Aeromagnetic Surveys

Interim data description document

هيئة المساحة الجيولوجية السعودية

SAUDI GEOLOGICAL SURVEY

www.sgs.gov.sa

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1. Introduction

This document will contain metadata information in accordance with ISO 19115 and define data specific metadata attributes in relation to the aeromagnetic survey acquired by Xcalibur Multiphysics.

2. Parent Identifier

Airborne geophysical surveys

3. Alternate Title

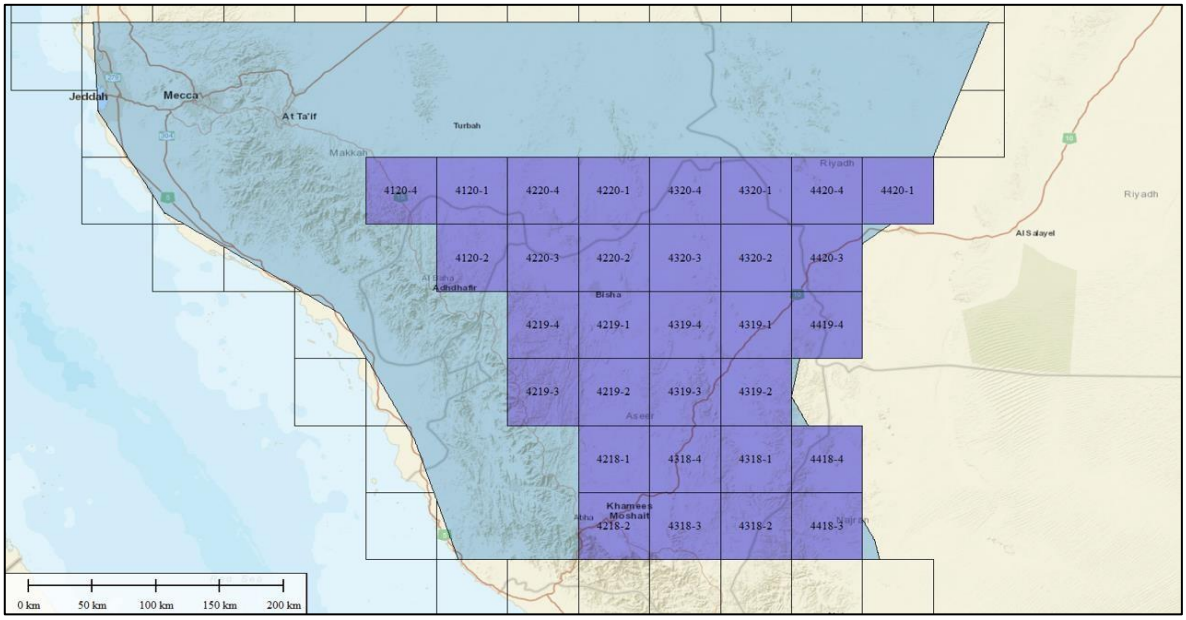
Magnetic and Radiometric Surveys

4. Reference Date

2022-2023

5. Abstract

The airborne geophysical survey covered Area 3 of the Arabian shield in Saudi Arabia. Magnetic and radiometric geophysical data was acquired between 2022 and 2023, with a survey line spacing of 300 meters and an average height of 60 meters in gentle topography and 120 meters in steep regions. The reference datum used for the dataset is KSA-GRF17 with UTM 37N projection (EPSG code: 9357). The sampling frequency for the magnetic and radiometric data is 20 Hz and 2 Hz respectively.



Block 3 survey area .
Delivered map tiles of preliminary processed data.

Figure 1: Index map of airborne magnetic survey data acquired by Xcalibur Multiphysics.

Table 1: Block 3 airborne geophysical magnetic and radiometric acquisition specifications.

Survey	**Survey Year**	**Flight Altitude (m)**	**Company**	**Supervisor**	**Line Spacing (m)**	**Line Orientation**	**Line km**
Area 3	2022-2023	60m	Xcalibur Multiphysics	Technical Partner	300	090/270 degrees	*719137*

Note: 719 137 is the total line kms of Block 3. The data delivered does not contain the entirety of Block 3 which will be completed at the start of 2024.

