

---

# Subduction Zones of the Caribbean: the sedimentary, magmatic, metamorphic and ore-deposit records

## UNESCO/IUGS IGCP Project 546 Subduction Zones of the Caribbean

---

A. GARCÍA-CASCO<sup>|1| |2| |\*|</sup> J.A. PROENZA<sup>|3|</sup> M.A. ITURRALDE-VINENT<sup>|4|</sup>

<sup>|1|</sup> **Departamento de Mineralogía y Petrología, Universidad de Granada**  
Fuentenueva s/n, 18002-Granada, Spain

<sup>|2|</sup> **Instituto Andaluz de Ciencias de la Tierra (CSIC-UGR)**  
Fuentenueva s/n, 18002-Granada, Spain

<sup>|3|</sup> **Departament de Cristal·lografia, Mineralogia i Dipòsits Minerals, Facultat de Geologia, Universitat de Barcelona (UB)**  
Martí i Franquès s/n, 08028-Barcelona, Spain

<sup>|4|</sup> **Museo Nacional de Historia Natural**  
Obispo no. 61, Plaza de Armas, La Habana 10100, Cuba

\* Corresponding author. Email: [agcasco@ugr.es](mailto:agcasco@ugr.es). Tel.: +34 958 246 613; Fax: +34 958 243 368

The International Union of Geosciences (IUGS) and UNESCO IGCP project 546 *Subduction Zones of the Caribbean* (<http://www.ugr.es/~agcasco/igcp546/>) was launched in 2007 and scheduled to be completed by the end of the current year 2011. It was set up with the aim of gathering researchers interested in the geological evolution of the Caribbean realm. The development of this region is largely controlled by a number of subduction zones that formed along its margins from the break-up of Pangea during the Jurassic until Present. The current setting is characterized by a very complex plate-tectonic configuration dominated by subduction zones, large-scale strike-slip faults, volcanic arcs and collision belts (Figure 1). The project was built upon previous developments of IGCP project 433 *Caribbean Plate Tectonics* (2000-2005), of which the Special Volume 4 (Issue 1-2) of *Geologica Acta Caribbean Plate Tectonics. Stratigraphic, Magmatic, Metamorphic and Tectonic Events* (Iturralde Vinent and Lidiak, 2006) deserves mentioning.

Since 2007, Project IGCP 546 *Subduction Zones of the Caribbean* has set up or participated in the organization of several events together with other institutions and agencies, such as field trips, seminars for students, and workshops in Cuba (2007, 2009), Guatemala (2007, 2010), San Francisco (2007, 2009), Dominican Republic (2008), Spain (2008, 2010), Houston (2008), Stanford (2009), United Kingdom (2009), Panama (2010), Venezuela (2010) and Colombia (2009, 2011). This has attracted the interest of researchers and students from a large number of countries including Australia, Austria, Canada, Chile, China, Colombia, Costa Rica, Cuba, France, Germany, Guatemala, Italy, Jamaica, Japan, Malaysia, Mexico, Netherlands, Nicaragua, Panama, Puerto Rico, Spain, Switzerland, United Kingdom, USA and Venezuela, who have produced field-trip guides, abstracts, papers and books dealing with different aspects of the Geology of the whole Caribbean region (see <http://www.ugr.es/~agcasco/igcp546/> for details).

This special issue of *Geologica Acta*, containing fourteen papers, is representative of the aims of IGCP 546, for it covers most of the cutting-edge topics pertaining to the Caribbean's geological development from the Jurassic to the Neogene in the whole Caribbean region (Guatemala, Cuba, Hispaniola, Puerto Rico, Venezuela, Colombia, the isthmus of Panama, Costa Rica, and the offshore Nicaraguan rise). The issue was conceived during the workshop *Subduction Zones of the Caribbean* and associated field trip *Subduction and arc complexes of central Cuba* organized by IGCP 546 in the III Cuban Convention in Earth Sciences, held in Havana, Cuba, during March 2009. The study cases presented in the workshop and contained in this volume are indicated in Figure 1 and briefly commented below.

Both the 2009 Havana workshop and this volume are dedicated to Wayne Travis Jolly, who passed away on

February 9, 2008. As noted in his **memorial** (Edward Lidiak, this issue), **Wayne Jolly** was an enthusiastic and valuable petrologist of the Caribbean community. He devoted much of his career to studying the petrogenesis of Puerto Rican, Virgin Islands and other northeastern Antilles ancient island arc volcanic rocks, associated peridotite sources, and subducted sediments (see the references listed by Edward Lidiak in the memorial). Based on firm stratigraphic, regional and geochemical constraints, his work enabled the refining of the tectonic evolution of the northeastern Caribbean, with special emphasis on the evolution of the Mesozoic-Tertiary subduction systems. In his contributions, he suggested a persistent southwest-dipping Cretaceous convergence in the northeast Antilles and a subduction flip (from NE-dipping to SW-dipping) by the Aptian or even earlier (e.g., Pindell and Kennan, 2009; Pindell et al., in press, and references therein), challenging those

