
FOREWORD

Contributions to the geological evolution of the Iberian Peninsula: a tribute to Pere Santanach

This special issue celebrates the career of Pere Santanach, who retired in 2016 (Fig. 1). Pere Santanach obtained his Geology Degree in 1969 and, after that, one of the most relevant features of his career was an intense dedication to the University, in a balanced way, in its three aspects: teaching, management and research. As a teacher, he played an important role in the innovation of the Geology Degree in Barcelona in the 70's, especially with the creation of the teaching framework of Structural Geology, practically non-existent at the time, and with a special interest in field-teaching activities. More recently, he devoted important efforts to the implementation of the Bologna plan, as the participation in the Tuning project, the organization and presidency of deans of Spain to become part of the project, or being coordinator of the White Book of the Geology Degree, chair of the Evaluation Committee of the branch of Sciences of the program VERIFICA of ANECA (Spanish Agency of Evaluation and Accreditation) and chair of the Geology Degree Studies Plan Commission of the University of Barcelona.

He spent many years in academic and research management. He committed with the academic management at the different levels the university offered (head of departmental, vice-dean, dean, assistant vice-rector and vice-rector). He assumed also responsibilities in Research management, as research vice-rector at the University, as Secretary of Drafting of the National Plan of Geological Resources and, after that, as the manager of this latter program. In doing so, he coordinated all the groups that deal with the Internal Geodynamics, both of geological and geophysical formation, in a macro seismic project of deep reflection at state level. This project marked a milestone by establishing the joint work of Earth scientists of geological and physical origin and represented a qualitative leap in the studies of Geodynamics in Spain.

Apart from his personal research, more than 150 published articles and 13 supervised PhD Thesis, one of the main values of his work has been to nucleate a research group in Structural Geology, nowadays of recognized international projection. The group is organized in subgroups that focus in the different

research lines in which P. Santanach has worked: mainly the relationships between deformational structures at different time and space scales, both fragile and ductile. He also worked for the introduction of new and diversified research lines and was good at stimulating the collaborators to develop them. During these years, Pere has exhibited a continuous and renovated enthusiasm for the new methods and techniques that can improve and complement the classical field work in Structural Geology. Since the early 80's, he promoted in Barcelona a series of short courses done by specialists of specific tools, going through the basement study techniques, the balanced cross-section, paleomagnetism or seismic structural styles. Fruit of that spirit was the important role he played in the creation in Barcelona of the Paleomagnetism Laboratory in 1989 and the Terrestrial Cosmogenic Nuclides Laboratory in 2003. Pere stood out in promoting the Paleoseismology and the Active Tectonics studies in the eastern Iberia. Currently, he is interested in the History of the Geology, being his work focused on the Neptunistic and Magmatist visions of the formation of mountain ranges and on the Geology in Catalonia, particularly in the University, during the first half of the 20th century.



FIGURE 1. Pere Santanach (Photographed by J.M. Villaplana, in the Núria-Fontalba Path, June 2016)

