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## DATING SYSTEMATICS APPLIED TO A LARGE IGNEOUS PROVINCE: AGES AND TIMING OF THE EQUATORIAL ATLANTIC MAGMATIC PROVINCE

Oliveira, A.L.<sup>1</sup>, Hollanda, M.H.B.M.<sup>2</sup>, Schmitz, M.D.<sup>3</sup>

<sup>1</sup> Universidade de São Paulo, Instituto de Geociências, e-mail: [alisson\\_oliveira@usp.br](mailto:alisson_oliveira@usp.br); <sup>2</sup> Universidade de São Paulo, Instituto de Geociências, e-mail: [hollanda@usp.br](mailto:hollanda@usp.br); <sup>3</sup> Boise State University, Department of Geosciences, e-mail: [schmitz@boisestate.edu](mailto:schmitz@boisestate.edu)

The study of large igneous provinces (LIPs) has been a frontier topic in geosciences in the last decades due to the interrelationship between several areas such as petrology, tectonics, economic geology, paleoclimatology and biological evolution. According to the LIP Commission /IAVCEI, the main attributes that characterize a LIP refer to its size (area >0.1 Mkm<sup>2</sup>, volume >0.1 Mkm<sup>3</sup>) and emplacement timing (generally <5 myr). In this work, we present the results of a comprehensive geochronological study focused on a recently defined LIP in NE Brazil time-related to the breakup of the West Gondwana to form the Atlantic Ocean in the Early Cretaceous. The Equatorial Atlantic Magmatic Province (EQUAMP) comprises more than 2,000 kms of dike swarms intrusive in the Borborema Province, spatially and genetically linked to a sill complex exposed at the eastern side of the Parnaíba Basin. Overall, these igneous rocks form a connected plumbing system totalizing approximately 800,000 km<sup>2</sup>. In view of the lack of age information for this magmatism, a three-fold approach based on a systematic application from low- to high-precision radiometric techniques allowed: (1) to investigate regional age patterns, (2) to constrain the main interval(s) of magma emplacement throughout the entire province, and finally (3) to determine the precise timing of the EQUAMP formation. Firstly, an ‘unspiked’ K-Ar method (uncertainties around 10%) was implemented and applied to 105 samples of dikes from which most of the results were distributed between 140-110 Ma. Since this methodology is sensitive to argon loss when used in bulk rock samples, we selected pristine samples to apply the <sup>40</sup>Ar/<sup>39</sup>Ar method in plagioclase (precision ca. 1.0-1.5%). At this moment, 85 samples of dikes and sills were analyzed, 42 of them provided reliable plateau ages, while 40 others yielded isochron ages that were frequently affected by argon disturbance and inheritance. Ages between 135-128 Ma were reproduced over the entire province, whatever dikes or sills. By means of the <sup>40</sup>Ar/<sup>39</sup>Ar survey, we demonstrated that all igneous components of the EQUAMP were emplaced as a single event with a term of 5-7 myr. U-Pb zircon dating using chemical abrasion-isotope dilution thermo ionization mass spectrometry (CA-ID TIMS) was finally chosen as the highly precise radiometric method (uncertainties ca. 0.05%), able to robustly discriminate the age and timing of EQUAMP. Eight samples representative of the geochemical diversity (high- and low-Ti) observed in the dike swarms and sills were chemically prepared to extract zircon by means of a newly developed laboratory routine. We found that the intrusion of the southernmost dike swarm of EQUAMP occurred at 133.81-133.76 Ma marking the onset of the (pre)rift stage in the South Atlantic Ocean and propagated until 133.38-133.27 Ma, when sills and the northeastern dike swarms were emplaced. A younger age of 133.07 Ma obtained from zircon crystals of a Parnaíba sill is interpreted as evidence of final crystallization of the magmatism. The CA-ID TIMS U-Pb zircon ages unequivocally indicate the magmatism in the Equatorial Atlantic margin was a very short-term event not longer than 800 ka, and it was synchronous to the Valanginian carbon isotope excursion usually associated to the emplacement of the Paraná-Etendeka lava flows and intrusive rocks. By its size and well-established geochemistry and timing, the EQUAMP is likely one of the largest plumbing system LIPs on Earth, and certainly had influenced paleoclimate changes and biotic crisis occurred in the Early Cretaceous.

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Palavras-chave/Keywords: Large Igneous Province, Unspiked K-Ar method, <sup>40</sup>Ar/<sup>39</sup>Ar dating, CA-IDTIMS U-Pb dating, Early Cretaceous