

PALAEOSEISMICITY ALONG THE TSHIPISE FAULT, SOUTH AFRICA, AND ITS IMPLICATIONS FOR THE FEASIBILITY OF A MAJOR POWER FACILITY

¹ T.C. PARTRIDGE, ² S. WOODBORNE, ³ J.A. DRENNAN AND ⁴ F.A. LOUWINGER. ¹ University of the Witwatersrand, Johannesburg, South Africa, ² Quaternary Dating Research Unit, CSIR, Pretoria, South Africa, ³Drennan, Maud and Partners, Durban, South Africa, ⁴ESKOM, Sandton, South Africa.

This study was undertaken for a pumped storage scheme, involving upper and lower dams and a subterranean power station, and intended to satisfy peak power demands as well as to stabilize the national transmission grid. Although based on hydro rather than nuclear power, in its size and sensitivity to seismically induced ground accelerations the scheme shares many similarities with conventional nuclear power plants.

The Tshipise Fault, showing recent reactivation, occurs within 28 km of the proposed scheme. Trenching across the fault scarp revealed multiple planes of movement. Three of these included entrapped aeolian sand; given the amplitude of the associated displacements, it could be assumed that sufficient temperatures were generated to release any accumulated radiation dose. TL dates on these sands were therefore taken as indicative of the age of the respective movements. The associated seismic magnitudes were estimated using accepted empirical relationships.

The TL dates enabled the magnitude/frequency relationship established from recorded seismic events spanning the past century to be extended back to 101 ka. The 1:10 000 year event, approximating to M7.0, was selected for risk analysis in view of the sensitive nature of the structures and the frequent, relatively rapid, drawdowns to which the upper dam would be subject under operating conditions.

The deep, clayey soils covering the slopes of the upper dam basin were characterized in the laboratory and then subjected to stability analysis. Even under accelerations produced by the 1:1000 year seismic event, 100% probability of failure, involving some 10^6 m³ of material, was predicted. The scheme was abandoned in the light of these findings.