Magnetic Boundary Map of Puerto Rico

By

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INTRODUCTION

The magnetic boundary map displays the boundaries of the magnetic sources producing the major anomalies on the magnetic map. The boundaries were created predominantly from the magnetic data with a computer program that locates the edges of source bodies from magnetic anomalies (Cordell and Grauch, 1985; and Simpson, 1986). Comparison of this map with the magnetic map shows that, in general, depending upon whether the boundary is on the south or north side of a magnetic mass, the boundaries are located respectively near magnetic highs or near magnetic lows; however, in either case the boundary is a short distance to the south of the magnetic high or low. These particular locations relative to magnetic anomalies are a consequence of the inclination of the Earth's main field (about 49^{o} down to the north in Puerto Rico); in other words the calculated magnetic signature of a rectangular magnetic prism at the latitude of Puerto Rico displays a magnetic high near, but north of the south contact and a magnetic low near, but north of, the north contact. The user of this boundary map should bear in mind that it is somewhat generalized by the computer process (upward continuation) used to smooth the magnetic data. In addition, the boundary map is not necessarily the same as a geologic map because it may combine similar magnetic rock units together or it may identify a magnetic feature that is only a part of a geologic map unit. Only a few magnetic boundaries appear to be artifacts of the data collection process and are caused by adjacent flight lines having slightly different datum levels; examples of such artifacts are seen in the survey of the Utuado batholith area (a few linear features trending N30^{o}E near long 66^{o} 45' W) and in the survey of central Puerto Rico (three north-trending boundaries at the north edge of the survey near long 66^{o} 15' W). We extended and connected the automatically located boundaries by visual inspection of the magnetic map and added hachure marks to indicate the direction of less magnetic material at the boundaries.

INTERPRETATION

Comparisons of the boundary map with the magnetic and geologic maps indicate that many of these boundaries can be explained in terms of the general geology and also that many magnetic features are either combinations of several magnetic geologic units or are simply a magnetic portion, possibly massive flows, of a larger, less magnetic geologic unit. Some of the magnetic features defined by the boundaries are described below, but much more detailed geologic and geophysical work will be necessary to decide upon the economic significance, if any, of numerous other anomalies on the map.

1. This boundary marks the southwest contact of a highly magnetic Cretaceous or Tertiary pluton that is located at the headwaters of streams containing gold placers and that may have magnetite-bearing skarn deposits at contacts with carbonate rocks.

2. This boundary, as far west as approximately long 66° 00' W, is the south limit of a linear zone of nonmagnetic altered rocks that provide an environment permissible for quartz-alunite gold deposits.

3. These eight locations contain one or more intense local magnetic highs on the detailed aeromagnetic maps and are thus favorable locations for magnetite-bearing skarn deposits at the contacts of the San Lorenzo batholith and satellite plutons.

4. These two areas, one subcircular, the other defined by an elongated elliptical boundary, are the strongest magnetic features on the magnetic map. These anomalies are predominantly caused by the Perchas Formation (mostly submarine basaltic flows). This same area correlates with the highest gravity anomalies on Puerto Rico at the crest of the central antiform.

5. The southwest border of the Utuado batholith is displayed as a linear boundary between the weakly magnetic batholith and the strongly magnetic metamorphosed basaltic country rocks.

6. Approximately parallel and adjacent to boundary 5 is a boundary that forms the southwest contact of a belt of magnetic country rocks. This magnetic boundary correlates with the gravity boundary map that separates gravity anomaly 16 (a high) to the northeast from gravity anomaly 17 (a low) to the southwest. The magnetic boundary also correlates with a contact on the geologic map, but the rock unit descriptions seem similar on both sides of the contact. The rocks northeast of the boundary may be more magnetic for two

reasons: (l) a higher percentage of magnetic mafic flow rocks and (2) contact metamorphism by the Utuado batholith, which may have fanned extra magnetite in the metamorphosed volcanic rocks. Most of the promising porphyry-copper deposits in this area are associated with local magnetic highs and lows distributed along the belt of magnetic volcanic rocks lying between boundaries 5 and 6. Locations of known porphyry copper mineralization are plotted on the boundary map, and the detailed magnetic data indicate other deposits are possible.

7. Boundary 7 is another relatively straight and long boundary farther southwest but also subparallel to boundaries 5 and 6. The boundary lies for the most part within generalized geologic units and implies that an important geologic contact remains still to be identified in this area.

8. Boundary 8 lies southwest of and subparallel to boundary 7. The boundary appears to be associated with contacts of the Anon Formation, which here is relatively magnetic compared to the adjacent rock units.

9. Boundary 9 is the south contact of a narrow antiformal belt of magnetic serpentinite that is substantially covered but appears to connect the two major serpentinite belts of southwestern Puerto Rico with each other. This serpentinite belt is similarly interpreted from the narrow gravity low (gravity anomaly 21) that is also in this location. The wide magnetic gradient sloping down for distances of 5-8 km to the north of this boundary implies that the serpentinite may be present at shallow depths of less than 1 km beneath the Cretaceous and Tertiary rocks associated with the magnetic gradient.