

EXTENDING GIS INTO THE THIRD DIMENSION: APPLICATIONS FOR REGIONAL GEOLOGICAL MAPPING AND MINERAL EXPLORATION

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Geological problems, especially hard rock mining and regional mapping problems, are at present only beginning to be dealt with adequately by the traditional 2 and 2 1/2 dimensional GIS. However, geology is inherently a 3D science. The challenge for future development is to extend the traditional GIS tool-kit into the third spatial dimension, so that the interpretive, representative and data management functions work directly with X,Y,Z georeferenced data. A collection of techniques and approaches to the integration of map based geological data is presented, with the aim of constructing 3D structural models. Methods focus on the geological integration of field based structural information to constrain surface interpretations of geological interest. The 3D geometric approach presented provides an initial route for the routine combination of extracted geological map based information, surface topographic data and the intuitive knowledge of a geological 'designer'. Local field based structural observations are used to control the sub-surface projection of map traces such as bedding, faults, shear-zones and other curvilinear geological contacts. Advanced interpolations of clustered and sparse data are utilized in conjunction with knowledge driven design tools within virtual 3D editing environments, to create simple speculative visualizations. 3D visualization and modeling tools now in existence are adopting more GIS and geophysical modelling functionality. In the last decade significant advances have been made in graphics and computer aided geometric design methods. The geometric techniques, coupled with new, sophisticated geophysical forward modelling and inversion algorithms can radically enhance our ability to make extended geological interpretations into the sub-surface.