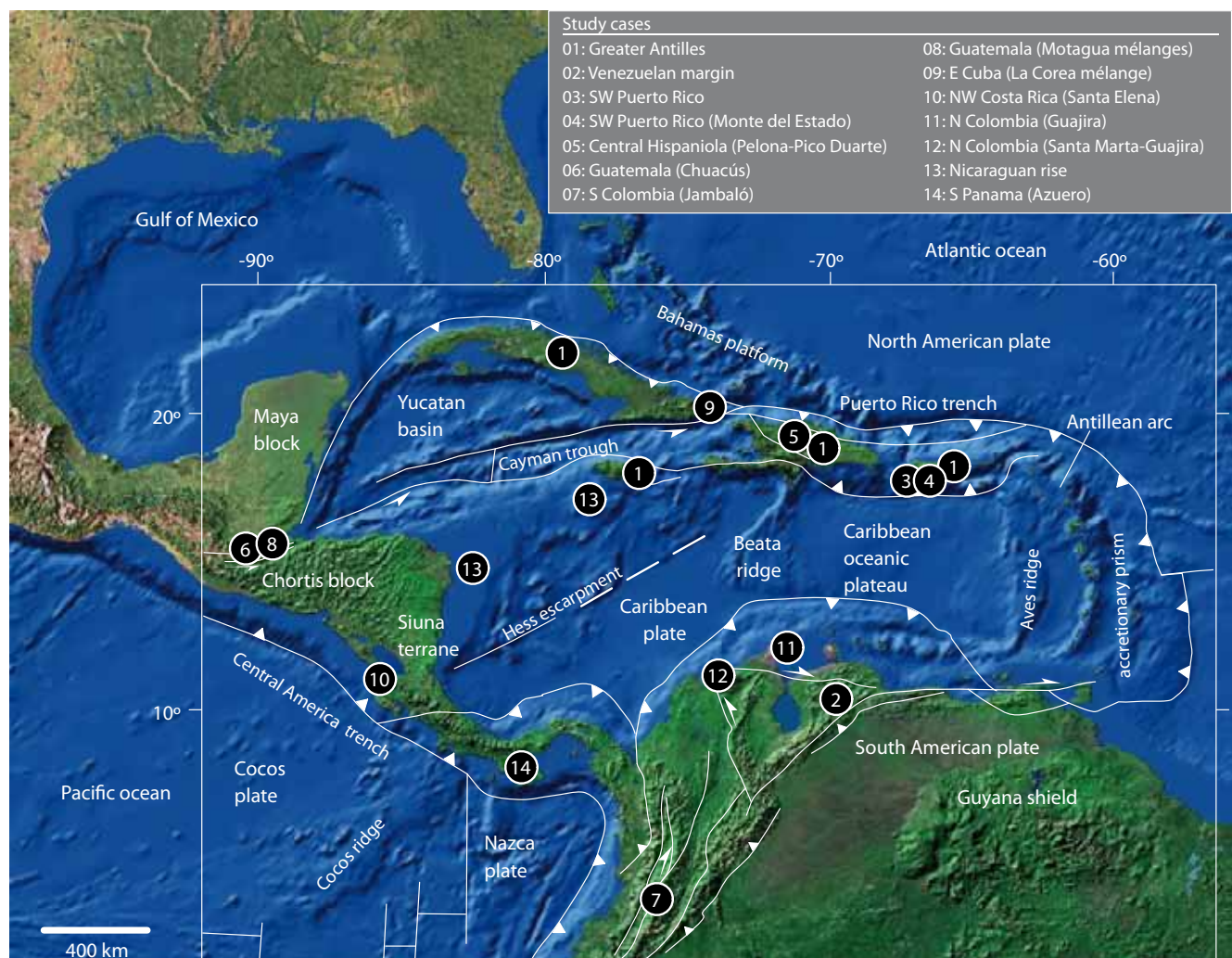


FIGURE 1 | Plate tectonic configuration of the Caribbean region showing the location of the study cases presented in this issue (numbers refer to papers, arranged as in the issue), and other important geological features of the region (compiled from several sources).

portraying a subduction flip during the Late Cretaceous (e.g., Kerr et al., 2003, and references therein) .

## ORE DEPOSITS OF THE GREATER ANTILLES AND THEIR PLATE TECTONIC SETTINGS OF FORMATION

The first paper of this issue (C.E. Nelson, J.A. Proenza, J.F. Lewis and J. López-Kramer) presents a different approach to that suggested by W. Jolly for evaluating plate tectonic models. This article offers comprehensive maps and descriptions of ore deposits and evaluates **the record of metallogenesis in the Greater Antilles** in relation to the tectonic environment of formation of ore deposits, including (from Jurassic to Recent): rift, platform, volcanic arc, fore-arc and back-arc, syn-orogenic (subduction/collision) and post-orogenic environments. These authors consider that ore formation in the Greater Antilles can be reconciled with plate tectonic models of SW-dipping subduction of the Atlantic since -at least- the Aptian, and in particular with the model proposed by García-Casco et al. (2008) for the Greater Antilles.

