Presentation of *The Geology of Colombia*

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Abstract The number of research papers and brand new geoscientific data of the Colombian territory has increased progressively in recent years. This has generated the rise of new hypotheses to explain the origin of what is now Colombia, but also the updating of pioneering ideas. This fact, added to the need to gather the increasing amount of information produced by different areas of the Earth sciences, encouraged the Servicio Geológico Colombiano to edit the first scientific book about The Geology of Colombia. The aim of this chapter is to describe The Geology of Colombia in terms of how the editorial process was outlined, the main issues considered to improve texts and figures, and the content the reader will find in each chapter. It also presents the scientific outreach strategy designed paralleled to the editorial process which includes two audiences mainly: one created for scientists based on topical sessions related to the geology of Colombia and oral presentations in scientific conferences, and secondly a strategy aimed at the general public which consisted in writing stories that were published in national and local newspapers, and producing multimedia content for social media and the web page. As a result, the editorial work presented in four volumes includes 58 chapters, almost three times the initial projection, written by 179 researchers and edited according to the international quality standards. On the other hand, the number of readers of the articles published in the newspapers as well as the engagement of the social media content by diverse audiences reflects the multidisciplinary and well–oriented work during the process.

Keywords: *Colombian geology, editorial process, editing figures, scientific outreach.*

Resumen El número de investigaciones y nuevos datos geocientíficos del territorio colombiano ha aumentado progresivamente en los últimos años. Esto ha generado el surgimiento de recientes hipótesis para explicar la formación de lo que hoy es Colombia, pero también la actualización de las ideas pioneras. Este hecho sumado a la necesidad de reunir el volumen creciente de información que se produce desde diferentes áreas de las ciencias de la Tierra llevó al Servicio Geológico Colombiano a producir la primera obra editada sobre la geología nacional: *The Geology of Colombia*. El objetivo con este capítulo es presentar qué es *The Geology of Colombia*, cómo fue

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Supplementary Information:

S1: https://www2.sgc.gov.co/LibroGeologiaColombia/tgc/sgcpubesp352019Presentations1.pdf

S2: https://www2.sgc.gov.co/LibroGeologiaColombia/tgc/sgcpubesp352019Presentations2.pdf

S3: https://www2.sgc.gov.co/LibroGeologiaColombia/tgc/sgcpubesp352019Presentations3.pdf

S4: https://www2.sgc.gov.co/LibroGeologiaColombia/tgc/sgcpubesp352019Presentations4.ens

S5: https://www2.sgc.gov.co/LibroGeologiaColombia/tgc/sgcpubesp352019Presentations5.pdf

el proceso editorial para su producción, cuáles son los principales aspectos que se consideraron para la mejora de textos y figuras y qué se puede encontrar en cada capítulo. Adicionalmente, se presenta la estrategia de divulgación científica que se realizó junto con el proceso editorial. La estrategia se dirigió a público especializado a través de la organización de sesiones técnicas sobre geología de Colombia y la presentación de conferencias en encuentros científicos y a público lego con la creación de contenidos de texto y multimedia que se publicaron en periódicos de circulación nacional, revistas, radio y en redes sociales y página web. El resultado de este trabajo editorial y de divulgación se ve reflejado en la producción de 58 capítulos, cerca del triple de capítulos proyectados durante la fase inicial del proyecto, que fueron escritos por 179 geocientíficos y editados siguiendo estándares internacionales de calidad. También, se refleja en los resultados positivos de la estrategia de divulgación para público lego: número de lectores de artículos periodísticos, alcance de las publicaciones en redes sociales, entre otros, que fueron posibles gracias al trabajo multidisciplinar y orientado durante la elaboración y publicación del contenido.

Palabras claves: *geología colombiana, proceso editorial, edición de figuras, divulgación científica.*

1. Introduction

Since its creation in 1916, the Servicio Geológico Colombiano (SGC) has been in charge of the research and publication of official geological information to support the development of state policies. With this aim, the SGC generates and makes available to the community scientific information related to the processes that occur inside the Earth and the external processes that shape the landscape of the Colombian territory. This information is useful for the planning and progress of the country, constituting one of the essential pillars for the balanced and sustainable development of Colombia, as expressed in the "Plan estratégico del conocimiento geológico del territorio colombiano 2014–2023" presented by the SGC.

With this approach and in light of the recent increase in the production of geoscientific information due to technological advances and accessibility of various analytical methods, the SGC considered it timely to compile the work *The Geology of Colombia*. This multivolume book includes the geological history of Colombia from the Proterozoic to the Quaternary and aligns with SGC's goal of generating and providing high–quality and sufficient knowledge. *The Geology of Colombia* reports updates on the main paradigms of regional geology and unpublished research and data that have not been released to the international geoscientific community. These factors account for the progress in the knowledge of the geology of the country and the development and implementation of new tools and technologies for Earth science research applied to the national territory.

The Geology of Colombia presents information on the regional geology of the country, local geological events of international interest, and contributions and results of some of the projects carried out by the SGC. This knowledge is fundamental to the management and planning of the territory and to compliance with the mining–energy and water demands, among others, for economic revival. The work also highlights the development and level of geoscientific research in Colombia. Through this publication, numerous research proposals and possibilities for establishing agreements and collaborations that strengthen geological research processes and encourage the training of Colombian geoscientists will emerge. Due to the type of information presented in the publication, will become a reference for those interested in Colombian regional geology as well as for those who study the geological evolution of the northern Andes.

Fifty–eight chapters distributed in four volumes make up *The Geology of Colombia*. Volume 1 brings together research on the events that occurred during the Proterozoic – Paleozoic; volume 2 deals with the Mesozoic geological history of the Colombian territory; volume 3 compiles Paleogene to Neogene events and record; and volume 4 groups research on the most recent processes (those that occurred during the Quaternary) and modern analytical techniques and national territory data acquired by the SGC in recent years. *The Geology of Colombia* is an edited, peer–reviewed editorial work written in English, the communication channel of the international scientific community. The chapters are presented in the same format in which research papers are delivered for discussion and debate: scientific articles.

The authors of *The Geology of Colombia* are geoscientists specializing in the study of processes, events, and geological features of the Colombian territory. Because the current level of knowledge in geology makes it impossible for books to be written by a single author, the SGC brought together renowned researchers who have worked in different areas of the country to produce a book written from various areas of geoscientific knowledge. In total, 179 researchers participated as authors representing 12 countries: Colombia, Argentina, Brasil, España,

Switzerland, Germany, the United States of America, Sweden, the United Kingdom, France, Japan, and the Netherlands. They also represent 55 national and international institutions, including research institutes, universities, academies, public institutions, and private and mixed companies. Fifteen of the twenty researchers with the highest h–index who publish on Colombian geology, according to Scopus, are authors of *The Geology of Colombia*. The h–index is understood as a numerical value that scores both the number of publications of a researcher and the impact or number of citations of their work.

The editorial group consisted of eight geoscientists, a graphic designer, an audiovisual producer, and a scientific journalist from the Grupo Mapa Geológico de Colombia of the SGC. This group led the two editions of the Geological Map of Colombia at a scale of 1:1 M, versions 2007 (Gómez et al., 2007) and 2015 (Gómez et al., 2015); the Geological Map of South America at a scale of 1:5 M published in 2019 (Gómez et al., 2019), and the production and editing of several scientific publications and scientific outreach, including the book *Compilando la geología de Colombia: Una visión a 2015* (Gómez & Almanza, 2015). It is worth mentioning that the main function of the Grupo Mapa Geológico de Colombia is to periodically update the Geological Map of Colombia. This entails the compilation and review of publications regarding Colombia in national and international indexed journals. This background was valuable since it allowed us to know who were the most suitable researchers, based on their trajectory, to write the different chapters, in addition to knowing what unpublished information of the SGC was relevant to be published in *The Geology of Colombia*.

The work of the editorial group focused on improving the quality of texts and images and developing an outreach strategy to disseminate the research published in the work. The editorial and scientific outreach activities were led by the coordinator of the working group and editor–in–chief of the work. To ensure that the publication met the highest technical specifications and indexing criteria, the editorial group had the support and counsel of the Observatorio Colombiano de Ciencia y Tecnología and the Asociación Colombiana para el Avance de la Ciencia. The Spanish–English translation and proofreading services in English were performed with American Journal Experts, an American publishing services company that works with world–class publishers such as Springer, Nature, AGU, Cambridge University Press, and Elsevier. The English translations and style corrections were carried out by scientists with postgraduate degrees in various branches of geoscience and whose native language is English. The editorial team also had the support of four globally recognized geoscientists with experience in the editorial field. These individuals formed the Scientific Committee of the publication:

Victor A. RAMOS: Senior researcher of the Consejo Nacional de Investigaciones Científicas y Técnicas (Conicet), professor emeritus at the Universidad de Buenos Aires, Argentina, and president of the Academia Nacional de Ciencias Exactas, Físicas y Naturales of Argentina. He has dedicated more than 50 years to the understanding of the tectonic evolution of the Andes. His contributions have helped establish the tectonic processes responsible for the Andean orogeny, from Tierra del Fuego in the south to the Colombian Andes in the north. He was recognized by the World Academy of Sciences in 2017 for his outstanding contributions in the field of geology. In addition to encouraging the production of the editorial work and actively participating in the planning of the project, Professor RAMOS supported the editorial committee through the review of the chapters on tectonics and advice on specific aspects of the editorial process. He was also the author of the Prologue of *The Geology of Colombia* (Ramos, 2020).

Cees PASSCHIER: Professor of structural geology and tectonophysics in the Department of Earth Sciences of the Johannes Gutenberg–Universität Mainz in Germany. He has been president of the Commission on Tectonics and Structural Geology of the International Union of Geological Sciences (IUGS) and editor–in–chief of the *Journal of Structural Geology* since 2008. His research focuses on the quantitative analysis of the kinematics of deformed rocks through microtectonic studies and numerical and laboratory procedures. Professor PASSCHIER helped with the review of the chapters on structural geology.

David BUCHS: Professor at the School of Earth and Ocean Sciences of Cardiff University in the United Kingdom. Professor BUCHS works on the formation and accretion of seamounts, as well as on the magmatic and tectonic evolution of the Isthmus of Panamá. He is the coordinator of the Erasmus+ exchange program, an editor for PLOS ONE and a consulting geologist for the Panamá Canal Authority. Professor BUCHS helped review the geochemistry content.

