

A Interactive Online Geologic Block Modeling*

Rowan Cockett¹

Search and Discovery Article #120154 (2014)

Posted February 25, 2014

*Adapted from extended abstract prepared in conjunction with oral presentation at AAPG Hedberg Conference, 3D-Structural Geologic Interpretation: Earth, Mind and Machine, June 23-27, 2013, Reno, Nevada, AAPG©2013

¹The University of British Columbia, Vancouver, BC, Canada

Abstract

Geology is a highly visual science, and many disciplines require spatial awareness and manipulation. For example, interpreting cross-sections, geophysical data, geologic maps, or plotting data on a stereonet all require various levels of spatial abilities. These skills are often not taught in the geosciences and many learners struggle with spatial relations, manipulations, and penetrative abilities (e.g. Titus and Horsman, 2009).

Introduction

A newly developed program, Visible Geology, allows learners to be introduced to many geologic concepts and spatial skills in a virtual environment. Visible Geology is a web-based, three-dimensional environment where users can create and interrogate their own geologic block models. The program begins with a blank model; users then add geologic beds (with custom thickness, color, and properties) and can add geologic deformation events like tilting, folding, and faulting ([Figure 1](#)). Additionally, simple intrusive dikes and unconformities can be modeled. As in a real environment, these geologic deformation events add together to create complex formations.

Videos, animations, and images that show students one concept at a time are readily available; Visible Geology, however, allows users to simply and interactively create these models and animations. Users cannot only spatially manipulate their geologic model, but can create cross-sections and boreholes to practice their visualizing inside the models. The process of creating a model, physical or virtual, is an engaging and meaningful process that has substantial benefits for student or learner. Visible Geology allows learners, not just the teachers, access to these modeling tools such that the students can become invested and engaged in creating geologic models. Teachers are able to ask students to build geologic structures from scratch rather than showing them a pre-made video or picture. Students are thus able to gain geologic intuitions through this process of discovery-based learning.

Discussion

A core principle in the building and design of Visible Geology was ease of use; this was met by a hassle free installation (i.e. there is not one) and a clear distraction free user interface. A clear and purposeful design in the program means that students spend more time learning geology than learning a specific technology. For example, planar features and rotation events can be created by visually rotating and positioning handles on an interactive plane ([Figure 2](#)). As no download or installation is required, the program can be incorporated into current activities and assignments with ease. The target audience of Visible Geology has been introductory and structural geology at the undergraduate level, and learning activities have been developed with learning objectives such as relative geologic history, fault characterization, apparent dip and thickness, interference folding, and stereonet interpretation. Visible Geology provides a richly interactive and immersive environment for students to explore geologic concepts and practice their spatial skills.

Summary

The interactive and modular nature of Visible Geology allows it to be used in many unique ways that are not preconceived. This adaptivity is possible because Visible Geology is a modeling tool not another animation or video. Thus, although the program has been designed for education at the university level, it could be adapted for use in teaching newly hired interpreters. These interpreters not only need, for example, geophysical knowledge of seismic wave propagation, but this knowledge must be applied in a geologic context. As such, the geologic intuitions gained from working with and creating geologic models can be highly advantageous for interpreters who must think both spatially and geologically.

Reference Cited

Titus, S.J., and E. Horsman, 2009, Characterizing and improving spatial visualization skills: Special volume - Research on Thinking and Learning in the Geosciences: Journal of Geoscience Education, v. 57, p. 242-254.