## PASSIVE MARGINS

Mesozoic passive margins developed in the northern and southern margins of South and North America respectively upon the Jurassic rifting of Pangea. The zircon **provenance study of Early Cretaceous platform sediments of northern Venezuela** by M.I. Noguera, J.E. Wright, F. Urbani and J. Pindell confirms the Guyana shield provenance of Archean, Paleoproterozoic and early Mesoproterozoic detrital zircon grains, though a prominent age population (ca. 0.95-1.2Ga) suggests a western source (Venezuelan and/or northern Colombian Andes). In addition to previous zircon provenance studies (e.g., Rojas-Agramonte et al., 2008), these data allow for the constraint of the paleogeography of the Caribbean region prior to the breakup of Pangea and the longevity of continental scale river systems.

## OCEANIC BASINS

The nature of **pre-volcanic arc basement rocks and volcanic arc rocks of western Puerto Rico**, by E.G. Lidiak, W.T. Jolly and A.P. Dickin, help to constrain the nature of the oceanic basement of the Cretaceous-Tertiary volcanic arc crust in Puerto Rico. This basement is formed by serpentinitized peridotites, a sequence of Jurassic to mid-Cretaceous pelagic chert, blocks of N-MORB-type amphibolites, and tholeiite and associated trondhjemitic fractionates also of N-MORB affinity. The basement is overlain by a younger sequence

of pre-arc plateau basaltic and andesitic lava flows having E-MORB and OIB geochemical characteristics. A geochemical analysis of the arc lavas overlying these geologic units was carried out considering the potential effects of subducted pelagic and chert deposits from the Pacific/Caribbean and of pelagic sediments from the Atlantic/Proto-Caribbean on the enrichment of the ultramafic source. This analysis allowed the authors to conclude that the formation of the Late Cretaceous to Eocene (85 to 45Ma) island arc strata was related to the N-dipping subduction of the Caribbean, and not to the earlier (from 125Ma) SW-dipping subduction system that formed the volcanic arc of central Puerto Rico. Such a complex evolution of the Antillean arc, with multiple subduction zones of -possibly- limited lateral extent, are to be expected in the highly mobile/dynamic tectonic environment of oceanic volcanic arc systems. Similar complex histories, with the formation and consumption of back-arc basins, double arcs, reversals of arc polarity and episodic subduction are recorded in other oceanic arc regions, such as the Tertiary-Present arcs of the western Pacific (e.g., Honza, 1991). As a corollary, it could be added that rapid changes (in space and time) of tectonic arrangements should be the rule, rather than the exception in the Mesozoic-Tertiary oceanic evolution of the Caribbean arc. In a related paper, C. Marchesi, W.T. Jolly, J.F. Lewis, C.J. Garrido, J.A. Proenza and E.G. Lidiak give insight on the **origin and evolution of mantle peridotites from the Monte del Estado massif of southwest Puerto Rico**. They are interpreted as a section of lithospheric mantle which underwent several stages of partial melting in the garnet and spinel stability fields, probably during the Jurassic-Early Cretaceous spreading of the Atlantic/Proto-Caribbean oceanic basin. This conclusion is important for it follows that this fragment of the Atlantic/Proto-Caribbean lithosphere should have been tectonically incorporated to the fore-arc region of the Greater Antilles arc within a tectonic scenario of subduction polarity reversal during the Aptian-Albian as proposed by Mattson (1979).

J. Escuder-Viruete, A. Pérez-Estaún, M. Joubert and D. Weis examine the volcanism related to the Late Cretaceous **Caribbean large igneous province** emplaced in the Caribbean volcanic arc. Based on new geological, geochemical and geochronologic data from the **Pelona-Pico Duarte basalts Formation of Central Hispaniola**, these authors find fundamental changes in the mantle sources of Late Cretaceous lavas that fed the volcanic-arc region. This suggests that the Late Cretaceous Caribbean plume flowed toward the mantle wedge region of the Caribbean island-arc in response to back-arc opening induced by the rollback of the SW-directed subduction of the proto-Caribbean slab.