Agustín CARDONA: Professor at the Universidad Nacional de Colombia Sede Medellín. His research includes topics such as the geological evolution of the Andes and the Caribbean, the analysis of convergent margins, and the geochemistry and geochronology of igneous, sedimentary, and metamorphic rocks. Professor CARDONA helped review of the content regarding the geochronology and geology of Colombia.

As academic reviewers of the chapters, 81 researchers from different countries participated. They were selected by the editorial group based on their experience, scientific production, and knowledge on the subject of the chapter to be evaluated. The quality of the group of reviewers is demonstrated by the publication index scores (h–index) of the researchers that compose it. Peer–reviewed work was essential for ensuring the quality of the research included in the editorial work. The comments and criteria arising from the reviews of the peer reviewers allowed us to correct and enrich the first versions of the manuscripts and supporting material.

With this background, *The Geology of Colombia* is destined to become a classic of Colombian geology, both for the amount

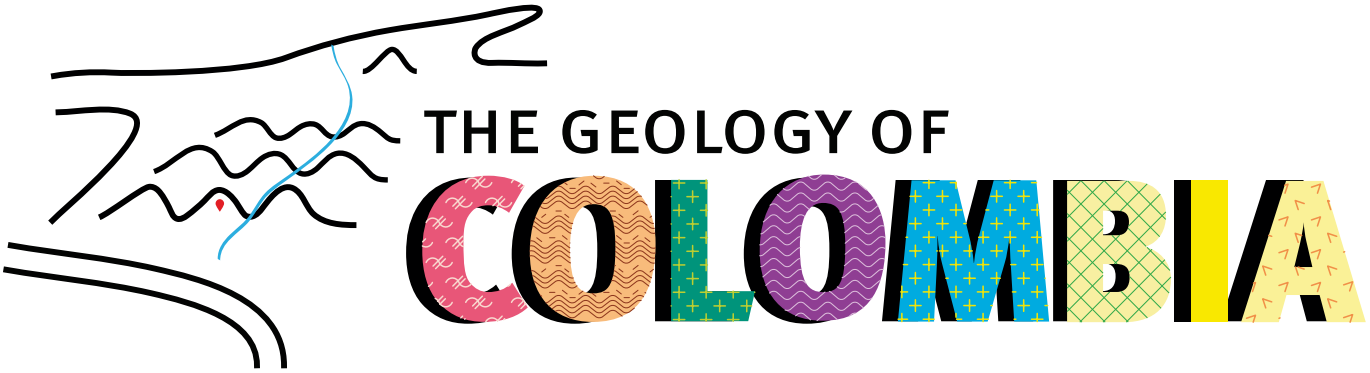


Figure 1. Image of *The Geology of Colombia*.

of new data and for the interpretations and novel ideas about the geological evolution of the Colombian territory and, in general, about the northwest South American subcontinent. The work was funded by the SGC, contains, 917 color figures, 190 tables, and 5873 bibliographic references and can be downloaded free of charge from the SGC website:

- Volume 1: https://doi.org/10.32685/pub.esp.35.2019
- Volume 2: https://doi.org/10.32685/pub.esp.36.2019
- Volume 3: https://doi.org/10.32685/pub.esp.37.2019
- Volume 4: https://doi.org/10.32685/pub.esp.38.2019

2. The logo of *The Geology of Colombia*

The logo of *The Geology of Colombia* (Figure 1) was inspired by major physiographic features of the Colombian territory and geological conditions and major geologic events that are shown in the Geological Map of Colombia 2015 (Gómez et al., 2015). The sinking Nazca Plate of the subduction zone, the three cordilleras, the Sierra Nevada de Santa Marta, the positioning of the actual magmatic chamber located in the Central Cordillera, and the Magdalena River, the most important river in Colombia in terms of its economy, culture, and history, are depicted.

Colors and patterns were used to fill in the word **COLOMBIA**. The colors were taken from the International Chronostratigraphic Chart (Cohen et al., 2013; updated v2020/01) and represent chronostratigraphic units of the Geological Map of Colombia 2015 (Gómez et al., 2015). The letter **C** is shaded in pink to represent the medium–grade gneisses of the Mitú Migmatitic Complex cropping out from the eastern region of Colombia in the Amazonas Craton from the Paleoproterozoic. The letter **O** is filled with a pattern that represents Mesoproterozoic and Neoproterozoic gneisses of the Putumayo Orogen (Ibañez–Mejia, 2020) that crop out from the Llanos Foothills, the Eastern Cordillera, Sierra Nevada de Santa Marta, and La Guajira. The letter **L** is shaded in green to represent Ordovician plutonic rocks of the Santander Massif representing the Famatinian Orogeny of Ramos (2018). The Triassic schists of the Central Cordillera, which are related to the assembly of Pangea, are represented in the letter **O**. The letter **M** is shaded in Jurassic blue to represent the numerous igneous rocks found in the Jurassic magmatic arc. The Upper Cretaceous strata deposited in the Cretaceous epicontinental basin of Colombia, which serve as a source of oil, are represented in the letter **B**. The Miocene sedimentary continental rocks of the Andean Orogeny compose the letter **I**. Finally, the letter **A** is shaded with a pattern that represents the active volcanic arc of the Central Cordillera of Colombia.

Thus, the colors and patterns used in the word *Colombia* symbolize major geological events that have occurred in Colombia, whose geological history is described in *The Geology of Colombia*.

3. The Editorial Process

The editorial production of *The Geology of Colombia* was carried out following a series of steps that are presented as a flow diagram (Figure 2). The editorial team developed this step by step process to ensure the quality of the publication, the standardization of the processes, and the accurate dissemination of the work among the geoscientific community. The process was created based on the international standards of the production and editing of scientific publications of research articles, the editorial experience of the working group in the preparation and editing of previous scientific publications, and the advice of the Observatorio Colombiano de Ciencia y Tecnología. The activities indicated in the diagram were carried out by the editorial team, the authors, the reviewers and, in some cases, involved the work of more than one of these contributors at the same time. Far from being a static working guide proposed at the beginning of the project, this editorial process was adapted and improved throughout the revision, adjustment, and publication of the chapters.

Although the diagram contains the stages typical of the editorial process of a publication such as *The Geology of Co-*

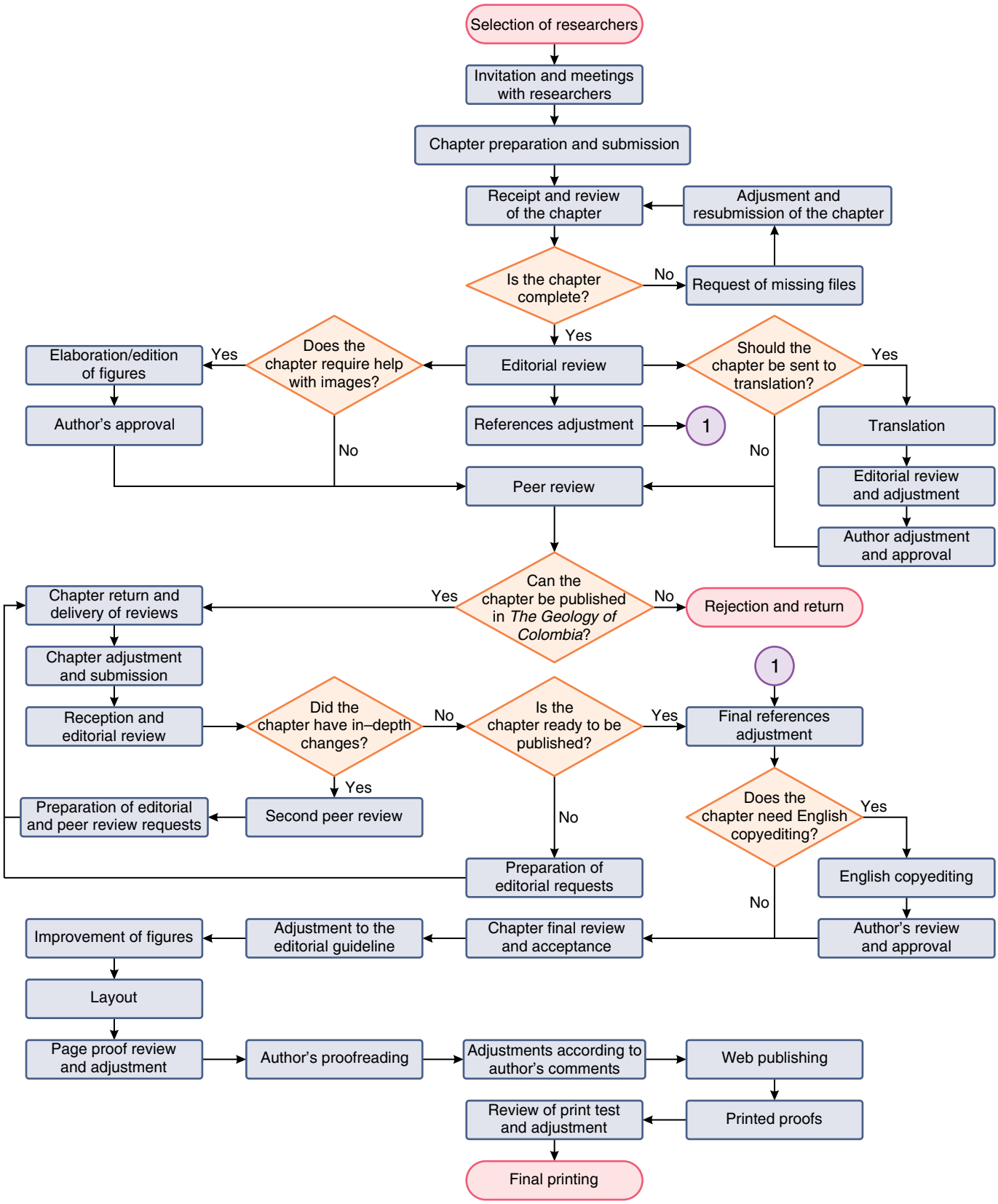


Figure 2. Editorial process of *The Geology of Colombia*.

Figure 3. Presentation of the editorial project in the offices of Ecopetrol. On the right, Jorge GÓMEZ TAPIAS, editor of *The Geology of Colombia*, and on the left, Andrés MORA, geologist and author and coauthor of seven chapters of the work.

lombia, it presents several characteristics that are detailed throughout this section. Note the support that the editorial team offered to the authors during the preparation of the chapters and before sending the manuscripts for peer review. In these stages, the support provided by the team focused on developing the figures, searching and consulting for information to complement the manuscript, and translation of content. The bibliographic references were created and adjusted following a citation style adapted to the publications generated in the country, the figures were developed and reworked based on concepts and hierarchies used by the Grupo Mapa Geológico de Colombia for several years, and editorial guidelines were created based on scientific and international style guides and manuals.

