THE UNIVERSITY OF ADELAIDE

School of Earth & Environmental Sciences,
Geology & Geophysics

# NEOTECTONICS OF THE MOUNT LOFTY RANGES (South Australia)

Victor Tokarev

Thesis submitted for the degree of Doctor of Philosophy
in the University of Adelaide, Faculty of Science

**February, 2005**

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# ABSTRACT

The Mount Lofty Ranges resulted from long-term interaction mainly between neotectonic movements and fluvial processes. This thesis presents an original comprehensive neotectonic study incorporating a structural analysis, lithostratigraphic data interpretations, and various geomorphological investigations. This study begins by introducing a multidisciplinary approach to neotectonic analysis including traditional and advanced methods such as Digital Elevation Models (DEMs). Regional stages were used as an appropriate time-framework for palaeoreconstructions and correlations of basin sedimentation with fluvial stream competence (erosion and sedimentary supply).

In contrast to the traditional hypothesis that Tertiary uplift of the Ranges was due to compressional reactivation of Delamerian structures (~500Ma), this study reveals three principal neotectonic stages associated with specific tectonic regimes: 1) Extensional Stage (Middle Eocene to Middle Miocene); 2) Transitional Stage (Late Miocene to Early Pleistocene); and 3) Compressional Stage (Early Pleistocene to the Present). Several lines of evidence are provided showing the independence of neotectonic structure from basement fabric.

A large region of South Australia was represented by a gently undulating and deeply weathered Palaeoplain during the early Tertiary. In a methodological/analytical first, the global eustatic curve was used to evaluate the altitude of this Palaeoplain (~250-300m above the present sea-level). This study also revealed that the effect of sea-level change onto the landscape during the Tertiary was more significant than previously considered. The initial crustal segmentation (Middle-Late Eocene) involved subsidence of the St. Vincent and Western Murray Basins while remnants of the high-standing Palaeoplain became the Mount Lofty Ranges. Further crustal segmentation and subsidence resulted in the formation of embayments, and intramontane basins such as Meadows-Myponga, Hindmarsh Tiers and Barossa. Fundamental attributes of extensional tectonics such as strain transfer and accommodation zones, tilting and crustal segmentation recognised in the Tertiary tectonic setting.

The major compressional tectonic activity was associated with steep reverse faults on both sides of the Ranges. This compressional neotectonic regime resulted in Pleistocene uplift of the Mount Lofty Ranges that resulted in a major lithological change in the sediments of both the St. Vincent and Western Murray Basins. The young and dissected landscape with a number of stream gorges and waterfalls on both marginal sides of the Ranges is correlated with stream gravels including cobbles, pebbles and slope debris. This compressional neotectonic uplift of the Ranges mainly occurred during the Pleistocene (~1Ma) and continues today as indicated by seismic activity and insitu stress measurements.