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Signatures of continental collisions and magmatic activity in central Brazil as indicated by a magnetotelluric profile across the southern Alto Paranaiba igneous province

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Broadband and long-period magnetotelluric soundings were collected along a 560 km E-W profile in a region in central Brazil subjected to Neoproterozoic collision tectonics and Archean to Cretaceous magmatic events. The profile crosses the northeast part of Phanerozoic sediments and volcanics of the Parana basin, the southern extension of the Neoproterozoic metasedimentary rocks of the Brasilia belt, locally pervaded by Cretaceous alkaline magmas of the Alto Paranaiba igneous province (APIP), and Neoproterozoic sedimentary cover and Archean exposed basement of the southern Sao Francisco craton. 2D conductivity structures derived by joint inversions of the TE and TM polarization modes and a separate inversion of the tipper components show signatures of the past tectonomagmatic events that affected the area. A gravity-defined suture zone beneath the Parana basin related to the Neoproterozoic collision of the Sao Francisco and Parana blocks is detected in the models as a subvertical conductor extending from crustal to upper mantle depths. Deep underthrusting of organic graphite-bearing metasediments in the suture zone is proposed to explain the increase of electrical conductivity. A similar conductivity signature beneath the sedimentary covered region of the Sao Francisco craton is interpreted as another suture zone. This previously undetected feature can be associated either with a trace of a much older event preserved in the cratonic rocks or an expression of accretionary events generating the larger Neoproterozoic San Franciscan plate. Isolated high-conductivity anomalies at midcrustal depths below the Parana and APIP provinces are interpreted as residues of the emplacement of Cretaceous mafic-ultramafic volcanics. A low resistivity wedge into the lithosphere is highlighted at the topmost upper mantle beneath the APIP volcanic complex, coincidental with a zone of low velocity defined by seismic tomography. Geochemical evidences indicate that the alkaline magmatism stemmed from a metasomatized upper mantle at only slightly raised temperatures. Although related to the same magmatic process, the seismic and conductivity anomalies are presently centered at different depths and probably triggered by different sources. Interconnected carbon at the topmost mantle is the most likely candidate to explain the high conductivity whereas the low seismic velocity can be related to either compositional or temperature variations. Conductivity anomalies at different depths in the southern segment of the Sao Francisco cratonic lithosphere suggest that it was significantly affected by the several magmatic episodes it has experienced throughout its geological history. Enhanced conductivity at lower crust can be genetically related to massive basaltic intrusions whereas upper mantle high conductivity can be related to refertilization by infiltrations of low degree basaltic melts from deeper-sourced metasomatic processes.