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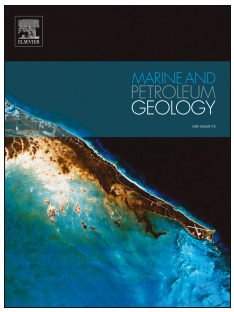

Present-day thermal field and Mesozoic-Cenozoic thermal evolution of the Western Bredasdorp Basin (South Africa): An integrated 3D numerical forward modelling approach

W.A. Sonibare, J. Sippel, R. di Primio, Z. Anka, M.Scheck Wenderoth, D. Mikeš

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Authors: W. A. Sonibare [1,2(*)], J. Sippel [2], R. di Primio [3], Z. Anka [4], M. Scheck-Wenderoth [2], and D. Mikeš [5]

[1] Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa

[2] Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, Telegrafenberg, 14473 Potsdam, Germany

[3] Lundin Norway AS, Strandveien 4, N-1366 Lysaker, Norway

[4] Total Exploration – New Ventures, 92078 Paris – La Défense 6, France

[5] Department of Geosciences, Nelson Mandela Metropolitan University, PO Box 77000, Port Elizabeth 6031, South Africa

(*) now at: Schlumberger Limited, Lagos, Nigeria

Corresponding author at: Department of Earth Sciences, Stellenbosch University, Private Bag X1, Matieland 7602, Stellenbosch, South Africa.
Email: shoniwas@yahoo.com; wsonibare@slb.com

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ABSTRACT

We analyse a crust-scale 3D structural model of the Western Bredasdorp Basin (WBB) located offshore southern South Africa to assess both the spatial and temporal development of geothermal gradients in the Southern African 'passive-transform' continental margin. The results of simulations of the present-day conductive thermal field were used to constrain the heat flow evolution during 3D numerical modelling of the paleo-thermal regime. Besides conforming to the regional geotectonic framework, the ensuing models are largely consistent with measured temperatures. The largest control on present-day temperatures is exerted by the basin's present-day geometry and distribution of thermal properties which, in turn, trace back to the earliest tectonic event involving crustal thinning and significant syn-rift sedimentation. Implying from the modelled shallow and deep geotherms, we find that the variations of present-day surface heat fluxes in the WBB are much more dictated by the long-term crustal radiogenic heat production in concert with the interaction of low thermally conductive sediments and high thermally conductive crustal rocks rather than by the present-day mantle heat flow. In addition, model calibration with measured vitrinite reflectance trends suggests that three major phases of thermal disequilibrium resulting in high heat flow during syn-rift and post-rift times characterise the distribution of maximum paleo-temperatures and paleo-