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New Advances in the Geochronology of South America: An introduction

The *Centro de Pesquisas Geocronológicas da Universidade de São Paulo* (Center of Geochronological Research of the University of São Paulo, CPGeo-USP), a leader center of geochronology in South America, accomplished its first 45 years in 2009. In the previous year the CPGeo-USP founder and scientific director for many years, Dr. Umberto Cordani completed 70 years and was obliged to retire. To celebrate both birthdays a scientific meeting was held in São Paulo, with the aim to update the geochronological knowledge and advances in our continent. A selection of the different conferences given in this event and assorted in this Special Issue, envisages focusing in the recent developments of the geochronology in South America.

CPGeo-USP has formed hundred of researchers from Brazil and from other countries of South America, as well as it has irradiated geoscientific knowledge, working together with experts and professionals from academic institutions and companies. Besides, the CPGeo-USP, as a center of excellence of international recognition, was seed, promoter, and decisive support of all the rest of the geochronological institutions of the continent. Umberto Cordani, founder of this center, has been always a modern and advanced geoscientist, supervisor of at least three generations of geoscientists. This Institution and Cordani have a common life, each one with their own light, but with a highly productive symbiosis.

This Special Issue celebrates both the CPGeo-USP and Umberto Cordani, assorting those scientific works presented in São Paulo, which have several frontier contributions that represent a step forward in the geochronological knowledge of South America.

Addressing the entire South American continent the Benjamim Brito Neves's article discusses, appropriately, the characteristics of the Paleoproterozoic in South America, identifying in this continent, four main stages of rock formation in good agreement with the International Stratigraphic Chart (IUGS/UNESCO 2004) proposal. This author criticizes the indiscriminate use of the term Transamazonian, since that term occupied, all the period of the four proposed stages.

In the Borborema Province, Maria Helena Hollanda and colleagues, presented U–Pb SHRIMP zircon ages around 2.17–2.25 Ga for the Caicó Complex orthogneisses with old Nd model ages and negative ϵ Nd values indicating the possible involvement of the Neoproterozoic crust in the generation of these rocks. The 1.75 Ga Serra Negra pluton is the first manifestation of the important extensional magmatism widely recognized in other areas of the Borborema Province.

Part of the Mesoproterozoic history of southern Ribeira belt is discussed by Oswaldo Siga Jr. and others, which deals with

radiometric and isotopic characteristics of the Calymmiano basic magmatism observed among the Votuverava and Perau volcano-sedimentary sequences.

For the Rio Negro-Juruena Province, SW portion of the Amazonian craton, the work of Wilson Teixeira and collaborators shows the characteristics of the juvenile Mesoproterozoic mafic-ultramafic suite of Figueira Branca, using U–Pb SHRIMP ages and Sm–Nd isotopes. Values around 1420 Ma and positive ϵ Nd (+3.0 to +4.7) support the interpretation presented.

For the southern Mantiqueira Province, Miguel Basei and colleagues, present for the Brusque Group units new stratigraphic, metamorphic and U–Pb zircon ages. This study, preceded by geological mapping, discusses the tectonic evolution of the Brusque Group in the Dom Feliciano Belt of Santa Catarina.

In central Amazonia, Carlos Dias Fernandes and coworkers discuss the petrogenesis of late Paleoproterozoic A-type volcanic-plutonic associations, occurring in the region of São Felix do Xingu. Archean Nd model ages are distributed between 3.12 and 2.56 Ga, featuring the participation of older crust in the genesis of this magmatism. The authors attribute to the low dip angle of the subducting plate the geochemical-isotopic characteristics of the magmatism and the metallogenic-geochronological zoning observed in this region.

The Major Gercino Shear Zone separates the Central and the Internal tectonic domains of the Dom Feliciano Belt. Claudia Passarelli et al. discuss the petrologic evolution of the Rolador and Fernandes magmatic associations, addressing in detail the geochemical characteristics of the magmatism associated with the development of this important crustal discontinuity.

Maria Nascimento-Silva and others, using carbon and oxygen isotope studies supplemented by geochemical data, characterize the carbonate units of the Paraíba Basin. Studies in three drill holes of the Recife region, allowed assigning the characteristics of the C and O curves observed in the carbonates to successive impacts of meteorites that preceded the Cretaceous–Paleogene transition. During that same period, prominent positive Mercury anomaly suggests that this transition would be associated with significant volcanism. Among the articles discussing the geology of Mantiqueira Province the work of Mario Campos Neto and colleagues presented the geochronological and tectonic steps of the Brasília orogen collage to the southern edge of the São Francisco Craton, using as example the Andrelândia Nappe system.

The gabbro-dioritic components of the Graciosa Province, characterized by A-type granites intrusive in gneisses and migmatites that separate the Ribeira and Dom Feliciano belts, was the subject of a TIMS geochronological U–Pb zircon study of Silvio Vlach and



co-authors. The data are compatible with the Ediacaran age of the felsic components corroborating the temporal coexistence of these two magmas.

