Understanding ground subsidence by integrating geology, geophysics and military history: “Reading the Ground” at the Vimy Ridge Memorial site in France

Abstract:
The Vimy Ridge site, north of Arras, France, commemorates the tremendous achievement of Canadian and Allied troops during the offensive of April, 1917. The site is one of the few places left in France where the terrain has been largely unchanged since the end of the First war, with the result that the configuration of trenches, military mining craters and other war-time excavations can be observed, in situ.

In the lead-up to the 90th anniversary of the Battle of Vimy Ridge, Veterans Affairs Canada undertook a substantial project to restore the memorial structure which has been progressively damaged by the effects of the weather, since its opening in 1936. At the same time, VAC became concerned about the relatively frequent occurrence of ground failure into underground excavations, both from the perspective of assuring the safety of visitors to the site, and because large loads would be applied to the surface by construction activities during the restoration project. As a result, a group of geologists, geophysicists and military historians was brought together to examine the issue of the potential for ongoing subsidence and to determine whether the underground voids left from WWI could be detected and their stability assessed.

The project work undertaken involved visits to underground sites that have been largely undisturbed since the end of the War, and the opportunity to map the structure in the chalk at a variety of surface and underground sites, to understand the factors that could lead to instability. Geophysical techniques were employed at the site to try to determine where the rockmass properties were weakened, and where underground voids still remain near surface. Based on the data collected, the risk of ground instability was assessed, with the result that some sections of the site were declared off limits for equipment and rock during the restoration work.

The beautiful and moving monument was successfully restored and rededicated in 2007, with no appreciable influence of the ground conditions on the site activities. Further commemorative ceremonies have been held at the site on the occasion of the 100th anniversary of the battle in April, 2017, and the very recent celebrations of the 100th anniversary of the WWI Armistice on November 11, 2018.

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