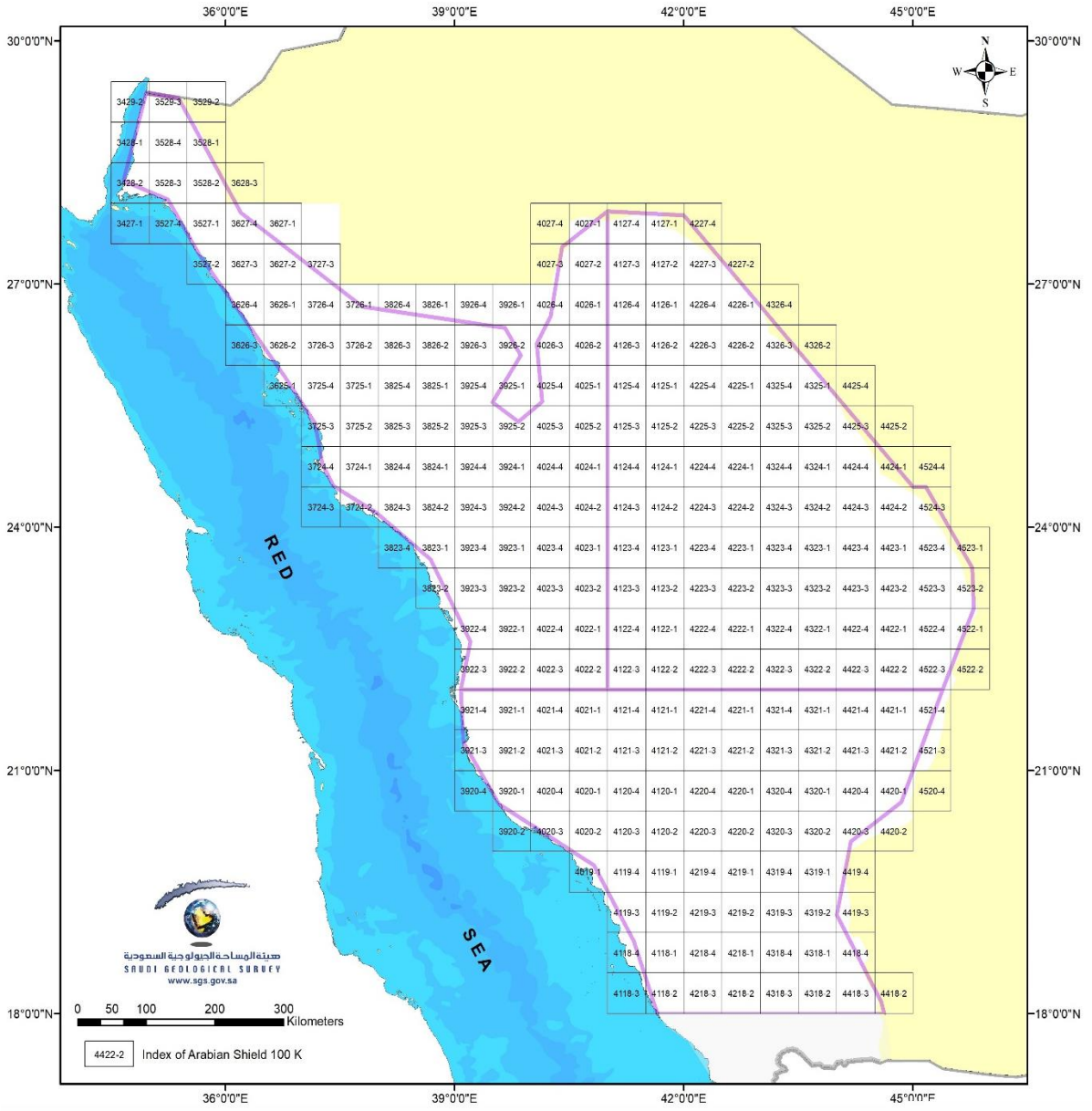


Figure 2: Topomape 1:100,000 index map of the Arabian Shoeld.

6. Purpose

The airborne geophysical survey (magnetic and radiometric) was initiated as a first line exploration tool to outline geological structures within the Arabian shield to allow for further targeted geophysical exploration over smaller mineral rich zones. Low level flying greatly improves spatial resolution and signal-to-noise ratios, thus providing more information on near-surface features such as faults and kimberlite pipes. The data will add more detail to the legacy data and will improve existing geological maps, with the benefit of magnetic gradient data which improves geological parameterization. The sole purpose is to add to the geoscience knowledge base of the Arabian shield for well-informed mineral resource prospecting in Saudi Arabia.

7. Credit

Xcalibur Multiphysics

8. Source

The data has been acquired utilizing 4 Pacific Aerospace (PAC750) fixed wing aircrafts for high resolution data. The instrument configuration across all aircraft is the same which allows for better consistency in data collection. The aircraft magnetic instruments are two Geometrics G-822A cesium vapour magnetometers mounted on the wingtips of the aircraft as well as a Billingsley ultraminiature triaxial vector fluxgate magnetometer. The radiometric equipment comprises of two 42-liter Sodium-Iodide (NaI) crystal pack. All data was merged daily to a master cumulative, and levelled at the end to produce multiple grid products for interpretation.

9. Processing Flow

Magnetics:

Airborne magnetic processing is a systematic procedure vital for extracting meaningful insights from airborne geophysical surveys. Corrections that are applied to the total magnetic field include lag and diurnal adjustments, with subsequent calculations of magnetic gradients offering additional anomaly details.

The diurnal data was filtered to reduce noise levels and subtracted from the mean diurnal base value for a residual correction which was applied to the survey data by synchronizing the diurnal data time (from the base station) and the aircraft survey time. The X and Y positioning (location) of the data was checked for spikes, followed by applying the IGRF correction.

Tie line leveling was applied to improve the quality of the magnetic data, followed by micro-levelling (in selected areas) to correct any minor level errors due to variations in terrain clearance or other factors. Horizontal and vertical gradients, analytic signals, tilt derivatives and reduction to the pole/equator were calculated to pinpoint anomalous source bodies and provide valuable depth/ orientation insights.

Radiometrics:

The radiometric processing is in accordance with the International Atomic Energy Agency (IAEA) recommendations and comprise of the following steps: Applying a Noise Adjusted Singular Value Decomposition (NASVD), Peak analysis, energy recalibration, and new ROI, Live time correction, 1D filtering, calculating the effective height (at Standard Temperature and Pressure (STP)), cosmic and background correction, a radon correction, applying stripping ratios, Height corrections, levelling the radiometric, converting the micro-levelled data to concentrations, and calculating grid ratios.

10. Source Data

http://sgs.gov.sa

11. Use Limitation

The data can be displayed in a scale of 1:100 000 and is of a preliminary version. The data has been delivered in map tiles which will need to be stitched together by an end-user if a larger area is of interest.

12. Keywords

Airborne Geophysics. Mineral Exploration, Radiometrics, Magnetics, Analytic Signal, Processing, Aircraft, Orientation, Arabian Shield, Anomaly, Depth, Precision, Geological Maps, Concentrations, Energy Recalibration, NASVD, Diurnal, Derivative