

3-D Structural Modeling - The Mount Lykaion (Greece) Sanctuary of Zeus Case Study

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3D structural modeling software has been developed for the Oil & Gas industries over the last 20 years or so to help establish whether geological models are geometrically valid. Typically they have been used in regions, onshore and offshore, where the bulk of data comes from seismic surveys and wells. Nevertheless, their modeling tools and techniques can be effectively applied to onshore settings where data are limited to what can be gathered at the surface through field mapping. Part of the versatility of structural modeling packages lies in providing the capacity to analyse in-progress geological mapping of tectonically complicated areas. A particularly important function is to check surface geological contacts in relation to measured strike-and-dip data for bedding.

Midland Valley's MOVE suite of software was used to test the viability, coherence and structural validity of geological mapping carried out by one of us (Davis) at the Sanctuary of Zeus, Mt. Lykaion (Peloponessos). Through the process of structural analysis and cross-section construction, inconsistencies between some of the data were seen. Investigating these inconsistencies became a primary objective during the most recent field season (2009). This iterative approach, where structural analysis and modeling helps to guide the fieldwork effort, resulted in refined interpretation in critical areas.

The Sanctuary of Zeus (Mt. Lykaion) has excellent rock exposure, significant topographic relief, and profound variations in slope orientations and steepness. These factors create challenges for the geologist during mapping, but provide opportunities for examining the 'match' between contact traces and measured orientations of contacts, bedding, and structures. Major structural contacts have quite a range in orientations. On one extreme, there is major near-horizontal thrust fault at the base of the Mt. Lykaion summit area, which is a tectonic klippe. On the other hand there are high-angle active normal faults, one of which can be traced for two kilometers across complex topography; this fault cuts and offsets the klippe. In addition there are major anticlines and synclines, which, along their axial traces, can be seen to vary from upright to overturned. Establishing accurate portrayals of all of these structures and contacts is imperative, for it is within this 'structural landscape' that the archaeological elements of the upper and lower sanctuaries of the Sanctuary of Zeus are assembled.