## SUBDUCTION ZONE-RELATED COMPLEXES

The nature and age of **metamorphic complexes** documenting the deep tectonic evolution of the convergent margins of the Caribbean realm is considered in detail by L.A. Solari, A. Gómez-Tuena, F. Ortega-Gutiérrez and C. Ortega-Obregón. These authors provide new geochemical and zircon-age data of the **Chuacús Metamorphic Complex of central Guatemala**. They describe a long-lasting evolution which includes three stages of metamorphism of Paleozoic (post-Ordovician/pre-Triassic), Late Triassic, and Late Cretaceous ages, in line with recent developments in the complex North American–Caribbean Plate boundary region of Mexico–Guatemala–Honduras (Ratschbacher et al., 2009). Subduction-related eclogite facies conditions (perhaps reaching ultra-high pressure conditions) were reached during the Paleozoic stage, and a high-*P*/low-*T* event –at eclogite-amphibolite facies conditions– also occurred in a Late Cretaceous stage. Such a history, not shared by adjacent continental blocks (e.g., Maya and Chortís blocks) points to an allochthonous character of the Chuacús complex. That is, rather than being a fragment of the Maya block, the Chuacús evolved independently from the Paleozoic until the Late Cretaceous, when it was accreted to the former. In any case, the latest Cretaceous high-pressure event indicates subduction and collision of the Caribbean arc with the margin of the Maya block, followed by accretion and exhumation. This is similar to what has been inferred from other high-pressure rocks of Guatemala (e.g., Brueckner et al., 2009) and the Yucatan basin-Cuba-Dominican Republic–Puerto Rico–Virgin Islands belt (García-Casco et al., 2008). It may not be causal, but the oceanic subduction-related **blueschists of Jambaló, Central cordillera of Colombia** were also exhumed during the latest Cretaceous-earliest Tertiary, as documented by the first Ar-age data available for these rocks provided by A. Bustamante, C. Juliani, C.M. Hall and E.J. Essene. Though the history of the Central Cordillera of Colombia is rather complex (Villagómez et al., 2011a), the data provided suggest that exhumation was caused by the collision of an intra-oceanic arc (rather than the Caribbean plateau; e.g., Kerr and Tarney, 2005) with the continental margin of South America. This collisional event is considered unrelated to synchronous arc-continent collisions in the Northern Andes (and the Antilles and Guatemala) and provides evidence for the possible existence of multiple arc-continent collisions along the margins of the Caribbean plate.

Petrological-geochemical processes occurring in the subduction environment do not only generate blueschists and eclogites. Locally, hydrothermal/metasomatic jadeitite and related rocks such as those from Guatemala are produced, as reported by G.E. Harlow, V.B. Sisson and S.S. Sorensen. These authors provide textural and mineral

data of **jadeitite blocks in serpentinite mélanges from distinct settings on opposite sides of the Motagua fault**, and conclude that a contrasting petrologic nature of jadeitite characterize the two districts. Such contrast has to do with different thermal, mechanical and geochemical conditions during slab subduction and development of the subduction channel. It is also related to the ensuing tectonic history, which may include metamorphic reworking, likely related to the complex Cretaceous evolution of the margin of the Caribbean plate and adjacent blocks (*sensu* Brueckner et al., 2009; Pindell et al., in press). The complexities of long-lasting subduction channels are also attested by ultramafic rocks of the related mélanges. I. Blanco-Quintero, J.A. Proenza, A. García-Casco E. Tauler and S. Galí provide petrological and geochemical data of **serpentinite-matrix and -blocks from the Antillean subduction channel, Eastern Cuba**. Antigorite-serpentinites correspond to upper plate peridotites serpentinitized at depth in the subduction channel due to dehydration of the subducting slab, whereas antigorite-lizardite serpentinites are lower plate abyssal serpentinitized peridotites accreted to the channel, in what seems a regular picture of subduction-related serpentinite-mélanges (e.g., Saumur et al., 2010). The authors emphasize that hydration of the upper plate mantle wedge is critical for exhumation of subducted material (e.g., Guillot et al., 2009). The geodynamic settings of formation of these serpentinites and their ultramafic protoliths, however, contrast with that of variably chromitite-bearing serpentinitized ultramafic rocks of obducted ophiolitic sheets. In Eastern Cuba these ophiolites (i.e., Mayarí-Baracoa ophiolite belt) have been interpreted as formed in a back-arc/arc region (Marchesi et al., 2006, 2007). Similarly, F. Zaccarini, G. Garuti, J.A. Proenza, L. Campos, O.A.R. Thalhammer, T. Aiglsperger and J.F. Lewis conclude that the **Santa Elena ultramafic nappe of Costa Rica** formed in a suprasubduction zone environment, as indicated by the first systematic geochemical description of chromite and platinum group minerals from Santa Elena chromitites. This work suggests formation of chromitite due to fractional crystallization of boninitic magma and strengthens the view that the ultramafic nappe was formed in a suprasubduction environment (e.g., Geldmacher et al., 2008) rather than at a mid-ocean rift or a hotspot setting. It also illustrates the use of ophiolitic chromitite as a petrogenetic and geodynamic indicator, which is particularly useful when related ultramafic-mafic rocks are moderately to strongly altered.

