

APATITE FISSION TRACK CONSTRAINTS ON EARLY LATE CRETACEOUS SUBSURFACE HEATING OF THE ATLANTIC MARGIN OF CANADA: POSSIBLE EFFECTS AT DEPTH OF ANOMALOUS HIGH PALEO-MEAN SURFACE TEMPERATURES

ZENTILLI, Marcos and GRIST, Alexander (Sandy) M. Fission Track Research Laboratory, Department of Earth Sciences, Dalhousie University, Halifax, NS, B3H-3J5, Canada

Our thermochronology studies offshore Nova Scotia detected a late-Albian to Early Campanian heating pulse in many wells, implying that the strata were at one time hotter by tens of degrees than their present temperature in the subsiding basin. New apatite fission track data, and time-temperature modelling on samples from outcrops and wells onshore and offshore indicate that this heating event was widespread. Modelling of data from the 1.5 km deep (Digby D1) drillhole in the Devonian South Mountain Batholith also detects this (50 degrees C) event at ca. 90 Ma. This regional heating had implications for petroleum migration, formation and overpressuring of gas reservoirs, and the formation of zeolite and native copper concentrations in Mesozoic strata. The following possible explanations for the recorded heating episode were evaluated: 1) an increase in the paleo-geothermal gradient, perhaps related to magmatic activity; 2) circulation of warm fluids at depth, in response to some structural/tectonic driving mechanism; 3) basin inversion; and 4) sub-surface heating in response to a thermal blanket, the result of a long-term increase in the paleo -mean annual surface temperature. Although all are possible contributors locally, the last hypothesis appears the most attractive. Thermal calculations using heat flow theory suggest that anomalously high mean-annual surface temperatures, peaking during the Turonian - Coniacian, may have penetrated kilometers deep into the crust and thus explain the mid to late Cretaceous heating event we detect in the wells. Time-temperature modelling of the apatite fission track data is compatible with normal paleo-geothermal gradients in the early Late Cretaceous.