3.1. Call for and Submission of Chapters

The production of *The Geology of Colombia* began in 2017. After planning the project in the first months of the year, the editorial group selected and invited authors to contribute. In total, 74 geoscientists recognized for their expertise in specific topics of national geology and the number and impact of their publications in geological cartography, volcanology, seismology, geochemistry, stratigraphy, and other branches of geosciences were convened. These scientists were invited to participate in the work together with their research groups. In the selection of authors, the coverage of the main geological events of the national territory was also considered. This allowed the work to cover the vast majority of events and outstanding geological features of national geology.

The editorial team made visits to universities, companies, and research centers to present the editorial project and convince the authors to participate, highlighting the relevance of their contributions. There were 57 presentations on the project and several meetings and teleconferences with the invited authors during April, May, and June 2017 (Figures 3, 4). This convening work resulted in the production and submission for publication of more than 50 chapters, even though based on similar editorial experiences in other countries, a maximum of 20 submitted chapters were expected.

During the chapter development phase, the editorial team prepared the necessary editorial guidelines for the generation of texts and figures (Authors' recommendations, Template, Checklist, and Reference Citation Style; see Supplementary Information 1, 2, 3, and 4, respectively), organized the editorial work scheme, and prepared everything from the image to the outreach pieces and the promotion of the editorial project. The material for the preparation of the chapters was sent to the authors through periodic newsletters that included videos and promotional pieces of the work to motivate them. During this phase and with the support of the Observatorio Colombiano de Ciencia y Tecnología, peer evaluation forms, certificates for reviewers, confidentiality agreements, and other documentation required in later phases of the editorial process were prepared.

Figure 4. Virtual meeting with Mauricio PARRA, professor at the Universidade de São Paulo, Brasil.

Additionally, a photographic record was compiled that accompanies the biographical notes of the publication and several field trips were made to collect high–quality photographic material. This material was used to replace low–quality photographs in some chapters, to develop the covers and back covers of the work, and to prepare the graphic pieces that were used for the chapter outreach campaign on the website (https://www2.sgc.gov.co/LibroGeologiaColombia/Paginas/Inicio.aspx) and the SGC social networks. Approximately 1500 photographs were obtained.

In this phase, the editorial team supported, in addition, the development of 70 chapter figures and the editing of more than 20 at the request of the authors, and the preparation of bibliographic references for 10 chapters (about 12 000 references). The team began the preparation of three chapters for publication in *The Geology of Colombia*: (1) *Presentation of The Geology of Colombia* , (2) *Physiographic and Geological Setting of the Colombian Territory*, and (3) *Rear–Arc Small–Volume Basaltic Volcanism in Colombia: Monogenetic Volcanic Fields*.

During the manuscript preparation stage, four workshops were organized for authors affiliated with the SGC to improve the technical level of the chapters. The workshops were on geochemistry, tectonics, geochronology, and structural geology with emphasis on the interpretation of geological outcropping structures and a cross–cutting theme that was addressed in all the workshops: recommendations for the writing, editing, and publication of high–impact scientific texts. The workshops were guided by the Scientific Committee of the publication: Victor A. RAMOS, Cees PASSCHIER (Figure 5), David BUCHS (Figure 6), and Agustín CARDONA. In these workshops, the authors had the opportunity to present their progress and resolve specific concerns about their research and writing process. The workshops were very useful since some of the authors had never presented their research in a scientific article format for indexed publication written in English.

Between October 2017 and 2018 the chapters that make up *The Geology of Colombia* were received. Once submitted, the chapters went through an editorial review in which an editorial concept or document was generated with the findings of the review and some comments or suggestions for the author. This review allowed to know the contents of the chapters to select possible reviewers and whether the chapter required improvement of the figures or translation into English before academic peer review.

The adjustment of the references was one of the main works carried out by the editorial team. This phase began in the early stages of the editorial process. It consisted of completing and adjusting the list of references according to the style proposed for the publication, as well as ensuring the citation of all the references in the text, figures, and tables.

3.2. Bibliographic Reference Style

The style of references adopted in the work *The Geology of Colombia* is the product of a historical work carried out by the Grupo Mapa Geológico de Colombia. This group has authored the different versions of the Geological Map of Colombia 1M,

Figure 5. Workshop on structural geology and publication of scientific articles offered by Professor Cees PASSCHIER. As part of this event, a field trip was conducted to determine the deformation of the Pericos and Ibagué Faults in the surroundings of Ibagué.

a work that is broadly based on compiling and synthesizing the geoscientific information of different national and international publications that have been generated by the SGC, universities, and other institutions. This resulted in an extensive and varied bibliography that had to be standardized for use and publication. The references were standardized considering the types of documents found and from the review of high–impact journals, from which the best reference criteria were obtained. Although this work began with the development of the first versions of the geological maps of Colombia, it has been perfected to give the reader, in the clearest and most accurate way, the information necessary to consult the supporting references.

The style of the references of *The Geology of Colombia* was initially based on the style of *Tectonophysics* and elements of other journals, such as the use of '&' instead of 'and' in the citations of references implemented in the publications of the Geological Society of London. This style had already been used in the book *Compilando la geología de Colombia: Una visión a 2015* (Gómez & Almanza, 2015). However, taking into account some particularities and the variety of information compiled on *The Geology of Colombia*, it was necessary to include additional information or to create different categories; thus, models for more than 10 types of scientific documents were obtained. Among these are the explanatory reports of the maps and unpublished reports, for which the SGC uses the Geoscientific Information Integration Engine (Motor de Integración de Información Geocientífica, MIIG), which allows access to a large portion of the documents that are widely cited in *The Geology of Colombia*. This search engine can be found on the web page https://miig.sgc.gov.co/Paginas/advanced.aspx.

Next, the references used for each type of document are described, a template and an example for each one are presented:

Geological Maps

In this type of document, it is important to specify whether the authors are compilers of the information contained in the maps, as is the case of the Geological Map of Colombia, so the word "compilers" is included. If this is not the case and the maps were created by the authors, this word is omitted, but all the available information provided is organized in the following model:

Last names of the authors, First and middle name initials. & Last names of the authors, First and middle name initials, compilers. Year. Name of the map. Scale. Publisher, number of pages (in case it has more than one). City of publication. DOI

Example:

Gómez, J., Montes, N.E., Nivia, Á. & Diederix, H., compilers. 2015. Geological Map of Colombia 2015. Scale 1:1 000 000. Servicio Geológico Colombiano, 2 sheets. Bogotá. https://doi.org/10.32685/10.143.2015.936

Figure 6. Geochemistry workshop offered by Professor David BUCHS.

Scientific Journals

Due to the large number of publications in scientific journals, it is important to provide all the information available to help the reader locate the reference. In addition to the name of the journal, volume, issue number, and range of pages must be included. Finally, the digital object identifier (DOI) is indicated, if available, which is the easiest way to access the article information.

Last names of the authors, First and middle name initials. & Last names of the authors, First and middle name initials. Year. Title of the article. Journal, Volume(Issue): Range of pages. DOI

Example:

Gómez, J., Montes, N.E., Almanza, M.F., Alcárcel, F.A., Madrid, C.A. & Diederix, H. 2017. Geological Map of Colombia 2015. Episodes, 40(3): 201–212. https://doi.org/10.18814/epiiugs/2017/v40i3/017023

Edited Books

One of the most common errors when citing this type of publication is the omission of the editors, so the proposed model ensures that this information is included correctly.

Last names of the authors, First and middle name initials. & Last names of the authors, First and middle name initials. Year. Title of the article. **In:** Last names of the editors, First and middle name initials. **(editors)**, Title of the book, Editor or publisher, Name of the edition Number, Range of pages. DOI

Example:

Moreno–Sánchez, M., Gómez–Cruz, A. & Buitrago–Hincapié, J. 2020. Paleozoic of Colombian Andes: New paleontological data and regional stratigraphic review. In: Gómez, J. & Mateus–Zabala, D. (editors), The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, p. 167–203. Bogotá. https://doi.org/10.32685/pub.esp.35.2019.09

A variation occurs when only the book editors are mentioned:

Gómez, J. & Almanza, M.F., **editors**. 2015. Compilando la geología de Colombia: Una visión a 2015. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 33, 401 p. Bogotá.

Books and Booklets

The following model contains the information necessary for referencing this type of document:

Last names of the authors, First and middle name initials. & Last names of the authors, First and middle name initials. Year. Title of the book, Editor or publisher, Number of pages. City of publication, Country. DOI

Example:

McGavin, G.C. 2001. Essential entomology: An order–by–order introduction. Oxford University Press, 328 p. Oxford, UK.

Proceedings from a Congress, Symposium, or Conference

For the documents obtained from different scientific outreach events, the type of format in which the information is found must be specified; this can include memoirs, abstracts, and summaries on CD–ROM, among others.

Last names of the authors, First and middle name initials. & Last names of authors, First and middle name initials. Year of the event. Title of the presentation. Name and version of the event. Document format, number of pages or page. City of the event. DOI

Example:

Bermúdez, H.D., Stinnesbeck, W., Bolívar, L., Rodríguez, J.V., García, J. & Vega, F.J. 2015. Paleosismitas asociadas al límite K–Pg en la isla de Gorgonilla, Pacífico colombiano. XV Congreso Colombiano de Geología. Abstracts CD Rom, p. 1080. Bucaramanga.

In some congresses, the PDFs of the abstracts are given a code; in these cases, it is recommended to use the code of the abstract instead of the pages.

Theses

In most university repositories, there is an option for filtering theses by the degree obtained with their presentation; therefore, in the reference for this type of document, whether it is an undergraduate, master's, or doctoral thesis must be specified.

Last names of the authors, First and middle name initials. & Last names of authors, First and middle name initials. Year. Title of the thesis. Degree of thesis. University, number of pages. City of presentation.

Example:

Leal–Mejía, H. 2011. Phanerozoic gold metallogeny in the Colombian Andes: A tectono–magmatic approach. Doctorade thesis, Universitat de Barcelona, 989 p. Barcelona.