## VOLCANIC ARCS

Ocasionally, suprasubduction zone rocks formed far away from oceanic trenches enter a subduction zone. Complex tectonic scenarios, involving subduction erosion and/or the interplay of several subduction zones

are commonly envisaged to explain these occurrences, as described by M. Weber, A. Cardona, V. Valencia, U. Altenberger, M. López-Martínez, M. Tobón, S. Zapata, G. Zapata and E. Concha for the **eclogites of the Guajira Peninsula, northern Colombia**. The geochemistry of these rocks is similar to that of the Early-to-Late Cretaceous basalts and basaltic andesites of the oceanic island arc tholeiitic series of the Caribbean realm and their Late Cretaceous metamorphic ages are comparable to those of other high-pressure rocks of the southern margin of the Caribbean plate from Venezuela. A generalized stage of volcanic-arc subduction in the southern branch of the Caribbean plate margin points to a complex plate tectonic scenario involving the approach of the volcanic arc to the continental margin of South America. A major question left open by the authors is whether the high-pressure belts of northern South America represent a single continuous subduction zone through time or are part of multiple subduction zones that were modified by a strike-slip system during their approach to the margin (Maresch et al., 2009). Collision and accretion of the Caribbean Cretaceous volcanic arc to the northern margin of South America during the latest Cretaceous-early Tertiary caused orogenesis. Further development of topography resulted from the onset of subduction of the Caribbean plate below South America. Renewed magmatism constrains the evolution of exhumation and tectonic stages during the Cenozoic, as exemplified by the paper by A. Cardona, V. Valencia, M. Weber, J. Duque, C. Montes, G. Ojeda, P. Reiners, K. Domanik, S. Nicolescu, and D. Villagómez on **U-Th/He thermochronology and barometry of Eocene plutonic rocks of the Santa Marta massif and the Guajira Peninsula, northern Colombia**. Several major exhumation events from up to ca. 20 km in Santa Marta and 10 km in Serranía de Guajira are identified since the Eocene, though both complexes experienced independent histories since the late Oligocene. The control of exhumation in this active subduction/strike-slip plate margin is considered essentially tectonic, including post-Eocene changes in plate convergence obliquity and rate. These changes caused the South American margin to override the Caribbean plate, in agreement with fission track thermochronology (Villagómez et al., 2011b).

The paper by J. Lewis, G. Kysar Mattiotti, M. Perfit and G. Kamenov deals with the geochemistry of **granitoids recovered from the basement of the northern Nicaraguan Rise**. This will certainly attract the scientific community, for the geology of this important part of the Caribbean is poorly known and controversial. According to this study, the elemental and Pb, Nd and Sr isotope systematics of granitoids indicate that basement rocks of the northern Nicaraguan Rise have a mature oceanic arc affinity and show no evidence for a continental component. Furthermore, these granitoids are similar to the possibly

related Late Cretaceous-Paleocene oceanic volcanic-arc granitoid intrusions of Above Rocks (Jamaica) and Terre Neuve (Haiti). Hence, the authors propose that the basement of the northern Nicaraguan Rise in the investigated region corresponds to a Caribbean oceanic arc, probably related to the Siuna terrane (or the Mesquito Composite Oceanic Terrane of Baumgartner et al., 2008, which includes the Siuna terrane) rather than to the Paleozoic-Precambrian continental crust of the Chortís block (e.g., Rogers et al., 2007). This oceanic arc was formed during Cretaceous-Paleocene subduction of the Caribbean lithosphere and the subduction could have been active until the thick Caribbean large igneous province arrived at the trench during the Eocene.

Another case of Late Cretaceous-Tertiary arc-derived rocks, though related to a different subduction zone, is that of the Panamá arc. I. Corral, A. Grieria, D. Gómez-Gras, M. Corbella, À. Canals, M. Pineda-Falconett and E. Cardellach present a study of the volcanoclastic **Río Quema Formation of the Azuero Peninsula, Panamá, and the associated gold and copper mineralization**. These authors conclude that the volcano-sedimentary rocks of the Cerro Quema area and associated Au-Cu mineralization were formed in the Panama arc/fore-arc basin during the late Cretaceous-Eocene. Rather than an accreted exotic oceanic terrane, the basement is confirmed to be part of the Caribbean large igneous province (in line with Buchs et al., 2010; Wegner et al., 2011) and is considered autochthonous. This allows the characterization of arc development and maturation since the onset of subduction of Farallon below the Caribbean large igneous province.

As shown, the papers presented in this issue cover a wide spectrum of Caribbean rock complexes in terms of space, time and geologic origin, and add new data and far-reaching ideas that will fruitfully contribute to the current debate on the evolution of the Caribbean and adjacent plates.