To the central portion of the Ribeira Belt, Claudio Valeriano and coworkers, based on LA-ICP-MS age determinations, discuss the chronological development of the 512–480 Ma post-collisional

magmatism of the belt, attributing it to the end of the Brasiliano Cycle.

The new ages of the Tapo Ultramafic Massif in the Eastern Cordillera of Central Peru presented by Colombo Tassinari and coworkers are the first ages of the ophiolitic complex that characterize the suture between the protomargin of Gondwana and the terranes accreted to the margin during the Neoproterozoic and early Paleozoic times.

Mónica Escayola and van Staal present the first direct reliable ages made by SHRIMP and LA-ICP-MS on zircons of the Puncoviscana Formation obtained from tuffs interbedded in this Ediacaran – Early Cambrian turbiditic deposits. These ages confirm the previous proposals based on fossils and ichnites. The manuscript also analyzes the Early Cambrian granitoids and demonstrates their arc signature.

Results obtained by Javier Alvarez and coworkers based on detrital zircons from late Paleozoic accretionary complexes in north-central Chile bring indirect evidence of the age structure of the Chilenia Terrane. The analyzed complexes show a very large subpopulation of zircons that cannot easily be traced to well known Gondwana sources and that are derived from the erosion of late Neoproterozoic to Early Cambrian sources, that possibly form a significant component of the basement of this microcontinent.

New Hf isotope data from Paleozoic rocks together with an extensive review of Tonian mafic rocks done by Jorge Chernicoff and coworkers indicate indirect evidence of the occurrence of juvenile early Neoproterozoic magmatism in South-Central Argentina. These authors relate these data to the early Rodinia break-up.

New data are presented by Mark Fanning and coworkers from the accretionary complexes of western Patagonia and the northern Antarctic Peninsula region. The Lu–Hf isotope evidence for the provenance of Permian detritus supports the proposal that widespread Permian magmatism in Patagonia represents voluminous crustal melting. The results are also consistent with a paleogeography with the Antarctic Peninsula and southern Patagonia closely located from Permian to Jurassic times.

The paper of Jorge Restrepo and coworkers suggest the existence of Triassic metamorphism in the northern part of the Tahamí Terrane in the Central Cordillera of Colombia. These new data pose some interesting constraints to the tectonic evolution of northern Andes and its relationships with Laurentia.

Precise U–Pb SHRIMP zircon geochronology of Cordilleran granitoids obtained by Antonio Castro and coworkers from the northern Patagonian Cordillera of Argentina indicates Middle to Late Jurassic age for this large batholith. The petrological analyses corroborate the arc signature of these granitoids.

Andrés Folguera and Víctor Ramos present an analysis of the long-term pattern of Andean uplift, sedimentation, and magmatism in the Southern Andes. A series of expansions and migrations of the arc magmatism toward the foreland is related to shallowings and steepenings of subducted slab along the Patagonian Cordillera.

The new SHRIMP data presented by Eugenio Aragón and coworkers in the north Patagonian batholith at Paso Puyehue between Argentina and Chile show the extension of the Miocene granitoids and the early Cretaceous volcanic country rocks in the region. The compositional features allow advancing a novel tectonic hypothesis for the Paleogene subduction along the margin.

Based on an extensive U/Pb ages on detrital zircons data base from the Southern Central Andes, Lucía Sagripanti and coworkers show the kinematics of a Neogene foreland basin and constraints the Andean exhumation at these latitudes. The provenance studies identify the timing of the formation of a broken foreland during a Miocene shallowing of the subducted slab.

The study of xenoliths from the extra-Andean Patagonia in the Chubut province of southern Argentina offered by Antonio Castro and coworkers present new SHRIMP ages and the analysis of their composition. These granulite xenoliths from Paso de Indios represent the time of complex lithosphere evolution in relation with the formation of this residual crust.

Besides these contributions, two other articles were written in honor of Professor Umberto Cordani and submitted to this special issue, but were previously published in volume 31 of JSAES. They are:

Marcio Pimentel and colleagues (JSAES, 31 (2011) 345–357) – Based on the analysis of age patterns of detrital zircons, the author's present a model for the tectonic evolution of the Brasília belt. Preferably using the provenance of the sediments, it is traced a paleogeographic zoning for the main lithostratigraphic units of the Brasília Belt with Paranoá, Canasta and Vazantes groups making the passive margin, Araxá and Ibiá representing the syn-orogenic deposits (forearc) and the Group Bambuí (at least part of it) constituting the foreland basin.

Inez Guimarães et al. (JSAES, 31 (2011) 383–396) – This article presents a set of U–Pb SHRIMP zircon ages of the calc-alkaline intrusive granites in the gneissic rocks of the Cariris Velhos Belt, Borborema Province. The U–Pb ages between 0.95 and 1.25 Ga obtained in the nuclei of the zircons are similar of the whole rock 1.3–1.6 Ga model ages of the same granitoids. Whereas the host rocks have similar isotopic characteristics, the authors suggest that the genesis of the study granitoids would be related to the metasedimentary components of the Cariris Velhos Belt.

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