A recently drilled exploratory well encompassing over 5 km of Mesozoic and Paleozoic sediments has been studied from the Bhiere Hammou field of the Berkine Basin, Algeria. Geophysical logs and downhole measurements have been integrated to ascertain rock strength, elastic properties, pore pressure and principal in-situ stress magnitudes. Vertical stress has an average 1.02 PSI/feet gradient in the studied field, as estimated from the density log. The Devonian shales are mildly over-pressured, while the Triassic and Carboniferous hydrocarbon reservoirs are in a hydrostatic pore pressure regime. Minimum and maximum horizontal stresses are quantified from a poroelastic strain model. The $S_h$ gradient varies between 0.59 and 0.80 PSI/feet, whereas the $S_h$ gradient is interpreted as 0.86–1.26 PSI/feet. Based on the relative stress magnitudes ($S_h \geq S_r > S_h$), a present-day normal to strike-slip transitional tectonic regime is inferred