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Observed subsidence progression at New Afton Mine in response to Lift 1 mining

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Abstract

New Gold's New Afton Mine is an operating gold-copper block cave mine located 10 km west of Kamloops, British Columbia, Canada. Mining of an initial lift (Lift 1), approximately 600 m below ground and partially beneath the historical Afton Pit, was completed in early 2022. The initial Lift 1 drawbell was blasted in September 2011 and cave breakthrough to the surface was monitored in February 2013. A state-of-the-art subsidence monitoring program has progressively been implemented at New Afton to monitor progression of surface and near-surface deformations in response to mining, including towards critical surface infrastructure.

This paper presents a case study of the observed subsidence progression in response to block cave mining, from initial breakthrough to the end of the Lift 1 production, using examples from the various instrumentation and monitoring techniques used at New Afton. The surface manifestation of deformation was found to be influenced predominantly by mine production rates and the location(s) of underground draw. Additional controls on the expansion of the subsidence zone and the spatial distribution of deformation rates included influence of topography, presence of major geological structures, preferential deformation within comparably deformable Nicola Group geological units, and interaction with the historical Afton Pit. A summary of the use of available instrumentation and monitoring methods and the phased development of New Afton subsidence monitoring system are also presented.

Keywords: *block cave, subsidence, monitoring, instrumentation, remote sensing*

1 Introduction

New Gold's New Afton Mine is an operating gold-copper block cave mine located 10 km west of Kamloops, British Columbia, Canada. Mining of an initial lift (Lift 1), approximately 600 m below ground and partially beneath the historical Afton Pit, was completed in early 2022. The initial Lift 1 drawbell was blasted in September 2011 and cave breakthrough to the surface (initial surface deformation in response to mining) was monitored in February 2013. Subsidence deformations resulting from Lift 1 mining have been rigorously monitored and evaluated due to the presence of surface infrastructure, including tailings storage facilities, in proximity to the mining area. Surface and subsurface deformations are monitored using a comprehensive network of in situ instrumentation and with remote sensing techniques. Extensive monitoring data collected during Lift 1 production have allowed for comprehensive characterisation of the spatial and temporal progression of subsidence in response to mining and facilitate cross-validation between multiple instrumentation and monitoring techniques.

This paper presents a case study of the observed progression of subsidence deformations in response to Lift 1 mining from breakthrough of the cave to surface through the end of the Lift 1 mining phase. Observed surface and/or subsurface (near-surface) deformations were found to be:

- Spatially and temporally linked to production rates and location(s) of underground draw.
- Laterally constrained by major geological structures and lithological contacts, which acted as significant bounding structures to subsidence deformation.


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observed to be constrained by the existence of bounding structural features (faults and lithological contacts), which have limited the expansion of subsidence within several areas, notably within the southern boundary downstream of the TSFs and northern boundary near the vent raises. The Lift 1 footprint extends partially beneath the historical Afton open pit and the observed subsidence behaviour within the various pit sectors is complex and diverse depending on geology and pre-existing pit wall instabilities within the pit from historical mining. Initial monitoring data following the conclusion of Lift 1 mining indicate that deformations have begun to slow across the subsidence zone, including within the Afton Pit, as expected.

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