Map Memoirs

These explanatory reports are documents that accompany the geological maps of the SGC. To differentiate a reference to this type of document from a reference to a map, "Explanatory memoir" is included before the name of the map to which it corresponds, as shown in the following model:

Last names of the authors, First and middle name initials. & Last names of authors, First and middle name initials. Year. Explanatory memoir: Name of the map. Scale. Publisher, number of pages. City of publication.

Example:

Rodríguez, G., Zapata, G., Velasquez, M.E., Cossio, U. & Londoño, A.C. 2003. Memoria explicativa: Geología de las planchas 367 Gigante, 368 San Vicente del Caguán, 389 Timaná, 390 Puerto Rico, 391 Lusitania (parte noroccidental) y 414 El Doncello. Scale 1:100 000. Ingeominas, 166 p. Bogotá.

Unpublished Reports

Unpublished reports refer to the products of projects developed by professionals of the SGC or other national entities. These can be found on the MIIG page mentioned above and are referenced as follows:

Last names of the authors, First and middle name initials. & Last names of authors, First and middle name initials. Year. Name of the report. Publisher, unpublished report, number of pages. City of publication.

Example:

Celada, C.M., Garzón, M., Gómez, E., Khurama, S., López, J.A., Mora, M., Navas, O., Pérez, R., Vargas, O. & Westerhof, A.B. 2006. Potencial de recursos minerales en el oriente colombiano: Compilación y análisis de la información geológica disponible (fase 0). Servicio Geológico Colombiano, unpublished report, 165 p. Bogotá.

For internal reports of the SGC that are consecutive, it is recommended to indicate the number and use the expression 'Internal report'.

Hubach, E. & Alvarado, B. 1932. Estudios geológicos en la ruta Popayán–Bogotá. Servicio Geológico Nacional, Internal report 213, 132 p. Bogotá.

Web Links

When the information contained in web pages is referenced, it is important to specify the year and month in which it was accessed, since the information can be modified. If a program obtained from the web is referenced, the version used must be included.

Last names of the authors, First and middle name initials. & Last names of authors, First and middle name initials. Year. Name of the document: link (accessed on month year).

Example:

Dyment, J., Lesur, V., Hamoudi, M., Choi, Y., Thebault, E. & Catalan, M. 2015. World digital magnetic anomaly map version 2.0: http://www.wdmam.org (accessed on October 2017).

Others

There are a number of references that fall outside of the previous categories. For these, the suggestions usually given are to cite them as closely as possible to the style described above.

Cohen, K.M., Finney, S.C., Gibbard, P.L. & Fan, J.X. 2013 (updated v2020/01). The ICS International Chronostratigraphic Chart. Episodes, 36(3): 199–204. https://doi.org/10.18814/epiiugs/2013/v36i3/002

FGDC (prepared for the Federal Geographic Data Committee by the U.S. Geological Survey). 2006. Federal Geographic Data Committee Digital cartographic standard for geologic map symbolization. Federal Geographic Data Committee Document Number FGDC–STD–013–2006, 290 p. Reston, USA.

International Commission on Zoological Nomenclature (ICZN). 1999. International code of zoological nomenclature. The International Trust for Zoological Nomenclature, 401 p. London, UK.

Newell, D.B. & Tiesinga, E., editors. 2019. The International System of Units (SI). National Institute of Standards and Technology. NIST Special Publication 330, 122 p. https://doi.org/10.6028/NIST.SP.330-2019

USGS. 2004. Shuttle Radar Topography Mission, 1 Arc Second– República de Colombia, Unfilled Unfinished 2.0, Global Land Cover Facility. University of Maryland, February 2000. Maryland, USA.

3.2.1. Organization of the list of references

In addition to the standardization of the references, the order of the references had to be agreed upon to allow the reader to find the reference that corresponds to the citations within the chapters. The organization of this list mainly followed two guidelines:

1. The references were arranged alphabetically based on the surname of the first author.
2. The references with the same principal author were organized as follows: First, the references with a single author were chronologically ordered from oldest to most recent. Then, the references with a coauthor were organized alphabetically by the surname of the second author. Finally, references with two or more coauthors were sorted by year of publication.

Example:

Jaramillo, C. 2002. Response of tropical vegetation to Paleogene warming. Paleobiology, 28(2): 222–243. https://doi.org/10.1666/0094-8373(2002)028<0222:ROTVTP>2.0.CO;2

Jaramillo, C. 2018. Evolution of the Isthmus of Panama: Biological, paleoceanographic, and paleoclimatological implications. In: Hoorn, C., Perrigo, A. & Antonelli, A. (editors), Mountains, climate and biodiversity. Wiley–Blackwell, p. 323–338. Chichester, UK.

Jaramillo, C. & Cárdenas, A. 2013. Global warming and Neotropical rainforests: A historical perspective. Annual Review of Earth and Planetary Sciences, 41: 741–766. https://doi.org/10.1146/annurev-earth-042711-105403

Jaramillo, C. & Dilcher, D.L. 2000. Microfloral diversity patterns of the late Paleocene – Eocene interval in Colombia, northern South America. Geology, 28(9): 815–818. https://doi.org/10.1130/0091-7613(2000)28<815:MDPOTL>2.0.CO;2

Jaramillo, C. & Dilcher, D.L. 2001. Middle Paleogene palynology of central Colombia, South America: A study of pollen and spores from tropical latitudes. Palaeontographica Abteilung B, 258(4–6): 87–213.

Jaramillo, C., Rueda, M. & Mora, G. 2006. Cenozoic plant diversity in the Neotropics. Science, 311(5769): 1893–1896. https://doi.org/10.1126/science.1121380

Jaramillo, C.A., Moreno, F., Hendy, F., Sánchez–Villagra, M. & Marty, D. 2015. Preface: La Guajira, Colombia: A new window into the Cenozoic neotropical biodiversity and the Great American Biotic Interchange. Swiss Journal of Palaeontology, 134: 1–4. https://doi.org/10.1007/s13358-015-0075-0

Supplementary Information 4 includes the EndNote style of *The Geology of Colombia* for the different categories.

3.3. Complementing and Improving the Chapters Prior to Their Academic Peer Review

To achieve excellent quality chapters before peer review, the editorial team helped in the translation of more than 15 chapters and the reworking and editing of figures. In both stages, the author validated the adjustments before continuing with the following steps of the editorial process. The translation was carried out by scientific professionals at American Journal Experts. The profile of the translator was selected according to the area or areas of knowledge covered in the chapter (stratigraphy, geochemistry, etc.). The figure editing was led by the professionals of the editorial team in charge of the graphic arts. Although the editing and reworking of figures began in this initial phase of the editorial process, it was carried out continuously until the chapters were reviewed before their web publication, at which time it was still necessary to perfect the graphic material.

3.3.1. Developing and Editing Figures

The reworking and editing of the figures of the work *The Geology of Colombia* was performed using the software CorelDRAW® 2018 and Corel PHOTO–PAINT 2018, graphic design

programs that facilitate the creation and editing of vector figures and photographs. Adjustments were made to improve the graphic quality of the figures, to standardize them according to the editorial guidelines created for texts, and to standardize the use of terms in the text and figures. This allowed for clearer and more readable figures. The editing was based on visual hierarchy, which is a technique of graphic design for highlighting certain characteristics through line thickness, color, contrast, size, and alignment of the elements of the figure: points, lines, polygons, and texts. To ensure that the figures had the appropriate quality, both in printed and digital format, they were all obtained in vector format, since these types of images can be scaled to different sizes without losing resolution, in contrast to bitmap images. In cases where the original figures did not have this format, they were digitized using vectorization to ensure proper graphic output.

The figure size was important to the layout of the different chapters of the work. Three sizes were used: (1) Full page with 180.9 mm width in a vertical orientation. This format was rotated 90° to horizontally adjust the image. (2) Column and a half with 122 mm width. (3) Column with 88 mm width. For the three sizes, the maximum length in the vertical figures was 236.5 mm. The color profile used was CMYK (cyan, magenta, yellow, black). This profile is recommended for printing and digital versions in PDF format.

The typeface used for the text in the figures was Helvetica, with a variation between normal and narrow, except for the bodies of water, where the Book Antiqua font was used. The text sizes varied between 6 and 11 points, where 8 most often appropriate. Full uppercase text was not used to avoid visual distraction when reading the figures. For the highlights, the color, contrast, size, and alignment were considered.

The text was positioned horizontally except for names of oriented structures such as faults, folds, drainages, and indicative arrows. For structures with NE to SW inclinations, the direction of labeling is in the south–north direction, and for those inclined NW to SE, the direction of labeling is north–south. The text is straight or curved according to the shape of the structure. For the texts indicating an exact point, the text is positioned to the right of the point, preferably above rather than below. When one of these two positions is not possible, placements to the left are recommended, preferably above rather than below. The last option is to place the text directly above or below the point.

According to the editorial guidelines of texts for *The Geology of Colombia*, the coordinates were expressed geographically (latitude and longitude in degrees, minutes, and seconds) to facilitate and ensure that readers, especially those who do not know Colombian geography, can more easily locate them.

Additionally, shaded relief base maps were developed to visually improve several of the figures, for which the digital elevation model (DEM) with 30 m resolution of the Shuttle Radar Topography Mission (SRTM) of the National Aeronautics and Space Administration (NASA) and distributed by the United States Geological Survey (USGS) EROS Data Center (U.S. Geological Survey, 2004) was used. The methodology used to obtain the images was based on the *Hillshade* tool of the ArcMap software through image processing. Initially, two images were produced with a solar altitude angle of 45°, differentiated by the azimuth: The first with the shadow generated by a solar azimuth angle of 315° and the second by a solar azimuth angle of 45°. This second image is assigned transparency of 50% and overlaps the first generated image; thus, a shaded relief image with well–defined geomorphological features is obtained (Figure 7).

Figures 8a and 9a show two examples of the editing of an initial figure submitted for one of the chapters. By using a shaded relief image and digitizing the vector elements of the figure, following the visual hierarchy technique and the editorial guidelines, a figure with greater quality and legibility is obtained (Figures 8b, 9b).

For the 58 chapters of *The Geology of Colombia*, 942 figures were edited.

