PRE-MESOZOIC GEOLOGY OF IBERIA pdf

1: Nemesio Heredia Carballo | Instituto Geologico y Minero de EspaÃ±a (IGME) - www.enganchecubano.c

Pre-Mesozoic Geology of Iberia is a major reference for current understanding of the overall tectonostratigraphic evolution of the Iberian Massif. It represents a comprehensive overview which systematically describes characteristics of the seven major lithotectonic elements of the Iberian Massif in terms of: stratigraphy, - paleontology.

These differences in overprint reflect pre-Variscan crustal heterogeneity and thickness variation, where thinner segments were wedged into the subduction zone and rigid, thicker blocks escaped subduction. The heterogeneity of crustal thickness is considered to be caused by Ordovician rifting â€" Ma of the Cadomian crust â€" Ma at the Gondwana margin. Today, magmatic and sedimentary rocks deposited on the thin crust of these rifts form the metamorphic complexes of the Saxon Granulite Massif and the Erzgebirge Mtns. Variable response of crust of different thickness to Variscan deformation and metamorphism is not particular to the Saxo-Thuringian Zone, but rather a typical feature of the crust all over Variscan Europe. The 18 chapters of this book are review and synthesis papers and present overviews of the Cadomian evolution, the post-Cadomian development of the passive margin, a state of the art assessment of the biostratigraphic record of Saxo-Thuringian sediments, various aspects metamorphism, structure, magmatism of the Variscan reworking of the Saxo-Thuringian Zone and processes related to the erosion of the Variscan Orogen. Extensive references include also older, generally difficult to find literature references, PhD theses and original descriptions published in very local journals. This book makes use of, and in part provides, previously unavailable maps and borehole data, largely acquired in GDR time in the course of exploration for uranium, fossil fuels, and ore minerals. Numerous figures and additional materials are provided on the enclosed DVD. Gespickt mit zahlreichen geochronologischen Datierungen wird der modernste Kenntnisstand fundiert vermittelt. Hervorzuheben ist der Abschnitt zur Biostratigraphie dieses Buchteils. Die biostratigraphischen Tabellen orientieren sich an der aktuellen internationalen Chronostratigraphie. Die Modellvorstellung der synorogenen Variszischen Sedimentation, deren Strukturinventar und die zeitliche Einordnung der Deformationsphasen rundet Teil 2 ab. Die Synthese der vorangegangenen Teile erfolgt im Teil 5. Der Anteil der Literaturreferenzen ist enorm. Die Interpretationen der geologischen Prozesse werden anschaulich dargestellt. Abbildungen sind im Anhang auch in Farbtafeln wiedergegeben. Der erste Abschnitt umfasst die Einleitung aus drei Kapiteln. Das Saxothuringikum wird in seiner Gesamtheit aus verschiedenen Perspektiven vorgestellt. Die cadomischen orogenetischen Prozesse fanden im westlichen Peripherie-Bereich des westafrikanischen Kratons im Zeitraum von vor ca. Im Hangenden lagern kambrische bis karbonische Gesteinsfolgen Kap. Fossilien sind in diesem weiten Subsidenzraum relativ selten und ungleich verteilt, doch dokumentieren sie den Zeitraum vom Ediacarium bis ins Karbon Kap. Eine synorogene Flyschsedimentation mit gros-sen Mengen an proximalen und distalen Turbiditen fand ausgedehnt im Unterkarbon statt Kap. Der dritte Abschnitt widmet sich den allochthonen Einheiten des Saxothuringikums. Diese sind von Grund auf heterogen aufgebaut. Die Mitteldeutsche Kristallinzone Kap. Dann folgten bei ca. Die Decken sind bezogen auf ihre metamorphe und geochronologische Abfolge teils invers gestapelt. Sie entstanden aus Kambro-Ordovizischen, meist magmatischen Protolithen kalkalkiner und tholeiitischer Zusammensetzung. Geochemische Signaturen lassen Vergleiche zu Gesteinsserien u. Sie erstarrten in der oberen Kruste. Dabei wurden alte Strukturen reaktiviert. Es lassen sich Alter von ca. Kapitel 18 stellt sodann ein geodynamisches Modell des Variszikums vor. Das Modell wird in einer Reihe von zeitbezogenen, schematischen Plattenrekonstruktionen illustriert. Das Buch setzt dabei vertieftes Fachwissen aus vielen geowissenschaftlichen Bereichen, u. Petrologie, Strukturgeologie, Geochemie und Geodynamik, voraus. Geologica Carpathica, February , vol. Saxo-Thuringia represents a very important region displaying development of the Variscides in one part of the Pangea supercontinent. The first chapter of the first part Introduction of the book is absolutely devoted to the location of this region of Saxo-Thuringia in the context of the Pangea supercontinent, followed by detailed recapitulation of the geological maps and results from geological mapping in historical survey from oldest documents to almost presentday works, which are well preserved and represent for the reader the classical and modern shool of regional geology of this region. The third chapter of this part completely untraditionally, but in a very interesting way shows the region of Saxo-Thuringia from the point of view of geochemical potential. The whole first part of this book is under the full direction of the Chief Editors of the monograph: The second part of the book is devoted to The Autochthonous Domain and the Wrench-and-Thrust Zone of this whole region. This whole region is very interesting geologically. It is valued on the basis of results presented in four chapters following one after another 4, 5, 6, 7. They present the manifestations and consequences of the Cadomian Orogeny, as well as the individual transitional stages between the Cadomian and Variscan orogenes. On the basis of the development of basins and in this framework also of the tectonomagmatic evolution of the southern margin of the Rheic Ocean the Saxo- Thuringian Zone North Gondwana shelf is represented. In a further two chapters of the monograph, Biostratigraphy is treated in detail. The faunal province of the southern margin of the Rheic Ocean and consequently also Early Carboniferous synorogenic sedimentation in the Saxo-Thuringia Basin and adjacent Allochthonous Domain are covered. The third part of the monograph represents an extensive study in six chapters devoted to The Allochthonous Domain. In a further chapter the Saxon Granulite Massif as the key to the evolution of Variscan central Europe is evaluated. A very exhaustive chapter dedicated to the Erzgebirge region follows. The conclusion of this monograph part is the tectonic model of the Allochthonous Domain of the Saxo-Thuringian Zone and Carboniferous magmatism treated in detail. The fourth part of the book deals with Late and post-Variscan reactivation. The reader receives here complete information on Late Variscan development on the basis of analyses: The fifth part of the book represents a perfect finale designated as a Synthesis. In this part important information is summarized under the chapter Baltica and meets Gondwana the isotope geochemical record and a particular chapter The Saxo-Thuringian Zone â€” tip of the Armorican Spur and part of the Gondwana plate. The last part of the book includes a complete register of applied literature and Index of terms. The book is treated graphically very well, perhaps some figures and schemes are of medium low graphical level, but on whole they are legible and applicable for the user. List of Contributors represents the present-day European professional elite, which has presented the most important information on the geology of the Saxo-Thuringian Zone, to the professional public in individual chapters. The book includes Digital Appendices on a DVD with additional maps and explanatory notes, suplements to chapters and a series of additional figures. The book represents a perfectly specialized work as a source of information and stimulation to further research into the problems given. We are indebted and congratulate the Editors and Authors! Das zeigt zum einen die ganz andere Zielsetzung: Schwerpunkt ist dabei das Saxothuringikum an der Spitze des Kollisionssporns. Den Kapiteln jedes Teils sind ihre Inhalte kurz vorangestellt. Ein wichtiges zusammenfassendes Ergebnis dieser und anderer Kartierungen â€” die geologische Karte 1: Es sind die Erosionsprodukte des herausgehobenen Orogens. Ihren Ablagerungsraum deutet man als marines Vorlandbecken. Schwerpunkt des Kapitels ist die Analyse der strukturellen Einheiten dieser Zone vor allem unter den Aspekten Lithologie, Tektonik, Metamorphose und absolute Altersdatierungen. Das Letztere unterscheidet sich dabei durch sein abweichendes Streichen. Auf mehr als 1. Ihre detaillierte Beschreibung, vor allem unter lithologischen, biostratigrafi schen floristischen und radiometrischen Aspekten, ist Schwerpunkt dieses Kapitels. Die zeitliche Entwicklung dieser Becken ist biostratigrafi sch zum Teil gut nachzuvollziehen. Das ist allerdings eher vorteilhaft, weil es dem weniger mit der Materie vertrauten Konsumenten das Lesen erleichtert. Seine Aufmachung ist hervorragend, der Verkaufspreis akzeptabel. Den Abschluss des Buches bildet eine plattentektonische Interpretation, deren wesentliches Merkmal ihre Einfachheit ist. Es richtet sich einerseits an den in den Varisz既iden aktiven Forscher, bietet jedoch auch Personen, welche in anderen Kollisionsorogenen aktiv sind, einige attraktive Konzepte und Ideen. Geological mapping of the Saxo-Thuringian Zone: The historical perspective 17 R. Transitional stages between the Cadomian and Variscan orogenies: The Allochthonous Domain A. Early Variscan allochthonous domains: The Saxon Granulite Massif: Carboniferous magmatism Part IV: Late and post-Variscan reactivation B. Variscan early molasses in the Saxo-Thuringian J. Post-Variscan deformation and hydrothermal mineralization in Saxo-Thuringia and beyond: Baltica meets Gondwana â€” the isotope geochemical record U.