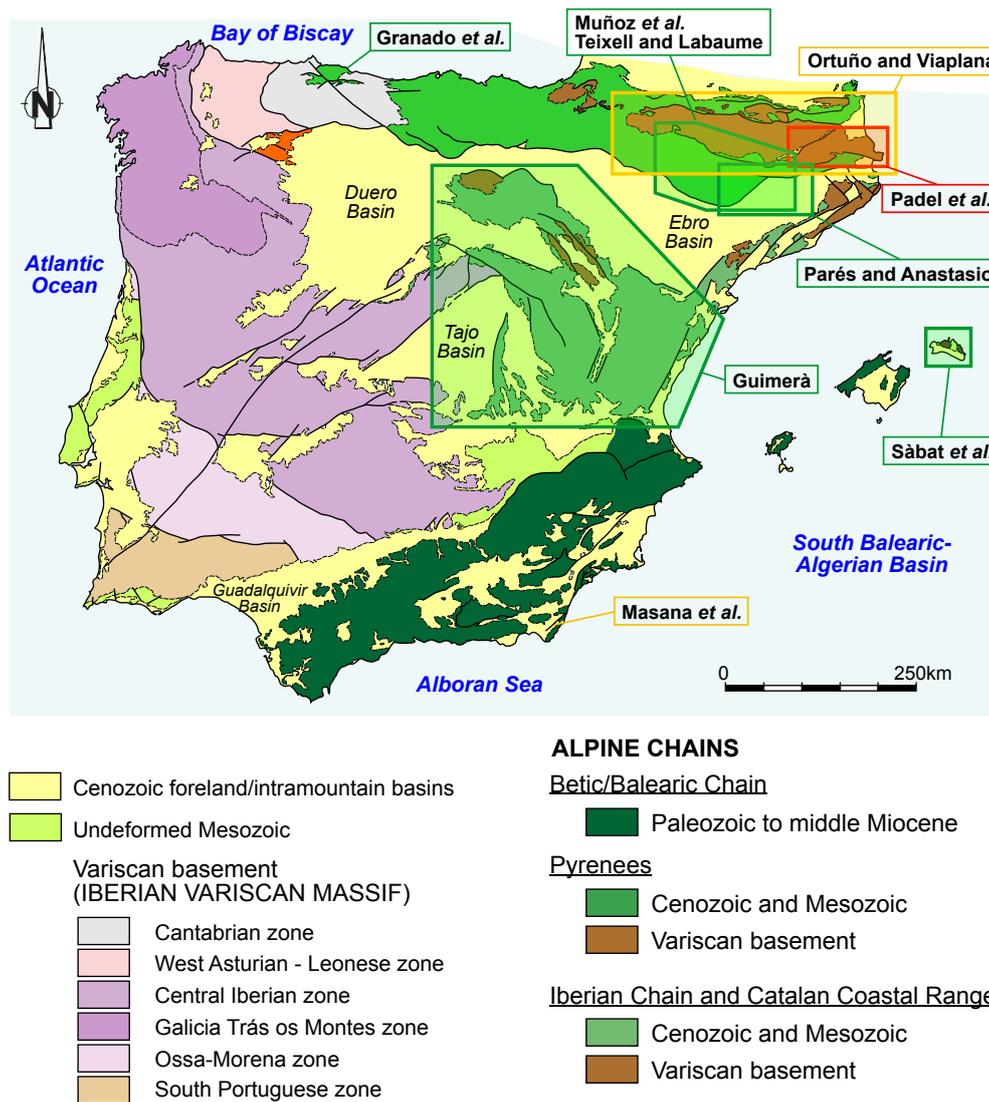


FIGURE 2. Major geological units of the Iberian Peninsula and Balearic Islands with setting of the contributions to this special volume.

This special issue of *Geologica Acta* presents contributions from friends and colleagues, including former students, who wish to honour Pere and wish him well upon his retirement. The authors of this issue cover the wide diversity of topics to which Pere Santanach contributed during his scientific career (Fig. 2). These topics may be arranged into four themes, to all of which Pere has been a prime contributor to our knowledge: i) Pyrenees, Variscan basement and Alpine structure; ii) Other Alpine realms, including Catalonian Coastal Range, Iberian Range, Balearic Islands and the North Iberian margin; iii) Paleoseismology and Active Tectonics and iv) new methods and techniques.

Pere's research career began in the Pyrenees, with a Degree Thesis devoted to the Alpine structure of the Montsec de Tost Massif. After that, his PhD Thesis focused on the structure of the Variscan rocks of the southern slope of the Canigó Massif,

and this work constitutes a cornerstone in the understanding of the Variscan structure of this area complemented with an accurate stratigraphic and cartographic work. We would like to emphasize his first documented description of the Upper Ordovician unconformity (Santanach, 1972), later on widely documented in other areas of the Pyrenees. Since the early 80's he manifested renovated interest in the thrust tectonics (Muñoz and Santanach, 1988) and in the Alpine overprinting of the basement Variscan rocks of the Pyrenees (Muñoz *et al.*, 1983; Fontboté *et al.*, 1986). In this volume, Padel *et al.* present an update of the stratigraphic arrangement of the pre-Upper Ordovician rocks of the area studied in Pere's Thesis, that is, between the Ter and the Freser rivers in the southern Canigó Massif. The Alpine structure of the central Pyrenees is the object of the contributions of Muñoz *et al.* and Labaume and Teixell, in which they discuss some uncertainties and controversies that remained to be resolved. Parés and Anastasio deal with the utility of the Anisotropy

of Magnetic Susceptibility (AMS) fabric as an indicator of the internal deformation in areas far away from the mountain front.