3.3.2. Peer Review and Chapter Adjustments

Once the submitted chapters were reviewed by the editorial team and some of them were translated and/or improved in terms of the quality of the figures and the style and consistency of the citations and bibliographic references, the editorial team sent the chapters for peer review. This process was supported by the Observatorio Colombiano de Ciencia y Tecnología and the Asociación Colombiana para el Avance de la Ciencia. Each chapter was reviewed by at least two reviewers. When peer evaluation concepts were dissimilar, an additional opinion was requested to support the acceptance or rejection of the chapter. The peer evaluation format included open questions with which the reviewer could express opinions on the content and presentation of the manuscript, as well as a numerical rating section that allowed quantification of the quality of the chapter and thereby the reviewer's decision to accept the revised chapter, to accept it with minimal changes, to accept it with significant changes, or to definitively reject it (see Format Review Editorial Board in Supplementary Information 5). The decision to accept or reject a chapter was made considering only the outcome of the peer review.

The chapters rejected for publication in *The Geology of Colombia* were returned to the author, along with a letter from the editorial committee. In the case of accepted chapters, the results of the peer review and the editorial concept containing the editorial criteria arising from the initial review were sent to the authors. Once the chapter was corrected by the author and resubmitted to continue the editorial process, the editorial group reviewed the new version and compared it with the initial

Figure 7. Shaded relief image of the northwestern corner of South America.

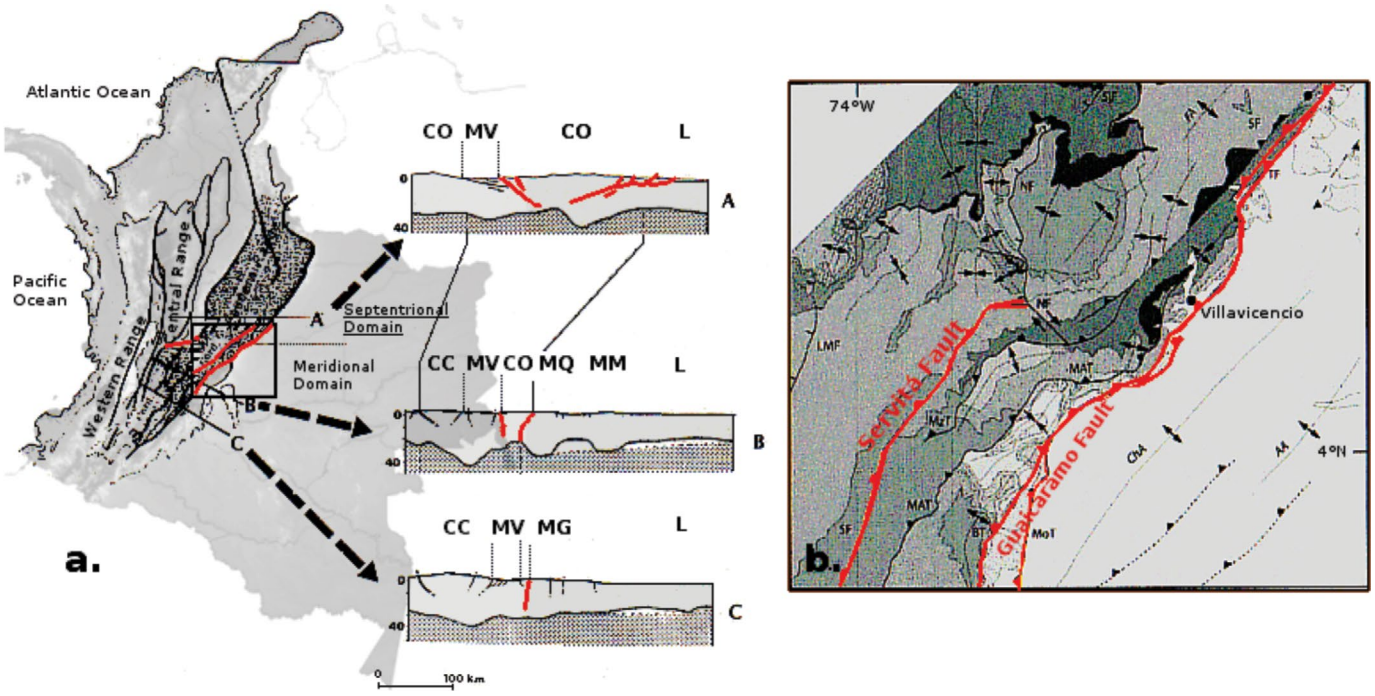


Figure 8a. Initial figure, first example.

version, reviewing the reviewer's comments and the author's responses one by one. When the chapter included considerable changes in content or the arbitrator requested to revise the chapter to verify that the modifications and additions were made, the chapter was sent to a second reviewer. Otherwise, the review of the editorial team was sufficient to verify whether the chapter was ready for publication.

From the review of most of the resubmitted chapters, editorial board's remarks emerged that were sent to the authors for review and response. In some cases, this process was carried out several times to ensure that the chapter met the editorial criteria before continuing to the next phase of the editorial process. The editorial group helped the authors to respond to the criteria, especially in terms of bibliographic references and figures. The correction of the bibliographic references was a process that was carried out in all stages of the editorial process; however, with the chapter ready for publication (in terms of content), a final review and update of the list of adjusted references was performed.

In the final version of the chapter, style correction was made in English for the chapters that, according to the comments of the peer review or the request of the author, required this action. With the correction of the style, the clarity, precision, and coherence of the language were improved. At this stage, grammatical, punctuation, and spelling errors were corrected. American Journal Experts supported this stage of the process once the team selected the style corrector profile. The style correction was validated by the author. In this phase, answers were provided to some questions or clarifications that the corrector, in general, had indicated in the edited document. With the approved version of the style correction, a final revision of the chapter was carried out before proceeding with the formal acceptance and moving to the stage of adjustment of the chapters to the editorial guidelines.

3.3.3. Adjustment of the Chapters to the Editorial Guidelines

After the English style correction, the chapters went through a stage of adjustment to the editorial guidelines to review the macrostructure and homogenize the style of the entire work. This stage was fundamental considering that the chapters were written by more than 100 different authors. For each chapter, the process of adjustment to the guidelines began with the review and final adjustment of the citations and bibliographic references, an ongoing activity that had already advanced since the initial submission of chapters. With the references ready, a cross–check that consisted of comparing all the citations in the chapter with their respective references and checking that the surnames of the authors and the year of publication in citations and references were the same was performed. Additionally, the DOI indicated in the references was tested to ensure that it linked to the corresponding document. Generally, in this activity, missing references or those that newly appeared in the final list of references without being cited in the chapter were detected.

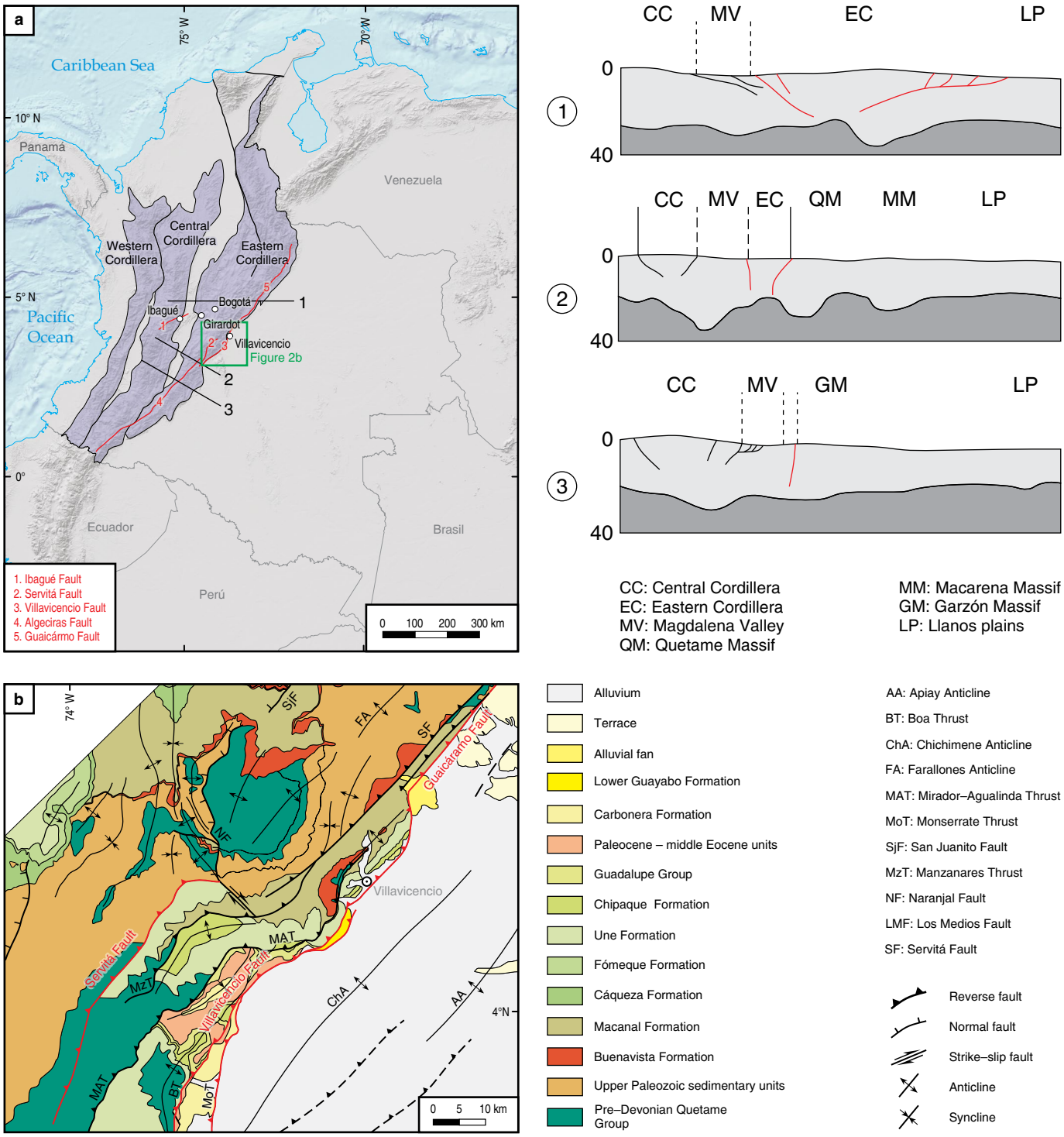


Figure 8b. Figure edited according to the image editing and reworking guidelines of *The Geology of Colombia*, where a shaded relief image is used that improves the visualization of the structural elements and the vector elements are digitized. First example.