## ACKNOWLEDGMENTS

The Editors wish to thank the reviewers (D. Buchs, A. Camprubí, A. Cardona, J. Escuder-Viruete, E. Gazel, D. Gimeno, T. Grammatikopoulos, S. Guillot, G.E. Harlow, M. Jaramillo, J.F. Lewis, E. Lidiak, C. Marchesi, W. Maresch, M. Grégoire, U. Martens, D. Morata, C. Nelson, Y. Rojas-Agramonte, J.H. Schellekens, R.J. Stern, T. Tsujimori, V. Valencia and J. Wright in addition to reviewers who wish to remain anonymous), *Geologica Acta's* Chief Editor (M. Liesa), Journal Manager (L. Rincón) and editorial staff (Montserrat Puig, Adriana Currin, Ivan Pineda and Guim Aguadé), who have made this issue possible. We also wish to thank the Cuban Geological Society, for assistance, and UNESCO/IUGS for funding the workshop *Subduction Zones of the Caribbean* and associated Field Trip *Subduction and arc complexes of central Cuba* organized by IGCP 546 in the III Cuban Convention in Earth Sciences (Havana, March, 2009).

## REFERENCES

- Baumgartner, P.O., Flores, K., Bandini, A.N., Girault, F., Cruz, D., 2008. Upper Triassic to Cretaceous radiolarians from Nicaragua and Northern Costa Rica - The Mesquito Composite Oceanic Terrane. *Ophioliti*, 33(1), 1-19.
- Blanco-Quintero, I., Proenza, J.A., García-Casco, A., Tauler, E., Galí, S., 2011. Serpentinites and serpentinites within a fossil subduction channel: La Corea mélange, eastern Cuba. *Geologica Acta*, 9 (3-4), 389-405.
- Brueckner, H.K., Avé Lallemant, H.G., Sisson, V.B., Harlow, G.E., Hemming, S.R., Sorensen, S.S., Tsujimori, T., Martens, U., 2009. Metamorphic reworking of a high-pressure-low temperature mélange along the Motagua fault, Guatemala: A revised record of Neocomian and Maastrichtian transpressional tectonics. *Earth and Planetary Science Letters*, 284, 228-235.
- Buchs, D.M., Arculus, R.J., Baumgartner, P.O., Baumgartner-Mora, C., Ulianov, A., 2010. Late Cretaceous Arc Development on the SW margin of the Caribbean Plate: Insights from the Golfito (Costa Rica) and Azuero (Panama) Complexes. *Geochemistry, Geophysics, Geosystems*, 11(7), 35pp.
- Bustamante, A., Juliani, C., Hall, C.M., Essene, E.J., 2011. <sup>40</sup>Ar/<sup>39</sup>Ar ages from blueschists of the Jambaló region, central cordillera of Colombia: Implications on the styles of accretion in the Northern Andes. *Geologica Acta*, 9 (3-4), 351-362.
- Cardona, A., Valencia, V., Weber, M., Duque, J., Montes, C., Ojeda, G., Reiners, P., Domanik, K., Nicolescu, S., Villagomez, D., 2011. Transient Cenozoic tectonic stages in the southern margin of the Caribbean plate: U-Th/He thermochronological constraints from Eocene plutonic rocks in the Santa Marta massif and Serranía de Jarara, northern Colombia. *Geologica Acta*, 9 (3-4), 445-466.
- Corral, I., Grier, A., Gómez-Gras, D., Corbella, M., Canals, À., Pineda-Falconett, M., Cardellach, E., 2011. Geology of the Cerro Quema Au-Cu deposit (Azuero Peninsula, Panama). *Geologica Acta*, 9 (3-4), 481-498.
- Escuder-Viruete, J., Pérez-Estaún, A., Joubert, M., Weis, D., 2011. The Pelona-Pico Duarte basalts Formation, Central Hispaniola: An on-land section of Late Cretaceous volcanism related to the Caribbean large igneous province. *Geologica Acta*, 9 (3-4), 307-328.
- García-Casco, A., Iturralde-Vinent, M.A., Pindell, J., 2008. Latest Cretaceous collision/accretion between the Caribbean Plate and Caribbeana: origin of metamorphic terranes in the Greater Antilles. *International Geology Review*, 50, 781-809.
- Geldmacher, J., Hoernle, K.A., Bogaard, P.V.D., Hauff, F., Klügel, A., 2008. Age and geochemistry of the Central American forearc basement (DSDP Leg 67 and 84): Insights into Mesozoic arc volcanism and seamount accretion on the fringe of the Caribbean LIP. *Journal of Petrology*, 49, 1781-1815.
- Guillot, S., Hattori, K., Agard, P., Schwartz, S., Vidal, O., 2009. Exhumation processes in oceanic and continental subduction contexts: a review. In: Lallemand, S., Funicello, F. (eds.). *Subduction Zone Dynamics*. Springer-Verlag Berlin Heidelberg, 175-204.
- Harlow, G.E., Sisson, V.B., Sorensen, S.S., 2011. Jadeitite from Guatemala: New observations and distinctions among multiple occurrences. *Geologica Acta*, 9 (3-4), XXX-XXX.
- Honza, E., 1991. The Tertiary Arc Chain in the Western Pacific. *Tectonophysics*, 187, 285-303.
- Iturralde-Vinent, M.A., Lidiak, E.G., 2006. Caribbean Tectonic, magmatic, metamorphic and stratigraphic events. Foreword. *Geologica Acta*, 4(1-2), 1-5.
- Kerr, A.C., Tarney, J., 2005. Tectonic evolution of the Caribbean and northwestern South America: The case for accretion of two Late Cretaceous oceanic plateaus. *Geology*, 33, 269-272.
- Kerr, A.C., White, R.V., Thompson, P.M.E., Tarney, J., Saunders, A.D., 2003. No oceanic plateau—no Caribbean plate? The seminal role of an oceanic plateau in Caribbean plate evolution. In: Bartolini, C., Buffler, R.T., Blickwede, J. (eds.). *The Circum Gulf of Mexico and Caribbean: Hydrocarbon Habitats Basin Formation and Plate Tectonics*. American Association of Petroleum Geology Memoir, 79, 126-268.
- Lewis, J., Kysar Mattietti, G., Perfit, M., Kamenov, G., 2011. Geochemistry and petrology of three granitoid rock cores from the Nicaraguan Rise, Caribbean Sea: implications for its composition, structure and tectonic evolution. *Geologica Acta*, 9 (3-4), 467-479.
- Lidiak, E.D., 2011. Memorial to Wayne T. Jolly. *Geologica Acta*, 9 (3-4), 225-227.
- Lidiak E.G., Jolly W.T., Dickin A.P., 2011. Pre-arc basement complex and overlying early island arc strata, Southwestern Puerto Rico: overview, geologic evolution, and revised data bases. *Geologica Acta*, 9 (3-4), 273-287.
- Marchesi, C., Garrido, C.J., Godard, M., Proenza, J.A., Gervilla, F., Blanco-Moreno, J., 2006. Petrogenesis of highly depleted peridotites and gabbroic rocks from the Mayarí-Baracoa Ophiolitic Belt (eastern Cuba). *Contributions to Mineralogy and Petrology*, 151, 717-736.
- Marchesi, C., Garrido, C.J., Bosch, D., Proenza, J.A., Gervilla, F., Monié, P., Rodríguez-Vega, A., 2007. Geochemistry of Cretaceous magmatism in eastern Cuba: recycling of North American continental sediments and implications for subduction polarity in the Greater Antilles Paleo-arc. *Journal of Petrology*, 48, 1813-1840.
- Marchesi C., Jolly W.T., Lewis J.F., Garrido C.J., Proenza J.A., Lidiak E.G., 2011. Petrogenesis of fertile mantle peridotites from the Monte del Estado massif (Southwest Puerto Rico): a preserved section of Proto-Caribbean lithospheric mantle? *Geologica Acta*, 9 (3-4), 289-306.
- Maresch, W.V., Kluge, R., Baumann, A., Pindell, J.L., Krückhans-Lueder, G., Stanek, K., 2009. The occurrence and timing of high-pressure metamorphism on Margarita Island, Venezuela: a constraint on Caribbean-South America interaction. *Geological Society of London*, 328 (Special Publications), 705-741.
- Mattson, P.H., 1979. Subduction, buoyant breaking, flipping