Simultaneously, Pere was interested in the fracture tectonics and structure of the Catalanian Coastal Range (Anadón *et al.*, 1985; Santanach *et al.*, 2010) and the Balearic Islands (Sàbat *et al.*, 1988; Fontboté *et al.*, 1990). Guimerà presents in this issue a general and updated overview of the structure of the Iberian Range and Sàbat *et al.* emphasize the peculiar geology of Minorca Island and analyse their significance during the Alpine evolution of the Western Mediterranean. On the other hand, Granado *et al.* present an example of the role of the structural inheritance in the structural evolution of poly-deformed areas.

Although Pere's interest in the Paleoseismology and Active Tectonics began in the early 80's, this topic reaches an important development at the University of Barcelona since the late 90's (Santanach and Masana, 2000) after leading one of the first paleoseismic studies in Western Europe in low-velocity active faults (El Camp fault) and, as stated above, he promoted the introduction of new geochronological techniques to date the movement of active faults (Pallàs *et al.*, 2006). In this issue, Masana *et al.* present the first paleoseismic evidence of the seismogenic nature of the Carboneras Fault, in the eastern Betic Shear zone, SE of the Iberian Peninsula, and Ortuño and Viaplana-Muzas discuss the relationships between low relief surfaces and the activity of normal faults in the Pyrenees.

Finally, Roma *et al.* present several analog models based on extensional basins with syn-rift salt that show how basement topography exerts an impact on weld kinematics during extension and inversion phases. They compare their results with two natural examples of the southern North Sea that highlights closely deformation patterns to those observed in the analog models.

To conclude, Pere's career has had a very direct impact in the Structural Geology development in Spain. His research has been key to our understanding of the geological and tectonic evolution of the Iberian Peninsula and has also been an example of the value of multi-disciplinary approaches and the use of the new methods and techniques. This philosophy is reflected in the wide range of disciplines presented in this special issue. At the same time, his mentorship and motivation of several generations of Earth scientists have left an enduring legacy, a legacy for Pere to be justly proud of, and for his colleagues and friends to celebrate.

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ACKNOWLEDGMENTS

We are grateful to the authors that contributed to this special issue and to the reviewers of these articles for their thoughtful and constructive comments. We are also indebted to the Geologica Acta staff for their friendly, continuous and professional help and assistance.

REFERENCES

- Anadón, P., Cabrera, L., Guimerà, J., Santanach, P., 1985. Paleogene strike-slip deformation and sedimentation along the southeastern margin of the Ebro Basin. In: Biddle, K.T., Christie-Blick, N. (eds.). Strike-Slip deformation, basin formation, and sedimentation. Society of Economic Paleontologists and Mineralogists, Tulsa, USA, Special Publication, 37, 303-318.
- Fontboté, J.M., Muñoz, J.A., Santanach, P., 1986. On the consistency of proposed models for the Pyrenees with the structure of the eastern sections of the belt. *Tectonophysics*, 129(1-4), 291-301.
- Fontboté, J.M., Guimerà, J., Roca, E., Sàbat, F., Santanach, P., Fernández-Ortigosa, F., 1990. The Cenozoic geodynamic evolution of the València Trough (western Mediterranean). *Revista de la Sociedad Geológica de España*, 3(3-4), 249-259.
- Granado, P., Tavani, S., Carrera, N., Muñoz, J.A., 2018. Deformation pattern around the Conejera fault blocks (Asturian Basin, North Iberian Margin). *Geologica Acta*, 16(4), 357-373. DOI: 10.1344/GeologicaActa2018.16.4.2
- Guimerà, J., 2018. Structure of an intraplate fold-and-thrust belt: The Iberian Chain. A synthesis. *Geologica Acta*, 16(4), 427-438. DOI: 10.1344/GeologicaActa2018.16.4.6
- Labaupe, P., Teixell, A., 2018. 3D structure of subsurface thrusts in the eastern Jaca Basin, southern Pyrenees. *Geologica Acta*, 16(4), 477-498. DOI: 10.1344/GeologicaActa2018.16.4.9
- Masana, E., Moreno, X., Gràcia, E., Pallàs, R., Ortuño, M., López, R., Gómez-novell, O., Ruano, P., Perea, H., Stepáncikova, P., Khazaradze, G., 2018. First evidence of paleoearthquakes along the Carboneras Fault Zone (SE Iberian Peninsula): Los Trances site. *Geologica Acta*, 16(4), 461-476. DOI: 10.1344/GeologicaActa2018.16.4.8
- Muñoz, J.A., Mencos, J., Roca, E., Carrera, N., Gratacós, O., Ferrer, O., Fernández, O., 2018. The structure of the South-Central-Pyrenean fold and thrust belt as constrained by subsurface data. *Geologica Acta*, 16(4), 439-460. DOI: 10.1344/GeologicaActa2018.16.4.7
- Muñoz, J.A., Santanach, P., 1988. Tectónica de cabalgamientos en el Pirineo. Introducción. *Acta Geológica Hispánica*, 23, 79-80.
- Muñoz, J.A., Sàbat, F., Santanach, P., 1983. Cisaillements alpins et hercyniens dans le versant méridional de la zone axiale des Pyrénées entre le Freser et le Ter (Pyrénées catalanes). *Comptes Rendus de l'Académie des Sciences de Paris*, 296(2), 1453-1458.