The next step was to read the entire manuscript to review its macrostructure. This activity was carried out to detect inconsistencies and possible errors in context or wording that could result in ambiguities or erroneous interpretations. The objective in this step was to identify the problems causing ambiguity and then communicate these problems to the author. Also, in this reading, the abbreviations, acronyms, and symbols used throughout the chapter were identified and compiled in a list at the end of each chapter.

In parallel, a review of the figures, tables, and supplementary information was performed. In the case of the figures, the versions that had been edited following the guide for editing and reworking the figures were reviewed. These were compared with their description, and the changes that had to be made for

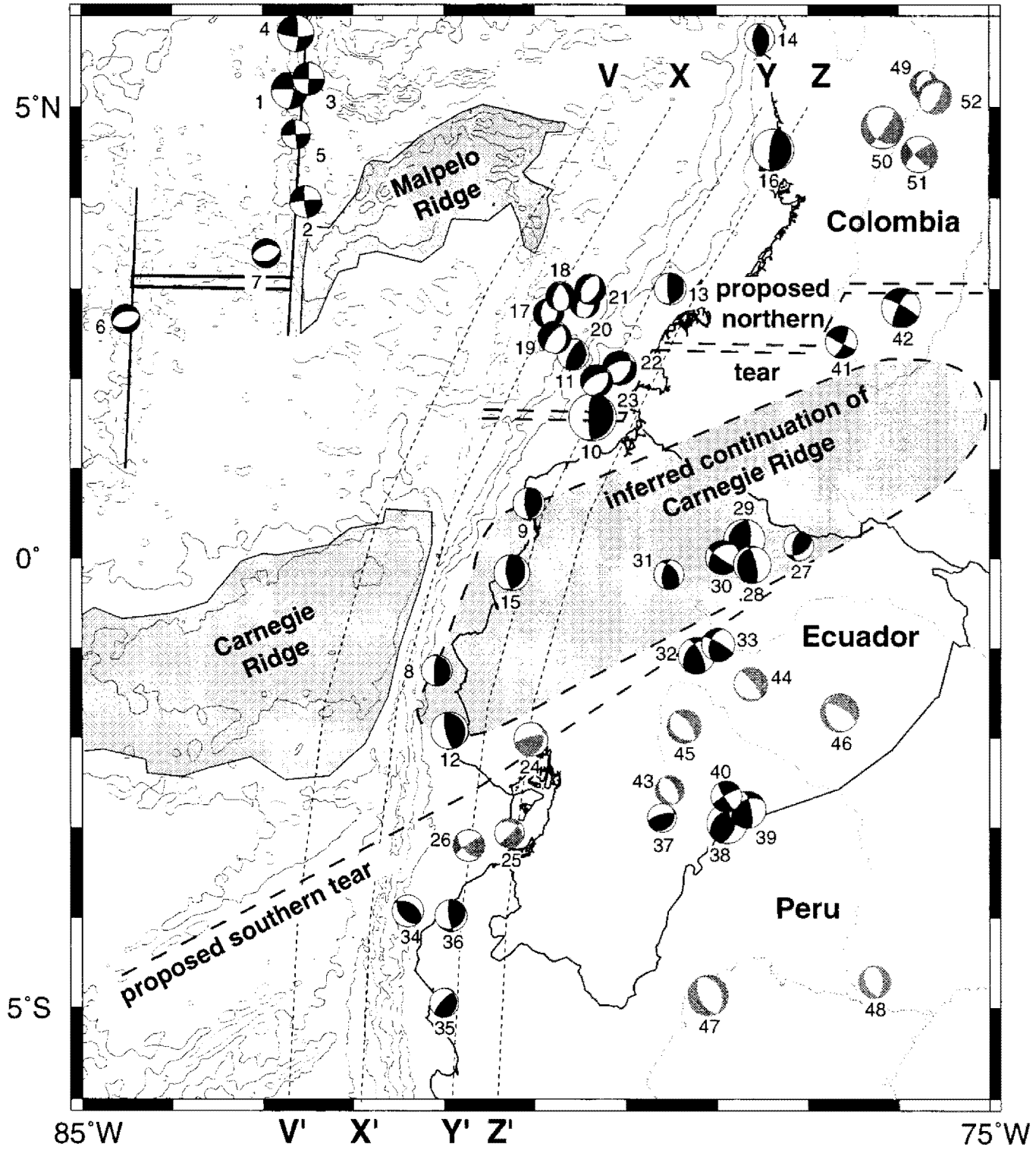
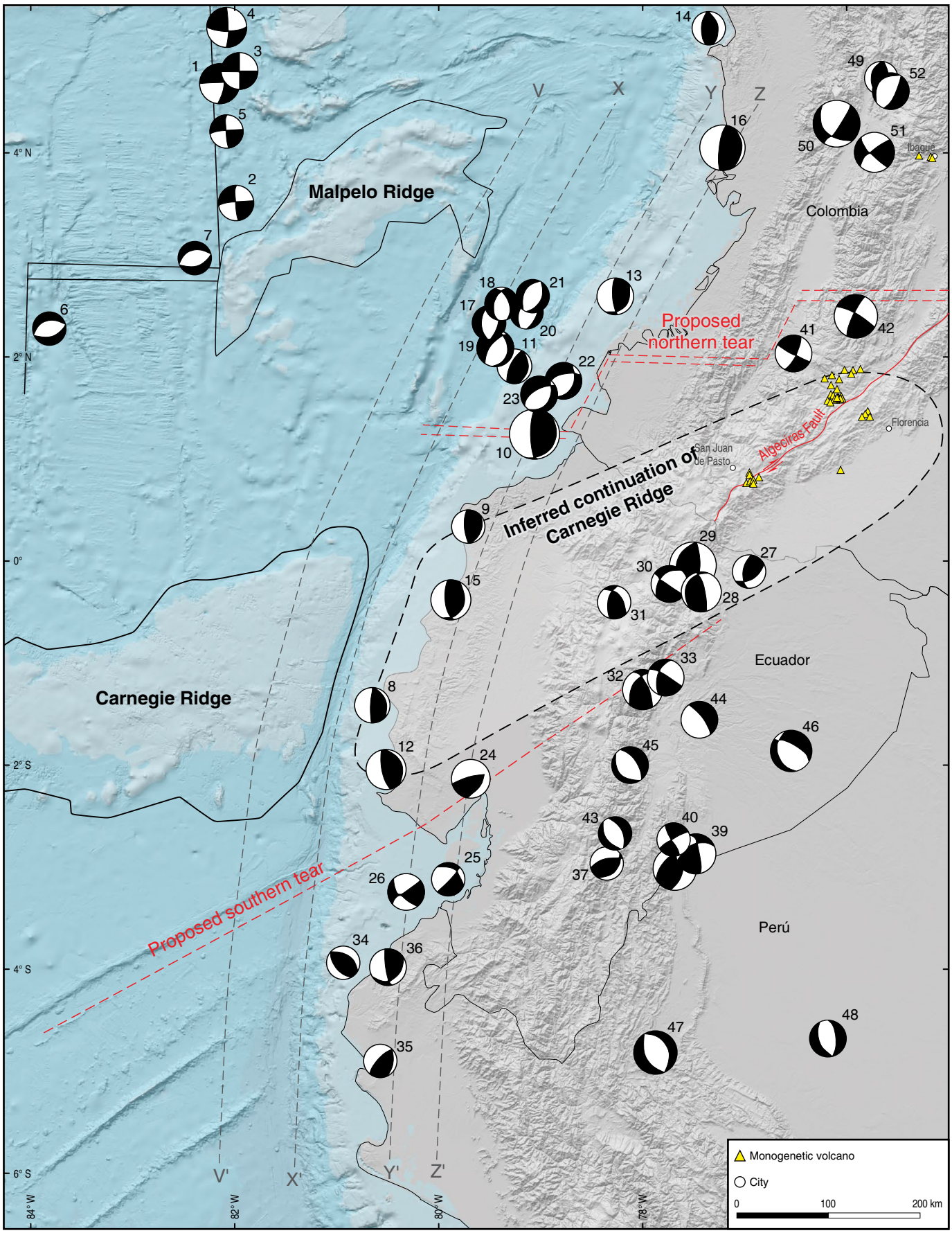


Figure 9a. Initial figure, second example.

consistency with the manuscript, the editorial guidelines, and the original figures submitted by the author in terms of content were identified. These modifications were left as comments and were sent to the person in charge of the adjustment. In this

Figure 9b. Figure edited according to the image editing and reworking guidelines of *The Geology of Colombia*, where a shaded relief image is used that improves the visualization of the structural elements and the vector elements are digitized. Second example.


Malpelo Ridge
Carnegie Ridge
Inferred continuation of Carnegie Ridge
Proposed northern tear
Proposed southern tear
Colombia
Ecuador
Perú
Ibagué
Florencia
San Juan de Pasto
Algeciras Fault
V
X
Y
Z
V'
X'
Y'
Z'
4° N
2° N
0°
2° S
4° S
6° S
84° W
82° W
80° W
78° W
Monogenetic volcano
City
0
100
200 km

step, it was essential to verify that the information projected by the figure was the same as that presented in the manuscript, since discrepancies and inconsistencies were frequently found between the figures and the text. In the same way, when the chapter included tables, these were reviewed and adjusted by comparing the information with that provided in both the manuscript and the figures. The most common modifications made to the tables included changing the coordinate system (the entire work was conducted in geographic coordinates), adjusting the footnotes, and converting punctuation between thousands and decimals.

Then, the chapter was standardized to the editorial guidelines. This pattern of text presentation was created by the editorial group as they advanced in the editorial process and is mainly based on *The Chicago Manual of Style, 16th Edition* (University of Chicago Press Staff, 2010), a detailed guide on the editorial process and writing standards in English. *The Chicago Guide to Grammar, Usage, and Punctuation* (Garner, 2016) and the Merriam–Webster online dictionary were used to resolve English grammar and spelling issues (https://www.merriam-webster.com/).

For the creation of the guidelines, the best manuals, guides, and articles for standards in geology were also used, such as *Suggestions to Authors of the Reports of the United States Geological Survey* (Hansen, 1991), *International Stratigraphic Guide* (Salvador, 1994), *North American Stratigraphic Code* (North American Commission on Stratigraphic Nomenclature, 2005), *Metamorphic Rocks: A Classification and Glossary of Terms* (Fettes & Desmos, 2007), *Igneous Rocks: A Classification and Glossary of Terms* (Le Maitre, 2002), *How to Use Stratigraphic Terminology in Papers, Illustrations, and Talks* (Owen, 2009), and *International Code of Zoological Nomenclature* (International Commission on Zoological Nomenclature, 1999).

