



Title	Modeling of the groundwater flow system in excavated areas of an abandoned mine
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1 **Abstract**

2 This study evaluated the assumption that back-filled excavated areas of old mine
3 workings can be modeled as porous media, where groundwater flow is governed by
4 Darcy's law. The Yatani mine, located in Yamagata Prefecture, Japan, was selected for
5 this study because several mining methods were used during its operation and detailed
6 drawings of the excavated areas of the mine are available. The model was calibrated
7 using combinations of hydraulic conductivities (k), with the best-matched case being
8 selected by comparing calculated and measured AMD fluxes. Modeled AMD fluxes
9 along the drainage tunnel (-2L level) were consistent with measured data when the
10 excavated areas were considered to be porous media with a specific hydraulic
11 conductivity, and the presence of faults and permeability were taken into account. The
12 model also successfully predicted the increasing trend of AMD flux from the shaft to
13 adit mouth. In the numerical model, the back-filled excavated areas were assumed to
14 behave as porous media, which was shown to be a valid assumption in this mine. The
15 model demonstrated that back-filling the excavated areas and drainage tunnel with low
16 permeability materials could reduce the flux of Zn in AMD by up to 61%.

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18 Keywords: Abandoned and closed mine, Acid mine drainage (AMD), Numerical model,
19 AMD reduction