- Ortuño, M., Viaplana-muzas, M., 2018. Active fault control in the distribution of Elevated Low Relief Topography in the Central-Western Pyrenees. *Geologica Acta*, 16(4), 499-518. DOI: 10.1344/GeologicaActa2018.16.4.10
- Padel, M., Clausen, S., Álvaro, J.J., Casas, J.M., 2018. Review of the Ediacaran-Lower Ordovician (pre-Sardic) stratigraphic framework of the Eastern Pyrenees, southwestern Europe. *Geologica Acta*, 16(4), 339-355. DOI: 10.1344/GeologicaActa2018.16.4.1
- Pallàs, R., Rodés, A., Braucher, R., Carcaillet, J., Ortuño, M., Bordonau, J., Bourlès, D., Vilaplana, J.M., Masana, E., Santanach, P., 2006. The late Pleistocene and Holocene glaciation in the Pyrenees: a critical review and new evidence from ¹⁰Be exposure ages, south-central Pyrenees. *Quaternary Science Reviews*, 25(21-22), 2937-2963.
- Parés, J.M., Anastasio, D., 2018. The extent of penetrative Pyrenean deformation in the Ebro foreland Basin: Magnetic fabric data from the eastern sector. *Geologica Acta*, 16(4), 375-390. DOI: 10.1344/GeologicaActa2018.16.4.3
- Roma, M., Ferrer, O., McClay, K.R., Muñoz, J.A., Roca, E., Gratacós, O., Cabello, P., 2018. Weld kinematics of syn-rift salt during basement-involved extension and subsequent inversion: Results from analog models. *Geologica Acta*, 16(4), 391-410. DOI: 10.1344/GeologicaActa2018.16.4.4
- Sàbat, F., Muñoz, J.A., Santanach, P., 1988. Transversal and oblique structures at the Serres de Llevant thrust belt (Mallorca Island). *Geologische Rundschau*, 77(2), 529-538.
- Sàbat, F., Gelibert, B., Rodríguez-perea, A., 2018. Minorca, an exotic Balearic island (western Mediterranean). *Geologica Acta*, 16(4), 411-426. DOI: 10.1344/GeologicaActa2018.16.4.5
- Santanach, P.F., 1972. Sobre una discordancia en el Paleozoico inferior de los Pirineos orientales. *Acta Geologica Hispanica*, 7(5), 129-132.
- Santanach, P., Masana, E., 2000. Palaeoseismicity in a low seismicity area: the case of Spain. In: Thorkelsson, B., Yeroyani, M. (eds.). *The Second EU-Japan workshop on seismic risk. Destructive Earthquakes: Understanding Crustal Processes Leading to Destructive Earthquakes*. Reykjavík, European Commission, 36-47.
- Santanach, P., Casas, J.M., Gratacós, O., Liesa, M., Muñoz, J.A., Sàbat, F., 2010. Variscan and Alpine structure of the hills of Barcelona: geology in an urban area. *Journal of Iberian Geology*, 37(2), 121-136.