Standards widely used by the international scientific community, such as *The International System of Units* (Newell & Tiesinga, 2019) and *The ACS Style Guide: Effective Communication of Scientific Information* (Coghill & Garson, 2006), were also taken into account. According to the manuals, guides, articles, and standards, the style of the terms used was established not only in the manuscript but also in all the components of the chapter: Figures, tables, and supplementary information. During the process of creating the guidelines, the writing style of some terms was established based on a thorough search of their use in high–impact international journals. In other cases, a consensus was reached among the editorial group to define the form of use.

In the adjustment of the chapters to the editorial guidelines, editorial board's remarks usually arose that were drafted and sent to the author. The author's responses were reviewed, and the necessary changes were made so that the chapter could move to the layout stage.

3.3.4. From the Layout to the Publication

At the end of the adjustment to the guidelines phase, the Spanish style correction of the abstract and the chapter keywords was performed. These were reviewed and corrected considering the writing guidelines used by the Grupo Mapa Geológico de Colombia in its publications in Spanish and recent updates to the orthographic and grammatical rules of the Real Academia Española (Real Academia Española, 2010). For the names of the geographic sites, the Geographical Dictionary of Colombia website of the Instituto Geográfico Agustín Codazzi was used: http://ssiglwps.igac.gov.co/digeo/app/index.html. Since they are proper names, they were used in the same way in texts written in Spanish and English.

With the chapters now complete (texts, figures, tables, and in some cases supplementary information), the next step was the layout. A quick review was performed on the layout version to ensure that all content had been included. If required, adjustments were made before sending the chapter layout to the author for proofreading. In this stage, the author, in addition to verifying the layout of the chapter, reviewed the contact information and biographical notes, the citation of figures, tables, and supplementary material throughout the chapter, and the acronyms and abbreviations, among others. However, note that at this stage, no changes in the content of the accepted chapter were allowed.

With the comments and requests of the author, two members of the editorial team who had not previously read or reviewed the chapters performed a detailed reading and review to identify errors that had been overlooked in previous phases of the process. In this review, some writing errors and even small content inconsistencies were found; however, most errors were related to the omission of relevant information in the final list of references, spelling errors, incorrect use of confusing geological terms (sediments for sedimentites, late for upper, early for lower, etc.), lack of consistency in some words and geological terms, and distribution of figures and texts throughout the document regarding readability and visual cleanliness. All these adjustments were indicated as comments in the PDF version of the chapter layout, and together with the authors' criteria, they were sent to the layout designer for adjustment. Finally, a new version was revised for adjustment verification. Once this stage was completed, the chapters were published on the website (https://www2.sgc.gov.co/LibroGeologiaColombia/Paginas/Inicio.aspx).

On the website, the chapters, supplementary materials, and citations suggested in EndNote were released for consultation and free download. The chapters were released one by one on the web to highlight each of the investigations of the editorial work. Once the chapter was published on the web, a promotional campaign was carried out through mass mailings, and posts were published on the social networks of the SGC with graphics developed from

material in each chapter accompanied by text that summarizes the content. The last stages of the editorial process correspond to printing, reviewing, and proofreading before the final printing.

4. Contents of *The Geology of Colombia*

4.1. Volume 1 Proterozoic – Paleozoic

Volume 1 Proterozoic – Paleozoic of *The Geology of Colombia* includes 10 chapters (Gómez & Mateus–Zabala, 2020a). The cover of this volume is a scientific illustration by the geologist Marie Joëlle GIRAUD that shows the Colombian sea during the Ordovician based on the fossil record collected from La Heliera–1 well in the Llanos Orientales Basin.

Chapter 1, written by Gómez et al. (2020), summarizes the physiographic, geographic, and geological context of the national territory and generalizes the Colombian sedimentary basins. This chapter serves as a basis for better understanding the chapters of the work. This chapter is useful, especially for foreign readers who are not familiar with the geography and physiography of the country.

The magnetometric and gamma spectrometric information (more than 400 000 linear km of information) generated by the SGC on the Colombian Amazon is presented in chapter 2. With these data, Moyano–Nieto et al. (2020) differentiated igneous and metamorphic rocks of Proterozoic age and structural trends of the Guiana Shield. The region is partially covered by sedimentary rocks from the Miocene and some Quaternary deposits, in addition to dense vegetation cover, so the authors propose a methodology for processing geophysical information that facilitates geological mapping in this region of the country.

In chapter 3, Restrepo & Toussaint (2020), who were the first to introduce the concept of geological terranes in Colombia, present a new vision on the mosaic of continental terranes that constitute the Colombian territory.

In chapter 4, using isotopic data (U–Pb, Sm–Nd, Lu–Hf, and δ18O), Ibañez–Mejia & Cordani (2020) show that the western part of the Guiana Shield, which includes the Proterozoic basement of eastern Colombia, has crystallization ages ranging from ca. 1.99 to ca. 1.38 Ga. This period corresponds to four periods of magmatic activity: two in the middle to late Paleoproterozoic, one in the early Mesoproterozoic, and another in the middle Mesoproterozoic.

Chapter 5 contains the first and to this day only report on the presence of acritarchs in the Ediacaran – Cryogenian in Colombia. The fossils reported by Dueñas–Jiménez & Montalvo–Jónsson (2020) come from well cores drilled in the Llanos Orientales Basin.

In chapter 6, Ibañez–Mejia (2020) describes the Putumayo Orogen, identified below the sedimentary wedge of the Putumayo Basin. The author exposes the evolution of this orogenic cycle, with an emphasis on its reconstruction, based on the interaction between Laurentia, Amazonia, and Baltica in the Proterozoic and the accretion of the supercontinent Rodinia. This discovery is an important contribution to the reconstruction of the geological history of the Colombian territory because directly correlates the basement blocks exposed in the Colombian Andes and the western margin of the Guiana Shield.

Chapter 7 presents the Paleozoic sedimentary record, over 6000 m thick, in the subsoil of the Llanos Orientales Basin. Dueñas–Jiménez et al. (2020) document the associations between acritarchs, chitinozoans, and trilobites, which allowed them to differentiate sequences from the Cambrian, the Lower and Middle Ordovician, the Devonian, and the Carboniferous.

Chapter 8 presents the lithological units, boundaries, and U–Pb data in the detrital zircons of the Anacona Terrane, considered by Restrepo et al. (2020) as a peri–Gondwanan terrane. In addition, its relationship with the Acatlán Complex in southern México and Marañón Complex in Perú is presented.

Chapter 9 contains a review of the stratigraphy, biostratigraphy, and geochronology of the Paleozoic rocks of Colombia. Moreno–Sánchez et al. (2020) proposed a relationship between the Paleozoic units and the underlying basement and reconstructed the geological history and paleogeography of the Colombian territory during the Paleozoic.

The magmatic activity of the late Carboniferous and the Permian is documented by Rodríguez–García et al. (2019) in chapter 10. With recent data from petrography, geochemistry, and geochronology, the authors identified this fragmented magmatic arc on the eastern flank of the Central Cordillera, the serranía de San Lucas, and the Sierra Nevada de Santa Marta. They indicate that it is made up of emplaced plutons on the western margin of the basement and that its origin may be related to a subduction zone located on the western margin of Gondwana.

4.2. Volume 2 Mesozoic

Volume 2 includes 14 chapters on the Mesozoic (Gómez & Pinilla–Pachon, 2020a). The scientific illustration on the cover, drawn by Marie Joëlle GIRAUD, recreates what Colombia would have looked like 110 million years ago in a Google Earth image and the crustal and mantle configuration that would produce this geography.

Chapter 1 is dedicated to the Permian and Triassic magmatic rocks of Colombia and Ecuador. Spikings & Paul (2019) present a review of outcrops and geochronological, geochemical, isotopic, and thermochronological data of these rocks and propose an evolutionary model for northwest South America during the formation and separation of Pangea. Additionally, the authors provide a large–scale reconstruction of western Pangea.

In chapter 2, Garcia–Casco et al. (2020) report the primary mantle mineralogical composition of the Medellín Dunite and confirm its harzburgite composition and subsequent metamor-

phism. The authors suggest that the unit may be the result of the cooling and hydration of the oceanic mantle in a back–arc basin, events prior to the tectonic processes that led to the emplacement of the metaharzburgite in the western margin of Pangea.

With the analysis of geochemical and geochronological data of the volcanic and plutonic rocks that make up the magmatic belt from the Late Triassic to the Jurassic, in chapter 3, López–Isaza & Zuluaga (2020) conclude that these rocks are the result of the interaction between the partial fusion of the crust and fluids derived from the mantle on a continental margin. This margin progressively changed from a post–collisional extension in the Late Triassic to a volcanic arc developed in a suprasubduction regime in the Late Jurassic.

The magmatic activity of the Mesozoic, recorded in several blocks of the Colombian Andes, is documented by Rodríguez–García et al. (2020) in chapter 4. The authors indicate that magmatism began in the Late Triassic and ended in the Early Cretaceous. They add that magmatism developed in at least three different magmatic arcs, the Santander Massif, the Upper Magdalena Valley, and the northern sector of the Ibagué Batholith, in clearly defined time intervals and on basements of different lithological characteristics.

In chapter 5, Bayona et al. (2020) synthesize knowledge about the metamorphic, plutonic, volcanic, and calcareous and clastic sedimentary rocks of the Jurassic exposed from northern Perú to Venezuela. From this synthesis, the authors evaluate three tectonic models proposed for the evolution of the northwestern corner of Gondwana and conclude that the presence of an orthogonal margin with a complex configuration such as the extreme northwest of Gondwana cannot be explained by the development of a single geodynamic process. To clarify this situation, they identified a need to improve the knowledge based on the gathering of information in the field and various analyses of each of the metamorphic, magmatic, and sedimentary sequences recognized.

The study of the origin and development of neotropical biomes is essential to understand existing ecosystems and making predictions about their future. With this in mind, Jaramillo (2019) states in chapter 6 that in the Colombian territory, during the Cretaceous, the biomass of tropical forests was dominated by gymnosperms and ferns and that the current tropical forests developed at the beginning of the Cenozoic as a result of the mass extinction that occurred in the Cretaceous – Paleocene boundary. The author illustrates that several existing biomes, including the páramos, the cloud forest, the savannas, and the dry forest, have increased significantly during the late Neogene at the expense of the tropical forest.

