Streaking Across the Gabbro: The Wichita Mountains’ Quanah Granite Dikes Exposed

QUEVY, Amber L. and PRICE, Jonathan D.
Kimbell School of Geosciences, Midwestern State University, 3410 Taft Blvd, Wichita Falls, Texas, 76308
amberquevy@gmail.com
GSA Section Meeting in San Antonio, Texas, USA March 2016, Paper No. 8-4, Session #8-Booth #26

Introduction

The predominately granitic Wichita Mountains expose the products of the Eocambrian Southern Oklahoma Aulacogen (SOA), a rift formed during dismemberment of Rodinia. The Quanah Granite is one of roughly a dozen alkali-feldspar granite plutons that intruded the upper crust of the SOA (Figure 1). It cuts into the Glen Mountains Layered Complex (GMLC), a series of older PSO-plutonic rocks. Domes of dike north of the Quanah Granite margin also intrude the GMLC (Gibbons, 2014). The majority of these are likely sourced by the Quanah Granite pluton.

The dikes are exposed over a few kilometers in the Central Lowlands of the Wichita Mountains Wildlife Refuge. The dike range is width from a few kilometers to at least two meters, and the longest is continuously exposed for a third of a kilometer. The dikes are a potentially useful piece to the puzzle that is the Southern Oklahoma Aulacogen. Prior to our own studies, the orientation of the dikes remained elusive even during fieldwork.

Methodology

We started this project with asset information on the dikes, we know of general locations and the potential magnetic sources. We used Google Earth to locate large surface expressions. We began fieldwork by looking for outcrops and walking the dike. The scale of the Central Lowlands is highly variable but the granite is less weathered than the surrounding GMLC gabbro. The dike is preserved as a few replace outcrops (Figure 2A) but their dominant expression is trends of large float in gabbro-derived soil (Figure 2B). Fortunately, the area is moderately vegetated. The dikes are partially obscured by younger sediments, including expanses of the Permian Post Oak Formation (Figure 2C). We traversed exposures and plotted waypoints every few decimeters using a handheld GPS (Figure 2D).

We measured orientations on well-exposed outcrops using a handheld Brunton pocket transit. After walking the entirety of the study area and acquiring nearly 300 annotated GPS waypoints, we then ranked our data using 4 grades: A, B, C, and D. A-grade data was determined by Brunton measurements and 3-point analysis, B-grade data was determined by Brunton measurements and 3-point analysis, C-grade data was determined by Brunton measurements and 2-point analysis, and D-grade data was determined by Brunton measurements and 1-point analysis. For data that did not pass sufficient criteria, we used the measured strike from the map and an assumed dip of 80°.

We then uploaded our data into Stereonet (Almendinger et al., 2013), where we graphically evaluated trends (Figures 5 and 6). We produced plots based on two sets of data: A- and B-grade data and C- and D-grade data. We then compared our data with stochastic simulations (Figure 7) to assess if our data were geologically realistic for rift induced dike trend.

Results

The surface trends were then mapped and given unique identifiers. The name of each dike includes three pieces of information: 1. the first author’s initials, 2. the number of the dike in that area (west to east), and 3. the location of the dike.

The trajectory is broken into three zones defined by the nearby lakes to the north: Bu for Burford Lake, Fi for Fish Lakes, and Fr for French Lake. Dikes are numbered in each zone from west to east. For example, the westernmost dike north of Burford Lake is labeled AQ 01 Bu.