Iowa Science Teachers Journal

Volume 17 | Number 1 Article 5

1980

Physics Olympics Rules

Survey and Iowa Geological Survey. The anomalies are due to the "basement" rocks, that is, the dense crystalline rocks buried at typical depths of a few thousand feet under Iowa. The overlying younger sedimentary rocks are relatively non-magnetic in comparison. This map, then, portrays the deeper buried rocks underlying the State, based on their magnetic differences. These rocks can be "seen" by magnetic surveys, despite there having been very few deep boreholes that penetrate the basement to any significant depth to sample the rocks directly.

The most prominent large-scale feature on the Iowa map is the sinuous magnetic trend running from north-central down to southwest Iowa. This is the magnetic signature of the Midcontinent Geophysical, or Gravity, Anomaly ("MGA"). This is a seam of denser, more magnetic basalt rock, about 75-100 km wide and 1000 km long that extends from Lake Superior down through Iowa to southeast Nebraska. This was injected up into the Earth's crust when the continent here tried to split apart about 1 billion years ago. This immense, deep, and extraordinary feature can be mapped by remote geophysical means — magnetics, as well as gravity and seismic. Elsewhere in the State, there are numerous regions of "busy" localized and intense magnetic anomalies. These represent rock bodies intruded into the surrounding basement rock. Some have a positive magnetic anomaly, being more magnetic than the regional normal Earth's field; they were intruded and formed when the Earth's field had "normal" polarity in the past. Others have a negative anomaly, that is, are a magnetic "low" compared to the regional field, and were formed at a time when the Earth's field had "reverse" polarity.

Minnesota and Wisconsin to the north of Iowa have analogous basement rock and similar magnetic anomalies associated with rich mineral deposits. Ores of typical interest would include iron, nickel, lead, or zinc. A question of great importance for the future of Iowa is whether geophysical surveying and interpretation, combined with geological analysis and eventually deep drilling, will lead to discovery of similar mineral deposits in the State.

Supplementary Reading

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Press, F. and R. Siever (1978), *Earth*, 2nd edition, W. Freeman and Co.

Sharma, P. (1976), *Geophysical Methods in Geology*, Elsevier Scient. Publ. Co.

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If you would like to know how to prepare your students for participation in the Official Iowa Physics Olympics, write: Joe Moore, Keystone AEA, Elkader, Iowa 52043.