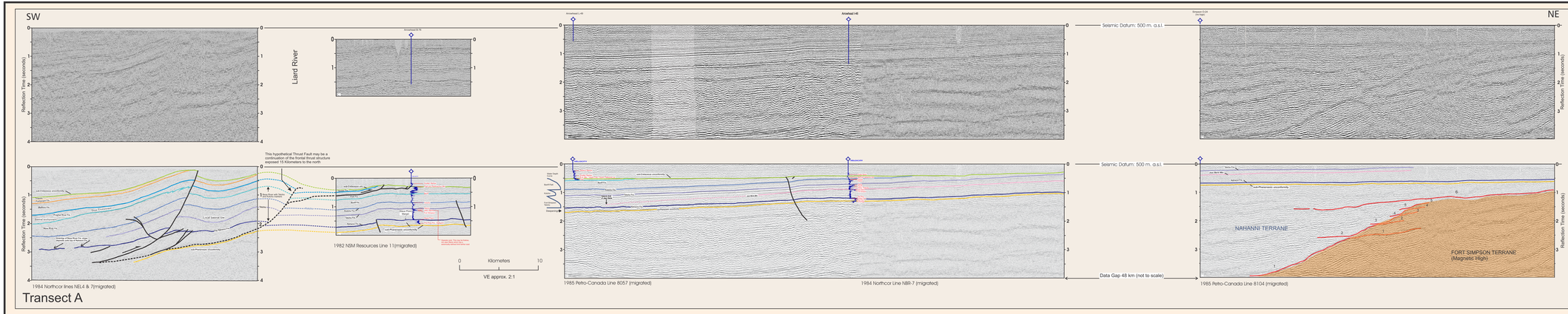
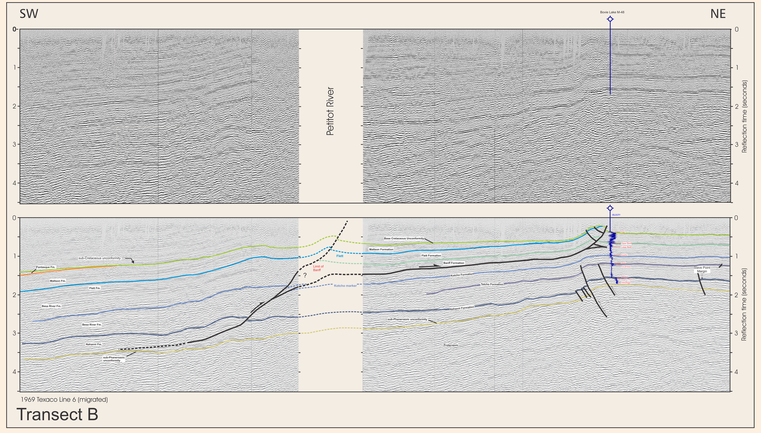
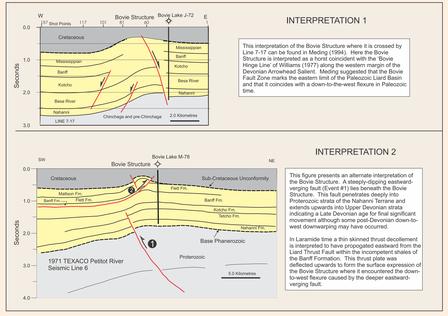
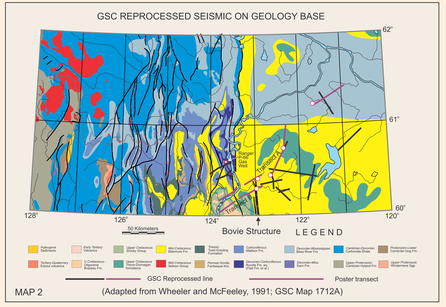


Transect A



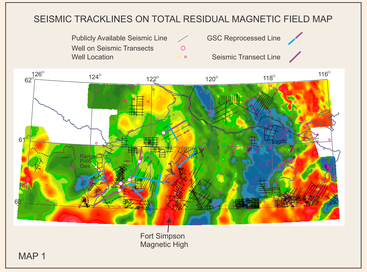
Transect B





MAP 2

(Adapted from Wheeler and McFeeley, 1991; GSC Map 1712A)



MAP 1

GEOLOGICAL SURVEY OF CANADA
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Regional interpretations of public domain seismic in the Liard Region north of 60°: Pre-Phanerozoic stuctural events, Phanerozoic stratigraphy and Laramide deformation.

