PRELIMINARY ANALYSIS OF GRAVITY AND MAGNETIC DATA FROM THE ST. FRANCIS MOUNTAINS, SOUTHEAST MISSOURI

Mark O. Larson, Johnny Bertalotto and Kevin L. Mickus
Geosciences, Missouri State University, Springfield, MO 65809, mark@live.missouristate.edu, klmickus@missouristate.edu, jbertal@ostatemail.okstate.edu

Geologic Background

The St. Francois Mountains of SE Missouri are a part of, and the only surficial expression of, the EGR Province. They are mainly composed of a series of plutons, calderas and ring intrusions which are felsic in nature. And are punctuated by mafic dikes, sills, and dike swarms. Work by Walker et al. (2002) conclude that two major tectonic events controlled two main phases of volcanism. The first being emplacement of the felsics and the first phase of mafics (1.48-1.35Ga). These are believed to be caused by subduction during the Mesoproterozoic. The second phase (1.24Ga) is believed to be due to back arc extension, and is exclusively mafic in nature. Lowel (2000) and Hildebrand (1996) suggest an orogenic origin for the second phase. More recent geologic activity related to the Redleaf Rift and New Madrid Fault zones has created a series of faults that have affected the region. Previous geologic mapping and geophysical studies showed that the area consists mainly of a few large calderas. The calderas are surrounded by ring intrusions, higher in silica content than the plutons they surround. Extensive weathering has exposed these bodies. Rhyolite, tuff, and other pyroclastic units are abundant in the area. Sedimentary units range from absent to prevalent in the region. Our research focuses on determining the upper crustal structure of the region. We aim to determine the location of mafic bodies, the geometry of the ring intrusions, and the depth and geometry of sedimentary units.

2.5-D Magnetic Gravity Models

Methods

We conducted a preliminary gravity survey which we collected gravity data in order to fill in gaps where the available data was sparse. All the data were mapped and a Bouguer gravity anomaly map was created and shown anomalies that agreed with the location of the proposed calderas determined from previous studies. (Figures 2 & 6a)

Therm detailed gravity data were collected along two profiles (1.1 mile spacing) that cut across these anomalies. We used 2-D forward modeling on the two profiles, which will be constrained by density measurements and surface geologic features, to determine the geometry and thickness of the calderas and the upper crust. Additionally we constructed a series of residual and horizontal derivative gravity and magnetic anomaly maps which will be created in order to better constrain the 2-D models.

We digitized a geologic map (Pratt, 1985) and superimposed the igneous rock outcrops to better understand our Bouguer gravity maps and models (Figures 7a & 6). A Lacoste & Romberg Granimeter and Topcon D-UPS units were used.

Acknowledgements

I would like to thank Johnny Bertalotto for getting us started on the project. Dr. Kevin Mickus for willingness to advise us on our independent project and for trustin using his equipment for days at a time. I would like to thank Dr. Thomas G. Pymate for his input on the geometry of the 2-D models, and for access to his personal collection of ~ 150 samples from the region. And Danielle Smith for putting up with my long nights spent on the project.

References Cited