A Case Study on the Application of a Magnetic Survey Using Magnetometers Carried by Multicopter-type Drones

*Shiga Nobuhiko[1], Harada Haruo[1], Wada Kazushige[1]

1. Mitsui Mineral Development Engineering Co., Ltd.

Recently, large radio-controlled helicopters have been successfully used to take magnetic measurements of active volcanoes due to their long cruising distance and large payload. On the other hand, in mineral exploration, multicopter-type drones can conduct successful surveys in spite of their shorter cruising distance by repeating a number of short-distance flights. The drones can be used for faster and more extensive reconnaissance magnetic surveys compared with land magnetic surveys, by flying at about 50m above ground level, with 100m of flight separation. The drones can also provide high-resolution results that cannot be acquired easily by manned airplanes or helicopters.

Since 2017, magnetic measurements have been taken by a drone as reconnaissance for a domestic gold exploration project survey, with a total flying distance of 680km so far. This type of drone is commercially available, with 5.5kg of payload. It carries an optical pumping magnetometer, a 4K camera, and a circuit board for data processing and telecommunications, among other equipment. It also has a hanging magnetometer sensor that is suspended from a single 2.5m Kevlar cable.

The TMI data quality has mostly been good, and the data repeatability is always satisfactory. Usually, the discrepancies at the intersecting points between regular flight lines and tie-lines are small enough to be negligible. And no magnetic influence of the drone has been found, so there has been no need to compensate for drone airframe magnetism. However, the optical pumping magnetometer has a dead zone in the incident angle of the input magnetic field. Because the magnetic sensor is suspended from the drone, measurements can sometimes be interrupted if the sensor is strongly shaken or tilted by the wind or by an abrupt change in the cruising speed.

Since 2017, we have been conducting drone magnetic surveys at an existing gold mine and surrounding area. As a result, a low magnetic zone was found around an outcrop of silica sinter with strongly silicified rocks. The location of the low magnetic zone coincides with the peak of the horizontal gravitational gradient strength in this area. The peak was interpreted to show the locations of faults, and the low magnetic zone was derived from the thermal demagnetization by hydrothermal fluids came up throuh the fault, which brought about mineralization and the silica sinter. Since the silica sinter and strongly silicified rocks were mineralized (Au:1g/t-- Ag:16g/t), an epithermal gold-silver deposit is likely to exist beneath the sinter area.

(Acknowledgement)
We would like to express our deep appreciation to Irving Resources Inc. for their valuable assistance for this survey and for their permission to use materials from their surveys in this presentation.

Keywords: magnetic survey, drone, mineral exploration

