6.3 HOW IMPORTANT IS MULTIPHYSICS FOR ELECTROMAGNETIC IMAGING

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ABSTRACT

Electromagnetic exploration methods, applied to depths ranging from 800 meters to 6 kilometers, can be categorized into three distinct classes for mapping various geological targets:

1. Conductive Anomalies: These anomalies include geothermal heat sources, water floods, and other conductive materials.

2. Resistive Anomalies: This category encompasses hydrocarbon accumulations, carbonates, CO2 plumes, and other resistive geological features.

3. Anomalous Responses: This includes detecting thin resistive layers, induced polarization, and mapping fault zones.

These methods are inherently limited by their resolution capabilities. However, their effectiveness is often enhanced when combined with other geophysical techniques and geological insights. When consistent results emerge, the risk associated with the solution significantly decreases.

By employing a multi-physics approach, where different physical principles are leveraged, we have developed a strategic method over the years. This approach involves capitalizing on the strengths of each method to compensate for the weaknesses of others, resulting in maximum synergy. Case studies from various environments, such as carbonate formations, sub-salt structures, and sedimentary regions, demonstrate the effectiveness of this combination. These examples also illustrate how this approach accelerates the derivation of project value.

KEYWORDS: Multi-physics, fluid imaging, controlled source electromagnetics (CSEM)