An Interprovincial Structural Database for the Western Canada Sedimentary Basin

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Abstract

A prototype structural database has been designed by the provincial geological surveys of Alberta, Saskatchewan and Manitoba in order to assist government and industry in their efforts to assess and better target possible occurrences of energy and non-energy minerals in the Western Canada Sedimentary Basin. Lineaments from literature sources and provincial survey work inferred on isopach and structural maps for various stratigraphic intervals, and tentatively interpreted to be structurally controlled, are being compiled digitally into GIS shapefiles, individually tagged and linked to a Microsoft Access® database. Data associated with individual lineaments will include attribute information such as original citation, criteria by author for inferring the existence of a fault or lineament, formation(s) affected, fault type and orientation. The structural database is intended to be both flexible and comprehensive, and has been designed to allow for continuous updates and refinements. This inter-provincial project will be distributed via web pages and on CD-ROM with free viewing software; the database includes thousands of lineaments derived from facies, thickness and elevation changes. The digital format allows various options for data selection based on such query criteria as location, timing, orientation and authorship. The structural database may also serve as a reconnaissance level mapping tool. At the scale of an exploration project, faults or intersections of faults inferred to have economic potential should be regarded as ‘zones of interest’ for further more focused investigation, not as immediate drilling targets. The structural database helps unravel the structural complexity of the Cordilleran foreland in Alberta and of the Williston Basin (including Elk Point Basin) in Saskatchewan and Manitoba. The compilation and organization of this structural information may permit future overviews of its Phanerzoic tectonostratigraphic evolution, and may inspire further comprehensive multidisciplinary studies of relationships between tectonics, sedimentation, diageneisis and mineral occurrences.

Keywords: structural database, Western Canada Sedimentary Basin, Williston Basin, faults, lineaments.

1. Introduction

Exploration for a wide range of economic deposits in the Western Canada Sedimentary Basin (WCSB) is critically dependent on knowledge of the location and age of fractures that have formed hydrocarbon traps, acted as pathways for diageneric and mineralizing fluids, and potentially influenced other geological processes such as kimberlite emplacement. Knowledge of the location and characteristics of faults is also highly important in geological site characterization studies for greenhouse gas storage, natural gas storage, mining activities and other processes that require knowledge of potential locations where cross-formational flow may occur.

Although regional structures and their controlling faults in the WCSB have been reasonably well documented in the subsurface by the oil and gas industry, no detailed publicly available synthesis of these data exists. A prototype structural database has been designed by the provincial geological surveys of Alberta, Saskatchewan and Manitoba in order to assist government and industry in their efforts to assess, and better target, possible occurrences of energy and non-energy minerals in the Western Canada Sedimentary Basin that encompasses the Cordilleran foreland, Elk Point and Williston basins. The present structural compilation in digital format is the first attempt to provide a tectonostratigraphic framework for hydrocarbons, metallic mineral and diamond exploration in the WCSB. It is intended to be both flexible and comprehensive, and has been designed to allow for continuous updates and refinements. Lineaments from various literature sources (digital and non-digital) were geospacially referenced, compiled digitally into shapefiles and individually tagged with attribute data stored in a database. This inter-provincial project will be distributed via web pages and on CD-ROM with free viewing software.

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