

The thermal evolution of the Maritimes Basin: evidence from apatite fission track analysis and organic maturation data

R.J. Ryan

Department of Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada

and

Nova Scotia Department of Mines and Energy, P.O. Box 1087, Halifax, Nova Scotia B3J 2X1, Canada

A. Grist and M. Zentilli

Department of Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5, Canada

Sandstone drillcore and/or cuttings from seven wells in the Gulf of St. Lawrence and Cabot Strait and five drillholes from onshore have been analyzed using the apatite fission track method. Uncorrected fission track ages for the late Paleozoic sandstones range from 84 ± 8 Ma to 220 ± 14 Ma. Additional samples from outcrops within the Cumberland Basin yielded uncorrected fission track ages of 167 ± 18 to 215 ± 30 Ma. Corrected ages of the oldest tracks range from 210-260 Ma with the older ages tending to occur in the youngest strata. Ages

corrected by the mean track length method generally yield younger ages and the downhole trend for decreasing age is more obvious. Burial history reconstructions and forward modelling can be interpreted to indicate: (1) the basin underwent rapid sedimentation and burial from about 320 to 290 Ma, (2) there was a basin-side erosion event that removed 1-3 km of strata which lasted from 270-200 Ma, (3) there was a slow unroofing (erosion) event from 200-100 Ma, (4) over the last 100 Ma the erosion rate has been very slow, (5) there is no evidence of Triassic sedimen-

tation or thermal activity in any of the samples from the basin studied to date, (6) the geothermal gradient, as interpreted from the TTI calculations indicates that the gradient was approximately 22-27°C/km, contrasting with gradients up to 67°C/km previously suggested; the finite age of the samples from depths of 2.5 to 3.0 km also suggest that the present gradient is approximately 25°C/km.

If the interpretations above are correct then the Maritimes Basin must have covered most of the Atlantic Canada region 290

Ma prior to the erosion of the 1-3 km of sedimentary cover. Further documentation of this sedimentary cover can be derived from additional fission track samples within the basin strata and from the surrounding highland regions. The implications of this study to petroleum and mineral resource exploration are the subject of continued research; however, preliminary results indicate that the timing of maximum temperatures in the basin can be well constrained by combining the apatite fission track method with the stratigraphic and organic maturation data.