- and strike-slip faulting in the northern Caribbean. *Journal of Geology*, 87, 293-304.
- Nelson, C.E., Proenza, J.A., Lewis J.F., López-Kramer, J., 2011. The metallogenic evolution of the Greater Antilles. *Geologica Acta*, 9 (3-4), 229-264.
- Noguera, M.I., Wright, J.E., Urbani, F., Pindell, J., 2011. U-Pb Geochronology of Detrital Zircons from the Venezuelan Passive Margin: Implications for an Early Cretaceous Proto-Orinoco River System and Proto-Caribbean Ocean Basin Paleogeography. *Geologica Acta*, 9 (3-4), 265-272.
- Pindell, J., Kennan, L., 2009. Tectonic evolution of the Gulf of Mexico, Caribbean and northern South America in the mantle reference frame: an update. In: James, K.H., Lorente, M.A., Pindell, J.L. (eds.). *The Origin and Evolution of the Caribbean Plate*. Geological Society of London, 328 (Special Publications), 1-55.
- Pindell, J., Maresch, W.V., Martens, U., Stanek, K.P., in press. The Greater Antillean Arc: Early Cretaceous origin and proposed relationship to Central American subduction mélanges: implications for models of Caribbean evolution. *International Geology Review*. doi: 10.1080/00206814.2010.510008.
- Ratschbacher, L., Franz, L., Min, M., Bachmann, R., Martens, U., Stanek, K., Stubner, K., Nelson, B.K., Herrmann, U., Weber, B., López-Martínez, M., Jonckheere, R., Sperner, B., Tichomirowa, M., McWilliams, M.O., Gordon, M., Meschede, M., Bock, P., 2009. The North American–Caribbean plate boundary in México–Guatemala–Honduras. In: James, K.H., Lorente, M.A., Pindell, J.L. (eds.). *The origin and Evolution of the Caribbean Plate*. Geological Society of London, 328 (Special Publications), 219-293.
- Rogers, R., Mann, P., Emmet, P., 2007. Tectonic terranes of the Chortis block based on integration of regional aeromagnetic and geologic data. In: Mann, P. (ed.). *Geologic and Tectonic Development of the Caribbean Plate in Northern Central America*. Geological Society of America, 428 (Special Paper), 65-88.
- Rojas-Agramonte, Y., Kroner, A., Pindell, J., García-Casco, A., García-Delgado, D. Liu, D., Wang, Y., 2008. Detrital zircon geochronology of Jurassic sandstones of western Cuba (San Cayetano Formation): Implications for the Jurassic paleogeography of the NW Proto-Caribbean. *American Journal of Science*, 308, 639-656.
- Saumur, B.-M., Hattori, K.H., Guillot, S., 2010. Contrasting origins of serpentinites in a subduction complex, northern Dominican Republic. *Geological Society of America Bulletin*, 122, 292-304.
- Solari, L.A., Gómez-Tuena, A., Ortega-Gutiérrez, F., Ortega-Obregón, C., 2011. The Chuacús Metamorphic Complex, central Guatemala: geochronological and geochemical constraints on its Paleozoic - Mesozoic evolution. *Geologica Acta*, 9 (3-4), 329-349.
- Villagómez, D., Spikings, R., Magna, T., Kammer, A., Winkler, W., Beltrán, A., 2011a. Geochronology, geochemistry and tectonic evolution of the Western and Central cordilleras of Colombia. *Lithos*, 125, 875-896.
- Villagómez, D., Spikings, R., Mora, A., Guzmán, G., Ojeda, G., Cortés, E., van der Lelij, R., 2011b. Vertical tectonics at a continental crust-oceanic plateau plate boundary zone: Fission track thermochronology of the Sierra Nevada de Santa Marta, Colombia. *Tectonics*, 30, TC4004. doi: 10.1029/2010TC002835.
- Weber, M., Cardona, A., Valencia, V., Altenberger, U., López-Martínez, M., Tobón, M., Zapata, S., Zapata, G., Concha, A.E., 2011. Geochemistry and Geochronology of the Guajira Eclogites, northern Colombia—Evidence of a metamorphosed primitive Cretaceous Caribbean Island-arc. *Geologica Acta*, 9 (3-4), 425-443.
- Wegner, W., Wörner, G., Harmon, R.S., Jicha, B.R., 2011. Magmatic history and evolution of the Central American Land Bridge in Panama since Cretaceous times. *Geological Society of America Bulletin*, 123, 703-724.
- Zaccarini, F., Garuti, G., Proenza, J.A., Campos, L., Thalhammer, O.A.R., Aiglsperger, T., Lewis, J.F., 2011. Chromite and platinum-group-elements mineralization in the Santa Elena Ultramafic Nappe (Costa Rica): geodynamic implications. *Geologica Acta*, 9 (3-4), 407-423.