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Introduction

Renewed industry interest in the Liard region north of 60° has prompted a re-appraisal of the public domain seismic database for this area. Most of this seismic (Map 1) were acquired before 1980 but few interpretations have been published although a few interpreted lines may be found in publicly available company reports. Representative interpretations of individual lines across or near significant hydrocarbon accumulations may also be found in the compilation of hydrocarbon pools of the Northwest Territories by Meding (1994). Seismic has been rarely used in the construction of published regional structural cross-sections across this region (see Douglas, 1976; Douglas and Norris, 1976; Douglas, 1974). Consequently, there is no published comprehensive and uniform interpretation incorporating the available regional seismic and well data. This study represents the beginning of such an interpretation.

Database and Methods

The publicly available seismic database is shown superimposed on the Total Residual Magnetic Field (Map 1). These lines are available as paper copies or as microfiche from the National Energy Board. It was common practice for industry to process their seismic data only deep enough to image the Phanerozoic despite, in many instances, recording data over times as long as five seconds. The cooperation of companies, such as Esso Resources, has made it possible to reprocess these lines to greater depths. Lines that have been reprocessed are highlighted on maps 1 and 2. In addition to quality considerations, these lines were chosen because of their location astride the eastern edge of Cordilleran deformation and across the interface between the Nahanni and Fort Simpson Proterozoic basement terranes.

Initial Findings

The seismic lines shown here document the influence of a Proterozoic to early Phanerozoic structure on Laramide-aged Cordilleran deformation across the Bovie Anticline. Two transects are shown extending eastward from the Liard Thrust to the Bovie Structure including the Bovie Fault, and, slightly farther east, across the Bovie Lake Thrust (Douglas and Norris, 1976). Previously, the Bovie Fault was interpreted as a near-vertical, down-to-the-west, normal fault which extends to the surface and the Bovie Thrust as being a high angle reverse fault extending upwards from Proterozoic strata through the entire Phanerozoic sequence (Structure section C-D in Douglas and Norris, 1976). Other authors have interpreted the Bovie Structure, on a seismic line 12 kilometres to the south near the Bovie Lake J-72 gas well, as being simply a fault bounded horst anticline (Interpretation 1). However, the seismic shown here reveals that the Bovie Structure developed in response to at least two events separated by a wide time span (Interpretation 2). The earlier structural event involved Proterozoic to Early Phanerozoic east-west compression that resulted in the westward-verging high angle reverse fault that extends upwards from the Proterozoic to the Upper Devonian Tetcho Formation. Higher in the sequence (Kotcho and Banff formations) this early event is manifested as a narrow west-dipping monocline. This was followed by the Laramide compressional event in Early Tertiary time that generated a thin-skinned eastward-verging thrust with a decollement horizon near the top of the Banff Formation. This thrust appears to have been deflected upwards above the west-facing Bovie monocline, causing the development of a thrust front anticline, and ending any further eastward advance. This thin-skinned thrust plate is also seen on a parallel line farther north. This thrust plate must extend eastward from the more pronounced thrusts, like the Liard Thrust, that mark the traditional eastern edge of Cordilleran deformation in this area. Also, the northern transect shows a possible large thrust fold beneath the Liard River that may be a southward continuation of the frontal thrust which is mapped on the surface, just east of Liard River and about 15 kilometres north of this transect.

Further east on Transect A, two 25 to 30 kilometer long lines reprocessed to 4 seconds cross the western flank of the Fort Simpson Terrane (FST, see Ross, 1991) magnetic high, or the Fort Simpson Anomaly (FSA, see Cook and Van der Velden, 1993). The upper part of the west-facing ramp or monocline that lies on the west side of the FSA, as described by Cook and Van der Velden (1993) for deep seismic lines north and south of this study area, can also be seen on these lines (line 8104) as a band of strong west-dipping reflectors.

These reflectors are more continuous in the lower part of the Proterozoic and may be interpreted to represent an ancient submarine 'escarpment' characterized by by-pass sedimentation as individual onlapping reflectors may be traced westward from the FST, down the monocline, and eastward into Proterozoic of the Nahanni Terrane. In Line 8104, correlative shelf and basinal sequences are sequentially numbered.

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Note: Although every effort has been made to ensure accuracy, this Open File Report has not been edited for conformity with Geological Survey of Canada standards.