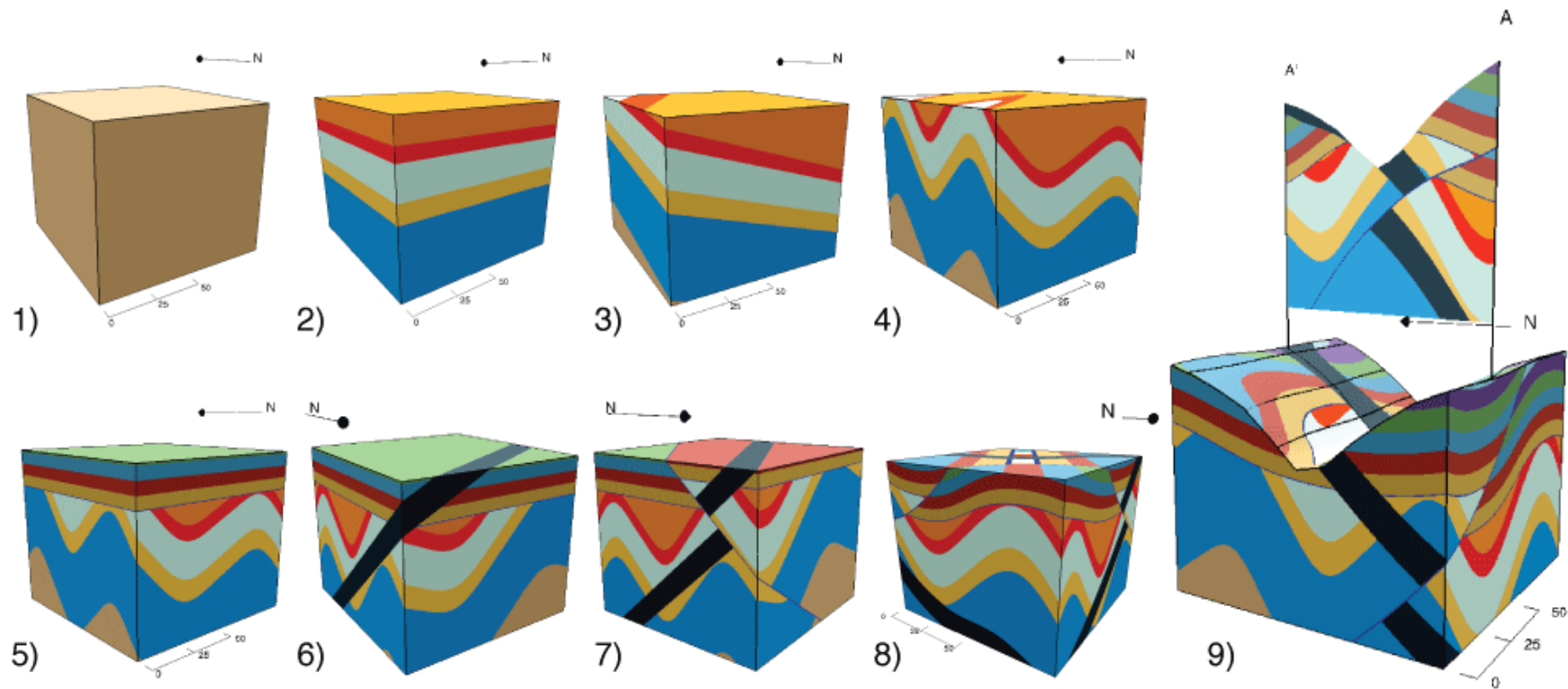


Figure 1. Evolution of a block model in Visible Geology: (1) blank model; (2) geologic beds added of various width and color; (3) tilting event; (4) folding event; (5) unconformity; (6) igneous dike; (7) reverse fault; (8) folding event; (9) final model on a valley topography showing cross-section.

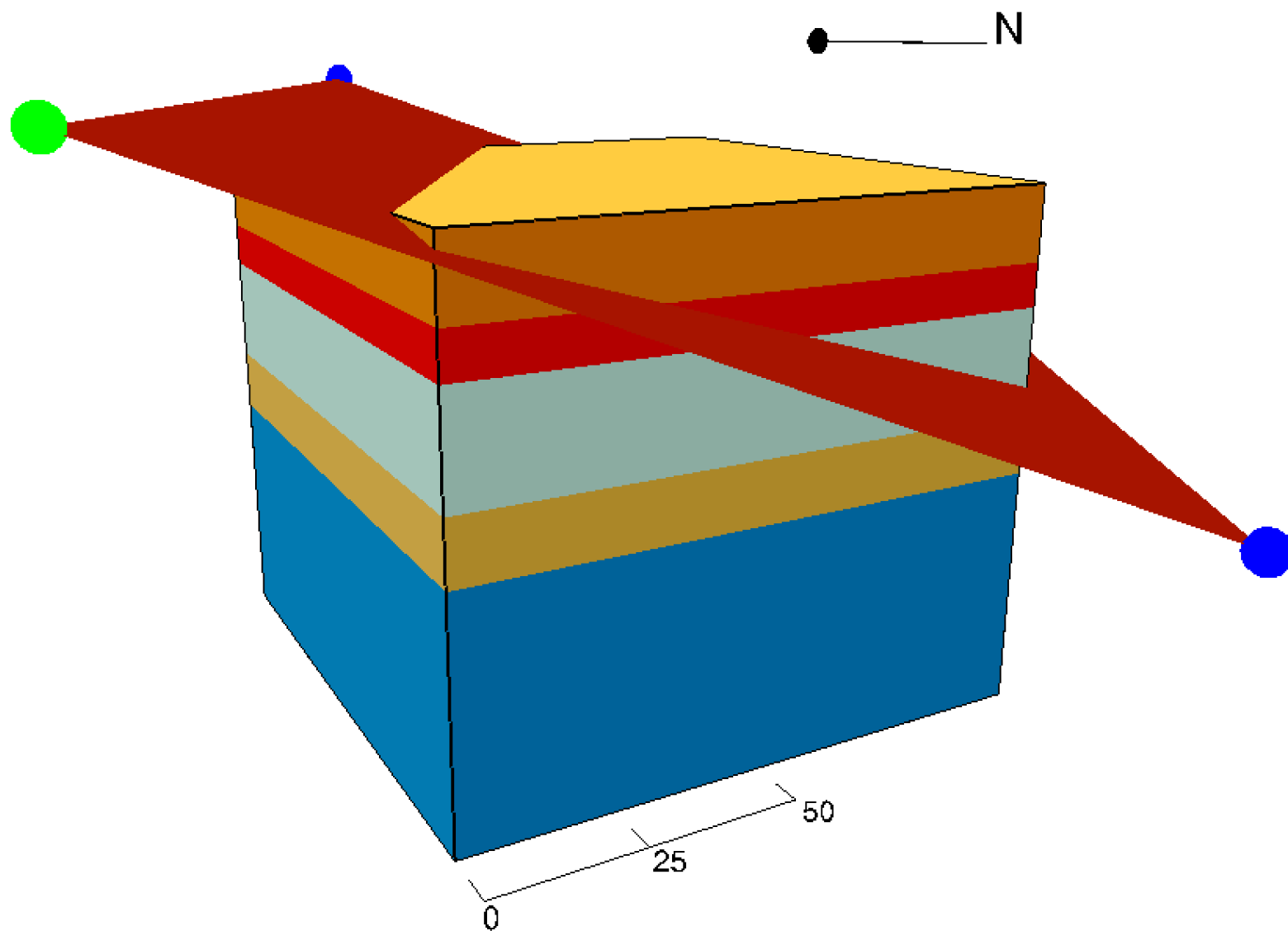


Figure 2. Simple, interactive, and visual controls for additions of geologic events allow both experts and novices to quickly create unique geologic block models.