

Summary of Multilevel Aeromagnetic
Survey of Hanford Site FY 1980 Final Report

BY

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**Final Report: Multilevel
Aeromagnetic Survey of the Hanford Site
(Washington State)**

Abstract

A five-level, stacked, high sensitivity magnetometer survey used to produce maps with a positional accuracy on the order of 250 feet. Data interpreted using Werner deconvolution profiles in conjunction with magnetic maps.

Data suggest numerous structures extending into Pasco Basin from the Yakima Fold Belt do not die out, but continue showing undulations along strike. Reference repository location positioned in an apparently undisturbed deep basalt. Similar conditions exist west of Wooded Island and on the northern Wahluke Slope.

Data Compilation

basic steps

1. editing
2. flight path recovery
3. magnetic data adjustment
4. final positioning
5. gridding and contouring

Geologic Setting

Columbia Plateau is a flood basalt province in which during Miocene times, an estimated 200,000 km³ of tholeiitic basalts were deposited.

Structural sub-provinces of Columbia Plateau:

1. Yakima Fold Belt
2. Palouse
3. Blue Mountains

Pasco Basin is located in the Yakima Fold Belt. Yakima subprovince characterized by narrow linear anticlines and generally broad synclines. Faulting, including thrust faulting, is widespread in the fold belt.

Major rock units in Pasco Basin:

1. Pre Columbia River Basalt Group (basement)
2. Columbia River Basalt Group
3. Late Cenozoic sediments

Columbia River Basalt Group (oldest to youngest)

1. Grande Ronde Basalt - possibly several hundred flows, extruded from generally NW oriented feeder dikes in eastern part of the Plateau
2. Wanapum Basalt Group
 - a. alternating phyric and aphyric flows of normal polarity
 - b. phyric flows deposited in a transitional period between normal and reverse polarity
 - c. four aphyric flows of reversed polarity
3. Saddle Mountain Basalts - mostly aphyric flows some phyric with normal to reverse polarity transition and back twice
4. Ellensburg Formation - dacitic, andesitic, and pumiceous clasts derived from Cascades, interbed with and overlie basalts

Late Cenozoic sediments include Pliocene fluvial sediments and fan conglomerates, Quaternary glaciofluvial deposits, plus recent alluvium, colluvium, and eolian deposits with interbedded ash.

Geophysical Interpretation - General

Attempt to explain the source of detected magnetic anomalies in the survey area and to give a general description of the geologic significance of anomalies in the outlying areas.

Werner deconvolution process solutions are in terms of thin magnetic layers, i.e., contacts between two rock types of essentially different magnetic susceptibility.

Possible solutions:

1. "dike-like" - solutions of thin magnetic layers dipping vertically (45°); mapped as dikes
2. "fault-like" - solutions with a horizontal orientation (45°); mapped as faults; no thrust faults mapped because of strong reversed remanent polarities which can affect calculated dips
3. combination of "dike-like" and "fault-like" - structural disturbance

An indicated fault does not necessarily imply that active faulting has taken

or is taking place; rather, it indicates a horizontal magnetic source ends in that particular area.

Causes of the termination of a horizon:

1. the ending of a flow
2. change in susceptibility within a flow
3. fault displacement of a horizon

Generally not possible to tell which of the three is the correct solution based solely on magnetic formation.

Flow pinch-outs within the thick basalt sequence produce anomalies too weak to be detected.

Conclusions and Recommendations

Numerous probable anticlines, domes, and synclines indicated which aren't found on geologic and structural maps of Pasco Basin.

Umtanum Ridge structures continues at depth past Gable Mountain, on to the southeast near the Ice Harbor Basalt feeder dikes in the eastern corner.

Yakima Ridge structure continues to the southeast, east of Horn Ridge, to near the Columbia River.

Southern part of the Horn Rapids structure has a persistent bend to the southwest. West of Enterprise, it bends sharply to parallel an interpreted mostly strike-slip fault.

The Badger Coulee fault appears to extend north to Goose Hill.

South of Columbia River, all major structures are oriented mostly northwest-southeast, a change from the east-west trend in the western part of the area.

Numerous N45°E trending mostly left-lateral transverse faults.

Interpreted structural high with a possibly related fault east of Priest Rapids Dam.

Three zones of deep buried basalt with no evidence of major disturbance. Areas appear favorable for further investigation as possible repository sites.

At the potential sites, 2-D (profile) and 3-D (map) modelling techniques recommended to better describe the geometry of the basalt structures.

Appendices

A - Computation of the Main Geomagnetic Field from Spherical Harmonic Expansions

B - Understanding and Use of the Werner Deconvolution in Aeromagnetic Interpretation

* 17 maps and cross section plates included with report. Referred to in report.