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Geo3DML: a public 3D geological model data exchange format

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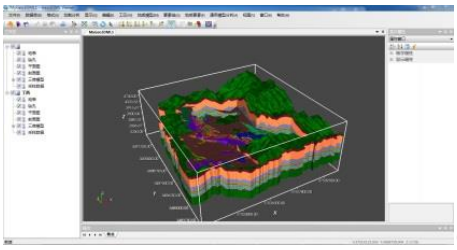
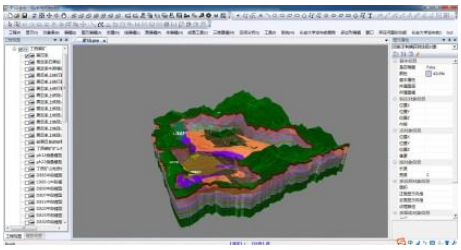
3D geological modeling has been widely utilized in geological survey and exploration result presentations. However, with the wide range of 3D geological modeling software packages and data models, it is difficult to implement an integrated management approach and interactively share 3D geological model data. With support from the China Geological Survey, we conducted an exchange format study with respect to 3D geological model data from 2011 to 2015 on institutions engaged in production, scientific research, and teaching to promote the exchange and sharing of 3D geological survey results. Based on the principles of being practical and open, regardless of the modeling software used and the reuse of existing standards, we proposed a general 3D geological data exchange model and defined this model to adhere to the data exchange format standard called Geo3DML. This standard has been promoted as the China Geological Survey standard in December 2015.

In Geo3DML, we defined 3D geological modeling as the presentation of geological phenomena and their relationship in three dimensions. Geo3DML regulates the general presentation of 3D geological bodies and supplies necessary extension mechanisms to achieve exchange of 3D geological models based on 3D points, lines, surfaces, solids, voxels, and notes while also supporting 3D geological model exchange in the geological fields, such as basic geology, hydrogeology, engineering geology, environmental geology, mining and energy, etc. While it has a reasonable theoretical basis, Geo3DML can also support general presentations of a range of 3D geological structure and attribute models, and general presentations of 3D boreholes, sections, geological maps, and 3D models.

Geo3DML uses the standardized XML schema language format for recorded model data language, and records 3D geological model data using structured XML files. Geo3DML is a GML application type used in 3D geological models, and was developed with reference to GML regulations. In the process of describing non-geometric attribute data, visual parameters, and metadata, we reused public standards, such as the OGC SWE, OGC SE, and GMD. At the same time, GeoSciML and CityGML have played an important role in reference.

In addition, to support the development and general use of this standard, we developed supportive tools Geo3DML Viewer and Geo3DML SDK (a type of transit joint). Fig.1 gives an exchange example.


(A)

(B)

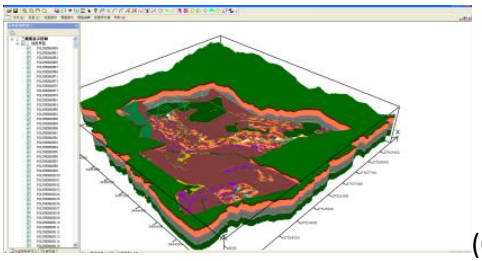
 (C)

Fig.1 Model of a phosphate mining area in Hubei province, China: (A) Display in the 3D Geological modeling software; (B) Display in Geo3DML Viewer; (C) Display in another 3D software