2: Pre-Mesozoic Geology of Iberia: Cantabrian Zone structure | Nemesio Heredia Carballo - www.enganch

Pre-Mesozoic Geology of Iberia is a major reference for current understanding of the overall tectonostratigraphic evolution of the Iberian Massif.

Heredia Carballo 3 Structure 3. To the east and south, the Paleozoic A. The general structure of the CZ is shown in the 3. The thrust surfaces mostly diverge from a collisional orogen in the northwestern Iberian decollement located within the limestones and do- Peninsula, Cantabrian Zone CZ , is located in the lomites of the Lancara Formation Lower-Middle inner part of an arc described by the structures of Cambrian , although in the western part of the the orogen Asturian arc or Iberoarmorican arc; cross-section it is possible to observe that the Fig. The structure of this thrusts affect Precambrian rocks. Geometrically zone has a thin-skinned type of geometry, compli- there are two major thrust systems in the section. Somiedo-Correcilla, Sobia-Bod6n and Ara- systems. These combine to produce complex and ir- mo units Fig. The second thrust system start- regular map outcrop patterns of the thrust units, as ed its development beneath this earlier system and shown in Fig. The deformation took place under caused out-of-sequence thrusts, a thickening of the shallow crustal conditions, without metamorphism orogenic wedge and the progression of deformation and with only the local development of cleavage. There are a large number of references dealing The out-of-sequence thrusts, superimposed over the with the geology of the CZ. General syntheses on first thrust system, were responsible for the geome- the structure can be found in the papers of Julivert try of the Narcea Antiform and the thickening of , , , , Julivert and Marcos the orogenic wedge Fig. Further along, the , Julivert et al. This can be observed by comparing To the west, the CZ is separated from the more in- cross-sections along the CZ from different orienta- ternal areas of the orogen, the West Asturian- tions and by observing the mapped disposition of Leonese Zone, by the Narcea Antiform Fig. These do not form a concen- which shows Precambrian rocks exposed in its core. This boundary di- Palentine Unit Martinez Garcia formed as a vides paleogeographically different areas and repre- relatively autochthonous part of the Asturian Arc in sents approximately the upper front of cleavage the southwestern sector of the CZ Fig. Since the structure of this unit displays some R. D, Dallmeyer and E. Geological cross-section through the central part of the Asturian Arc [Z: Cross-sections showing two structural evolution stages of Fig. Sketch map showing a disposition of major thrust units similar to that of the leaves in a photographic camera iris. Arrows indicate local transport directions of thrusts features that make it different from overlying al- view of the cross-sections can be observed in the lochthonous units it will be described in a separate eroded core of the antiforms. The folds of the arched set are related to the There are two sets of folds in the CZ, named thrust sheet geometry and can be interpreted as transverse or radial and arched because of their leading edge folds Boyer , dorsal and frontal orientation in relation to the Asturian Arc Julivert culmination walls, etc. The folds of and Marcos The arched set runs parallel to the radial set can be related to lateral structures of the thrust traces, whereas the radial set ist trans- the thrust. Both fold sets underwent an important verse to them. The existence of transverse folds al- tightening after the emplacement of the unit or lows analysis of the deep geometry of the thrust units to which they are related. The tightening of sheets, since, due to thrust surfaces tilting, a map the radial folds was particularly intense in the Pon- 58 A. Perez Estaun and F. Bastida ga Unit clearly visible through the sinuous trace of part of the stratigraphic sequence to three times its the thrust surfaces Perez Estaun et al. An important characteristic of rez Marron and Perez-Estaun ; Fig. To accommodate the 3. Its geometry can be compared, although on al ramp and flat staircase geometry as well as asso- a smaller scale, to that of the Narcea antiform. This ciated structures, especially folds. However, there is deformation also caused the formation of a syn- considerable geometrical variability among the dif- form Aguasalio synform between the anti formal ferent thrust associations that can be differentiated stack and the frontal ramps of the nappes. Al- in detail in the CZ. Representative examples of though not shown on the cross-sections presented these associations follow. In the Esla nappe region wall ramps. These are commonly modified by sim- Fig. These and complex geometry of tectonic superposition. A Geological cross-section through, the Esla Unit. Structure of the northern part of the Somiedo Unit. C Frontal and lateral hangingwall ramps. D Geological section longitudinal to the structures. Generally, the structure where hangingwall lateral ramps are separated by is less complex than that of the Esla nappe region. In the Somiedo nappe a duplex develops within the lower part of its hangingwall Fig. Also impor- Central Coal Basin. This is a thrust sheet with a tant in this nappe is the great length and height of thick synorogenic Carboniferous sequence about the footwall frontal ramp of the basal thrust. The 5 km thick. Its map outcrop shows a cross-folding position of the major folds in the Somiedo, Sobia pattern which developed domes and basins Fig. The absence of the ramps, while the size and geometry of the of remarkable thrusts within this unit makes the set- units is controlled by the distance between the ting up of the relationships between thrusts and ramps Fig. These rearmost westernmost folds difficult. Often, the folds in the Central Coal thrust sheets show good examples of footwall and Basin, especially in its eastern part, are nothing but hangingwalliateral ramps, such as the footwalllat- a continuation of those already present in the east- eral ramps in the southern part of the Somiedo and ernmost unit Ponga Unit. In some cases, they are Sobia nappes. The most remarkable effects of these the result of amplification and tightening suffered ramps are the sudden structural truncation of the by the transverse fold related to the lower thrust structures in the sector, in particular that of the La- sheets Ponga Unit. In other cases, they may be gos syncline Somiedo nappe, Fig. Additional lateral Ponga Unit. The Ponga Unit consists of a large structures also occur in the northern part of the number of individual thrust sheets Julivert a, Somiedo nappe Bastida and Castro Fig. Many of these sheets have accumulated signifi- Fig. Structural contours showing the interference figures in domes and basins formed by the superposition of arched and transverse folds After Aller 62 A. Bastida cant displacements Fig. The accumulated dis- diate ramps. The number of individual thrust sheets placement of this unit is about 62 Ian Alvarez Ma- is large, but the shortening is less significant than in rron and Perez Estaun In this unit, there are the above units. The accumulated displacement frequent out-of-sequence thrusts with a dominant within this unit is of the order of 35 km. It is impor- southward transport direction, some extending into tant to emphasize that in both the Ponga and Picos the adjacent unit Picos de Europa Unit. Trans- de Europa units, the deformation took place in a verse folds are well developed in the Ponga Unit. The succession tures and significantly amplified after their initia- there is composed almost entirely of monotonous tion. The most outstanding examples of the lateral and massive limestones, as opposed to well-layered structures in the unit are in Rio Monasterio and Rio sequences with alternating lithologies in the other Color antiforms Alvarez Marron and Perez Estaun units. This probably accounts for the distinctive ; Fig. In the same way, in the Mampodre region, an important tear 3. Those Picos de Europa Unit. A Main thrust sheets: B Cartographic sketch of 3 Espinaredo thrust nappe, Beleno imbricated system and Se- the main later transverse faults: Strike-slip components in the Leon and Sa- rocks and tectonic units in the maps. Perez Estaim and F. Bastida resent alpine reactivations of previous thrusts Tosal 3. A particularly prominent fault is the Ventaniella In order to determine the structural evolution of the fault, which crosses the CZ in a NW-SE direction CZ, it is necessary to know the emplacement se- Fig. The thrust faulting migrates, in a general way, from the hinterland towards the fore- land, in a forward-type sequence. This can be dem- 3. Indeed, the presence of several zones can be found wherein cleavage has been de- synorogenic clastic wedges that relate to the forma- veloped along with anchizone-epizone metamor- tion of successive nappes progressively younging phism van der Pluijm and Kaars-Sijpesteijn ; towards the east shows that the first units to be em- Raven and van der Pluijm ; Aller et al. One of these zones is the southern part of and Aramo Units. This sequence morphism were produced later than the major agrees with the data obtained from a study of the structures of the CZ. Here, they are probably re- age of olistostrome sediments related to the em- lated to a local thermal gradient. Another area placement of the nappes. The deposits associated where cleavage has been developed is the Pisuerga- with the rearmost units give Westphalian B ages Carrion Unit. The dis- Lowermost Stephanian show continental facies placement pattern, in its current configuration, pre- unconformably over the thrust sheets already em- sents the following features Fig. The displacement vectors of all of the thrust synorogenic marine facies in the Picos de Europa sheets in the CZ show a distribution that verges Unit Marquinez Similar relations can also towards the core of the Asturian Arc centripetal be seen in the earlier Westphalian rocks. Although the deformation sequence can be said 2. Small changes in the direction of the displace- to be a forward type, there are several anomalous ment vectors may occur between adjacent units structures that do not fit this pattern, such as faults and gradational variations may occur within the that affect previously emplaced thrust sheets. Also, very same unit. The thrust units display the CZ have been deduced from kinematic indica- curving wedge shapes, which widen in a clockwise tors such as frontal and lateral elements of the direction around the Asturian Arc and have a distri- nappes and, less often, from rocks and structures bution not unlike that of the iris of a photographic associated with the thrust surfaces Arboleya ; camera. Farias ; Bastida et al. Idealized scheme of the Asturian Arc development 66 A. Leidse Geol Meded This evolution Carboniferous conodonts of the Cantabrian Mountains is shown in Fig. Spain and their stratigraphic application. Principa- placement of each thrust unit implies a shortening do de Asturias, Consejeria de Industria y Comercio, direction different from that of the previous nappes.

3: Pre-Mesozoic Geology of Saxo-Thuringia â€" Schweizerbart science publishers

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6: Morais ophiolite complex - Wikipedia

A summary of the overall geodynamic evolution of the Iberian Massif, which systematically describes major lithotectonic elements in terms of stratigraphy, palaeontology, sedimentology, structural.

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8: Pre-Mesozoic Geology of Iberia : R. D. Dallmeyer :

There are a large number of references dealing The out-of-sequence thrusts, superimposed over the with the geology of the CZ. General syntheses on first thrust system, were responsible for the geome- the structure can be found in the papers of Julivert try of the Narcea Antiform and the thickening of (, , ,), Julivert and.

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