In chapter 7, Toussaint & Restrepo (2020) state that to the west of the San Jerónimo Fault, considered the boundary of continental terranes, there are several allochthonous oceanic terranes. The authors state that these were formed in the Pacific Ocean and migrated north to their current positions between the Late Cretaceous and the Miocene and that at least two of these terranes are part of the Caribbean Plateau.

Based on mineralogical, geochemical, thermochronological, and U–Pb dating of Cretaceous and Cenozoic sedimentary rocks of the Cordillera Oriental, Guerrero et al. (2020a) confirm the existence of a basin whose main depositional axis was in the current core of the aforementioned mountain range in chapter 8. The authors document two source areas, one in the magmatic/metamorphic arc of the Central Cordillera and another in the Guiana Shield. They add that the sediments deposited in the basin began their exhumation during the Late Miocene episode of the Andean Orogeny.

In chapter 9, Guerrero et al. (2020b) analyze and evaluate the potential of unconventional hydrocarbons in the Cretaceous back–arc basin of Colombia in terms of the total organic content (TOC), gas, vitrinite reflectance, porosity, permeability, pyrolysis, and organic geochemistry. They conclude that the best properties correspond to the limestone of La Luna Formation and laterally equivalent units deposited in a transgressive interval and relatively high sea level.

In chapter 10, Cardona et al. (2020) document that a change in the tectonic style is evident in the entire western continental margin of South America, going from the Mariana subduction to Andean subduction style. This change is associated with regional kinematic plate reorganizations that mark the onset of the construction of the Andean chain. The authors identify this change in the Cretaceous sedimentary and magmatic rocks of the Central Cordillera.

In Colombia, dinosaur remains are rare; therefore, the report by Noè et al. (2020) in chapter 11 on the discovery of six dinosaur tracks in rocks of the Batá Formation of the late Valanginian – early Hauterivian is important. The authors report that four of the tracks form a track left by a single dinosaur, interpreted as a subadult ornithopod of the ichnogenus *Iguanodontipus*. These findings suggest the existence of terrestrial communication during the Early Cretaceous, between Europe and North Africa today, that would have allowed migration along the northern coast of Gondwana to what is now South America.

In chapter 12, Patarroyo (2020) describes the marine sedimentary deposits of the Barremian in Colombia represented by different lithostratigraphic units that are found from the central zone to the north of the country, which are rarely studied except for the Paja Formation. The author indicates that the biostratigraphy of ammonites is the main tool for identifying chronostratigraphic levels because it facilitates more accurate relative dates than can be obtained by fossils of other animal and plant organisms. The author also explains that the fauna of Tethys allows correlation of the successions of the Barremian of Colombia with the standard biozones of the Mediterranean area and supports that the sedimentary and ecological variations are a consequence of the environmental factors, the paleoecology,

and the differentiation of the sub–basins that were subject to variations in the ocean floor.

In chapter 13, Noè & Gómez–Pérez (2020) propose that the Paja Formation, exposed in the alto Ricaurte region (Villa de Leyva, Sáchica, and Sutamarchán), is a unique *Lagerstätte* of marine vertebrates of the Lower Cretaceous worldwide. In this formation, very well–preserved marine fossils of plesiosaurs, ichthyosaurs, fish, turtles, and ammonites are found.

Based on the interpretation of the most recent data on total rock geochemistry and Ar–Ar and Lu–Hf ages, Bustamante & Bustamante (2019) conclude in chapter 14 that the three manifestations of high P/T metamorphism documented in the Central Cordillera of Colombia correspond to two different uncorrelated subduction events. The oldest (ca. 130–120 Ma) produced the high–pressure rocks of Pijao and Barragán, and the most recent (ca. 70–60 Ma) is represented by the blue schists of Jambaló.

4.3. Volume 3 Paleogene – Neogene

Volume 3 covers the events that occurred during the Paleogene – Neogene and includes 17 chapters (Gómez & Mateus–Zabala, 2020b). The image on the cover shows the Cretaceous – Paleogene boundary deposits of Gorgonilla Island in a photograph provided by the geologist Hermann BERMÚDEZ.

Chapter 1 of this volume, written by Bermúdez et al. (2019), presents the first record from Gorgonilla Island of the Chicxulub impact occurred at the K/Pg boundary in the Yucatán Peninsula. The tektite and microtektite stratum, approximately 20 mm thick, left by the impact constitutes one of the best–preserved accumulations in the world, and its age is confirmed with $^{40}Ar/^{39}Ar$ dating and micropaleontological analysis.

The origin, structure, age of the basement, and tectono–stratigraphy from the Late Cretaceous to the Holocene of the Lower Magdalena Valley Basin and the folded belt of San Jacinto are described by Mora–Bohórquez et al. (2020) in chapter 2. The authors explain that the subsidence controlled by faults between the late Oligocene and the early Miocene facilitated the initial filling of the lower valley, while contemporaneous uplift pulses in Andean terranes made the connection of the Lower and Middle Magdalena and the formation of the largest drainage system in Colombia (Magdalena River) possible. In addition, they highlight the relationship between the changes in the kinematics of the plate tectonics, the structures inherited from the basement, and the contribution of sediments in the evolution of forearc basins.

The sedimentary record of the northern Andes contains important evidence on the geological history of the Eastern Cordillera, which separates the hinterland basin of the Magdalena Valley from the Llanos Foreland Basin. This Mesozoic – Cenozoic marine and continental sedimentation, as revealed by Horton et al. (2020) in chapter 3, took place during contrasting and well–differentiated tectonic regimes.

In chapter 4, Mora et al. (2020a) provide a summary of the evolution of the uplift of the northern Andes. With a combination of the cooling histories and analysis of the provenance, they offer a critical view of the most recent paleogeographic interpretations. The authors draw attention to the use of limited data to provide paleogeographic interpretations that are often presented as definitive and unequivocal.

In chapter 5, Mora et al. (2020b) outline the structural geometry and the evolution of the eastern foothills of the Eastern Cordillera, comparing the shortening records of thick– and thin–skinned deformational styles of the Caguán–Putumayo and Llanos Foothills along the Andean deformation front. According to the proposals, the main factor in the thick–skinned deformation style is the basement composition, which is crystalline in the Caguán–Putumayo region and metasedimentary in the Piedemonte Llanero (Llanos Foothills). They note that the evolution of the foothills of the Colombian Andes began in the Oligocene with similar structural styles and that divergence occurred in the accelerated shortening that took place between the Miocene and the recent, when a rapid sedimentation of thick fluvial sequences allowed the source rocks of the foothills to enter the oil generation window and to assist with the formation of efficient detachment horizons for the thin–skinned deformation.

The tectonic of the Eastern Cordillera is described by Kammer et al. (2020) in chapter 6, in which the authors seek to clarify the relationships between the inherited pre–Cretaceous crustal structures and those formed by a more superficial folding during the Neogene. For this, they differentiate three structural domains: a meridional domain that presents shortening in its lower structural levels and folding in the upper; an intermediate domain, north of the first, characterized by large–scale antiforms involving a basement in the core; and a northern domain that includes an antiformal lobe with considerable topographic relief, which corresponds to the Cocuy Syntaxis. The authors also propose the existence of a forebulge during the Cretaceous from an impinging mantle plume.

In chapter 7, Parra et al. (2020) reconstruct the history of the uplift of the Sierra Nevada de Santa Marta and the erosive processes that acted on its relief, based on the results of bedrock and detrital thermochronology, new contributions from fission tracks and (U–Th)/He in apatites of active sediments, and the stratigraphic study of adjacent marginal basins of the Miocene – Pliocene. With this information, the authors posit that the uplift was an episodic and asymmetric process that began with a rapid uplift during the late Eocene – early Miocene and that the southwestern sector experienced a faster uplift than the north. They also showed that the uplift of the Sierra Nevada de Santa Marta is a very recent phenomenon, less than 2 million years old.

The Tumaco Forearc Basin is described by Pardo–Trujillo et al. (2020) in chapter 8 as a symmetric basin whose depocenter accumulated more than 8000 m of sediments, containing information on the geological evolution of southwestern Colombia, where the subduction of the Farallón and Nazca Plates under the South American Plate controlled the subsidence and magmatic activity between the Oligocene and the Holocene. Volcanoclastic fans, as well as fluvial and coastal sediments associated with the Patía and Mira Rivers, partially cover the Miocene – Pliocene deposits.

In chapter 9, Silva–Tamayo et al. (2020a) describe the successions of Cenozoic marine carbonates from different sedimentary basins in Colombia; the authors analyze the biological associations and relate them to the deposition conditions and the movements of continental and marine blocks.

In the basins of the Middle Magdalena Valley and south of the Llanos, the outcrops, the core and well records, and the existing sedimentological and palynological investigations allow Caballero et al. (2020), in chapter 10, to study shallow and continental marine sedimentary records in the context of sequence stratigraphy and to obtain information on the evolution of reservoirs and their properties.

The Amagá Formation, a carbon–rich unit, of the late Oligocene – middle Miocene is described in chapter 11. This formation constitutes, according to Silva–Tamayo et al. (2020b), one of the most complete tropical siliciclastic sedimentary sequences deposited in an intramontane basin in the northern sector of the Colombian Andes. The integration of the available information and new sedimentological, biostratigraphic, geochronological, and thermochronological data allow the authors to evaluate the mechanisms that controlled the sedimentological evolution along Andean–type convergent margins.

The Combia Formation, exposed in the northwest of the Colombian Andes, is a unique occurrence of tholeiitic magmatism formed in an extensional basin and associated with calc–alkaline magmatic rocks. The review of geochemical and geochronological information by Weber et al. (2020) described in chapter 12 indicates that the two magmas coexisted. The tholeiites were formed from a primitive mantle, with a limited supply of sedimentary or continental contaminants, and the calc–alkaline magmas, mainly adakitic, were formed from the fractionation of garnet and amphibole at high pressures from a hydrated melt from an enriched source.

Chapter 13 describes the Morales Formation of the Patía Sub–basin, defined by Gallego–Ríos et al. (2020) as a sequence consisting of mudrocks interbedded with thin beds of sandstones. The authors interpret this sequence as deposited in an environment of lakes and swamps with adjacent fluvial channels. The sudden increase in volcanic material in the sequence is explained by the authors as the onset of volcanic activity of the Central Cordillera, which continues until the present.

In chapter 14, Zapata–García & