

Shallow Sedimentary Features of Cook Inlet, AK and Surroundings Revealed by Aeromagnetic Data

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Bordered on the west by volcanoes and magnetite-bearing bedrock, the Cook Inlet basin continually receives an influx of magnetite-rich sediments. When heavily concentrated, these sediments can be traced and mapped using aeromagnetic data. Marine sediments are traditionally omitted from airborne and shipboard magnetic survey analyses because their contribution to the observed field is often weak and difficult to distinguish from survey noise; associated anomalies are often filtered out during gridding. We have developed a spectral filtering approach that works on flight line profiles to highlight such anomalies and distinguish them from responses to deeper, larger sources such as igneous intrusions.

Applying this approach to low-altitude aeromagnetic data collected over Cook Inlet shows both clusters of areas where such sediments are concentrated, as well as linear features. Many of these clusters are associated with glacial moraines, with some focusing along rivers and other features. In some cases the anomalies extend for some distance offshore, most likely following glacial inputs. Noticeable differences in the magnitudes of anomalies in these clusters appears to be related to the source of the glacial sediments and the concentration of magnetic minerals within them: anomalies near the Alaska Range and nearby volcanoes show the greatest magnitude, those from the more distant Talkeetna Mountains are intermediate, and those from the metamorphic Chugach Mountains are low to negligible, except in some limited areas. Models incorporating susceptibility measurements are used to better quantify the amounts of magnetite-rich sediments.

Offshore, most short-wavelength anomalies form lineations that are parallel to known folds in sedimentary strata. These anomalies can be modeled by assuming that some stratigraphic layers have high enhanced magnetic properties (probably due to volcanoclastic concentrations). Most of these lineations are located on the northwestern side of Cook Inlet from Susitna to Trading Bay. South of West Foreland, they change direction from NE-SW to N-S, similar to changes in channels and other submarine topography in the Inlet, before gradually subsiding. We consider the relationship between these anomalies, sedimentary inputs to the Inlet, and the tectonic evolution of the region.