**Antonio García-Casco, Ph.D. 1993 (University of Granada), is Full Professor of Petrology and Geochemistry at the University of Granada. His main research interests are metamorphic geology, phase equilibria, P-T-t paths and experimental petrology, with applications to the geodynamic evolution of plate margins (mostly in the Betics, Variscan and Caribbean belts). He has led several research projects in the Caribbean region. More information available in <http://www.ugr.es/~agcasco/personal>.**



**Manuel A. Iturralde-Vinent is the President of the Cuban Geological Society, a member of the Cuban Academy of Sciences, senior professor at the School of Geophysics at the IPSJAE in Havana and at the School of Geology at the University of Pinar del Río, and retired senior researcher of the National Museum of Natural History (Cuba). He has been a member of the scientific board of UNESCO/UGS Geoscience Program and of several other international organizations. He is author of more than 250 scientific contributions including books, papers, web sites and documentary films about Cuban and Caribbean geology. Lately he is focused on public education to prevent natural disasters derived from extreme geological events. More information available in <http://www.redciencia.cu/cdorigen/arca/iturre.html>.**



**Joaquín A. Proenza got his PhD degree in Geology at the University of Barcelona in 1998. He is currently an Associate Professor at the Departament de Cristal·lografia, Mineralogia i Dipòsits Minerals of Barcelona University. His research activities are concerned with mineralogy, petrology and metallogenesis of mafic and ultramafic rocks (mainly in the Caribbean region). His recent projects include the metallogenic processes of supergene Co-Ni enrichment and platinum group elements in Ni-laterite deposits.**