

# **SpringerBriefs in Earth System Sciences**

## **Series editors**

Jorge Rabassa, Ushuaia, Argentina

Gerrit Lohmann, Bremen, Germany

Justus Notholt, Bremen, Germany

Lawrence A. Mysak, Montreal, Canada

Vikram Unnithan, Bremen, Germany

More information about this series at <http://www.springer.com/series/10032>

Silvia Leonor Lagorio · Haroldo Vizán  
Silvana Evangelina Geuna

# Early Cretaceous Volcanism in Central and Eastern Argentina During Gondwana Break-Up

Silvia Leonor Lagorio  
Instituto de Geología y Recursos Minerales  
Servicio Geológico Minero Argentino  
(IGRM-SEGEMAR), Parque Tecnológico  
Miguelete  
San Martín, Buenos Aires  
Argentina

Silvana Evangelina Geuna  
IGEBA (CONICET-UBA)  
Departamento de Ciencias Geológicas,  
Facultad de Ciencias Exactas y Naturales,  
Universidad de Buenos Aires  
Ciudad Autónoma de Buenos Aires  
Argentina

Haroldo Vizán  
IGEBA (CONICET-UBA)  
Departamento de Ciencias Geológicas,  
Facultad de Ciencias Exactas y Naturales,  
Universidad de Buenos Aires  
Ciudad Autónoma de Buenos Aires  
Argentina

ISSN 2191-589X                      ISSN 2191-5903 (electronic)  
SpringerBriefs in Earth System Sciences  
ISBN 978-3-319-29591-6              ISBN 978-3-319-29593-0 (eBook)  
DOI 10.1007/978-3-319-29593-0

Library of Congress Control Number: 2016930287

© The Author(s) 2016

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made.

Printed on acid-free paper

This Springer imprint is published by SpringerNature  
The registered company is Springer International Publishing AG Switzerland

# Preface

The objective of this contribution is to analyse the geochemistry, petrogenesis and geodynamics of the Early Cretaceous volcanism in Argentina, mainly located in Córdoba and Misiones provinces, during the break-up of Gondwana.

In Córdoba (central Argentina), the analysed volcanic rocks are outcropping in Sierra Chica and different groups of lithological types were recognized in various localities. These are mainly alkaline basalts that reflect a lithospheric mantle source.

In Misiones (north-eastern Argentina), the volcanic rocks are tholeiitic basalts and belong to Paraná Magmatic Province (PMP) which is regionally extended in South America and has a counterpart in Africa (in the localities of Etendeka and Angola). This large igneous province (LIP) has been widely studied by several authors, and different models have been considered to explain its origin. Dating obtained through various methodologies ( $^{40}\text{Ar}/^{39}\text{Ar}$ , U–Pb, and Re–Os isochrons) and published by different authors indicate an Early Cretaceous age between  $131.6 \pm 2.3$  and  $134.7 \pm 1$  Ma for PMP, though interbedded acid volcanic rocks yielded even  $137.3 \pm 1.8$  Ma.

A new  $^{40}\text{Ar}/^{39}\text{Ar}$  age of  $129.6 \pm 1$  Ma from an alkaline rock of Sierra Chica of Córdoba (SCC) presented in this contribution, points out that this volcanism was slightly younger than PMP.

It is suggested that the volcanism in Misiones and in the overall LIP could have been linked to an ascending limb of a large-scale convective roll induced by the subduction in the western margin of Gondwana. This ascending limb might have mainly affected weak cortical areas (old sutures between cratons). On the other hand, the volcanism of Sierra Chica might have been related to a small-scale edge-driven convection triggered by the great contrast in thickness between the Río de la Plata craton and the Pampia terrane.

# Acknowledgments

This monograph is dedicated to the memory of Enzo Piccirillo, Carlos Ernesto Gordillo and Daniel Alberto Valencio, from whom the authors learnt how to work in science. Enzo Piccirillo and Marco Iacumin are specially acknowledged for the helpful discussions and reviews of the Ph.D. thesis of the first author, as well as for the support in technical, analytical and field work received from the University of Trieste. Special gratitude for Giuliano Bellieni for microprobe analyses carried out at the University of Padova. In the same way, the following are kindly acknowledged: Marcela Remesal, Sonia Quenardelle, Stella Poma, Víctor Ramos, Carlos Rapela, José Viramonte, Mónica Escayola and Iván Petrinovic for significant opinions and suggestions expressed in diverse opportunities. We also thank SEGEMAR, CONICET and Universidad de Buenos Aires for letting us do this work, particularly to Alberto Ardolino and Jose Mendía, for the encouragement received to undertake the study of Misiones rocks. Kindly thanks to Claudio Gaucher and Jorge Bossi for the significant comments on the Precambrian units in south-eastern South America. This work was supported by grants from Universidad de Buenos Aires (UBACyT 20020100100894) and Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET-PIP 112-200801-02828).

# Contents

<b>1 Introduction</b> . . . . .	1
1.1 Introduction . . . . .	1
References . . . . .	5
<b>2 Early Cretaceous Volcanism in Central Argentina</b> . . . . .	9
2.1 Early Cretaceous Volcanism in Córdoba Province . . . . .	9
2.1.1 Volcanism of the Sierra Chica of Córdoba Province . . . . .	9
2.1.2 Early Cretaceous in the Levalle Basin of Córdoba Province . . . . .	75
2.2 Early Cretaceous in San Luis Province . . . . .	76
2.3 Probable Early Cretaceous Rocks in La Pampa and Buenos Aires Provinces . . . . .	78
References . . . . .	78
<b>3 Early Cretaceous Volcanism in Eastern Argentina</b> . . . . .	87
3.1 Early Cretaceous in Misiones Province . . . . .	89
3.1.1 Geological Setting . . . . .	89
3.1.2 Age of the Paraná Magmatic Province (PMP) . . . . .	91
3.1.3 Classification and Petrography . . . . .	92
3.1.4 Geochemistry of Lavas from Misiones Province and Comparison with Magmas from the Whole Paraná Magmatic Province . . . . .	95
3.1.5 Petrogenetic Aspects of Lavas of Misiones Province in the Context of Paraná Magmatic Province . . . . .	108
3.1.6 Petrogenetic Aspects of Tholeiites of Misiones Province (North-eastern Argentina) in the Context of PMP. Relationship with the Source of the Alkaline Volcanism of Córdoba Province (Central Argentina) . . . . .	112
References . . . . .	116

<b>4 Palaeoreconstruction of Pangea During the Early Cretaceous, and Location of Volcanism in Córdoba and Misiones Provinces with Respect to Seismic Structures in the Lower Mantle . . . . .</b>	<b>123</b>
References . . . . .	125
<b>5 Geodynamical Setting for the Tholeiites of Misiones Province (North-eastern Argentina) in the Context of the PMP and the Alkaline Volcanism of Córdoba Province (Central Argentina) . . . . .</b>	<b>129</b>
References . . . . .	134
<b>6 Conclusions . . . . .</b>	<b>137</b>
<b>Index . . . . .</b>	<b>141</b>