by Dr. B.Carter Hearn, Jr., USGS, Reston, VA, and senior scientist at Smithsonian Institute, Washington, D.C., expert on Montana kimberlites and published author of many articles on Montana kimberlites.

Purpose of Research:

To collect samples of kimberlite, carbonatite, and rocks of kimberlitic affinity for $^{40}\text{Ar}/^{39}\text{Ar}$ age determinations, Sr-Nd isotopic studies, as well as whole-rock geochemical analyses.

July 22, 2007 (Sunday):

Mileage in Rapid City (starting point): 145467.5 miles.

Drove to Forsyth, Montana. 108°F in Miles City.

July 23, 2007 (Monday):

Field work.

Starting point: Forsyth, MT, covering area of Porcupine Dome.

First stop: Froze-to-Death Butte. Samples collected at Froze-to-Death:

G7-23-07-1

G7-23-07-2

G7-23-07-3

Second stop: Johnson Ranch via Ingomar Road. Collected samples of Johnson Ranch aillikite (previously named “Johnson Ranch dikes” and “aillikite” by Doden, 1996). Also collected carbonatite at margins of aillikite dikes.

Samples collected:

G7-23-07-4

G7-23-07-5

Record temps of 111°F. Headed back to Forsyth, Montana for the night.

July 24, 2007 (Tuesday):

Field work.

Starting point: Forsyth, MT (initial mileage 145,622), heading to Grassrange kimberlites.

Drove through Roundup, Montana, up to the Grassrange to explore the “Homestead” kimberlite, carbonatite, and diatreme breccias. Grassrange mileage: 145,770.

Samples collected:

G7-24-07-1

G7-24-07-2

G7-24-07-3

G7-24-07-4: N45-50E – trending carbonatite dike trending directly into Homestead kimberlite, 4 to 6 inches in width. Pretty weathered. Not good for geochem at all.

Drove west from Grassrange to find hotel in Lewistown, but the central Montana State Fair was taking place there, and there were no rooms available. Slept in the back of my car up in the Judith Mountains, north of Lewistown.

July 25, 2007 (Wednesday):

Field work.

Starting point: Lewistown, MT (initial mileage 145,872), more fieldwork at Grassrange kimberlitic center. Took Dr. Hearn's van today.

Collected samples from the Schultz dike carbonatite on the Grassrange.

Sample number:

G7-25-07-1 Much fresher carbonatite than at Homestead.

G7-25-07-2 Carbonatite dike.

Night at Sunset Motel in Lewistown, MT.

July 26, 2007 (Thursday):

Field work.

Starting point: Lewistown, MT (initial mileage 145,874.7). Heading to Missouri Breaks kimberlitic/diatreme center.

Samples of Williams kimberlite at the western edge of the Little Rocky Mountains.

Beautiful, clean kimberlite samples. Collected multiple samples, as well as carbonatite, at this spot on the Schwenke Ranch.

Samples:

G7-26-07-1: Williams kimberlite (not as fresh as further east).

G7-26-07-2: Carbonatite/carbonate veinlets in kimberlite, near area of previous sample.

G7-26-07-3: "Williams 1" kimberlite with carbonate. Very good sample.

G7-26-07-4: Probably not carbonatite.

Night in Lewistown, MT, at Sunset Motel.

July 27, 2007 (Friday):

Field work in remote area of Missouri Breaks.

Starting point: Lewistown, MT: 146,051 miles.

Heading north of Winifred, Montana, took the McLelland ferry (free) across the Missouri River. Headed out to the remote Ervin Ridge to collect samples of kimberlite and carbonatite. Carbonatite sample NE of Big Slide Diatreme: Collected a sample that represents the full width of the dike.

Sample:

G7-27-07-1 Great carbonatite sample for age/isotopes/geochem.

At Lone Tree Ridge Diatreme, collected nice, fresh sample of monticellite peridotite.

Sample:

G7-27-07-2: Lone Tree Ridge diatreme, monticellite peridotite. Great sample. Dark, almost black olivine, some euhedral. Watch out for possible zeolite in this sample.

Camped in tents on Lone Tree Ridge.

July 28, 2007 (Saturday):

Field work in remote area of Missouri Breaks (morning only).

Initial mileage at campsite:

From Lone Tree Ridge, collected samples at Tick diatreme. These were very minor carbonatite veinlets, only maybe 2 inches in width.

G7-28-07-1 Carbonate veinlet sample. Questionable. Very large calcite crystals (2-5 mm).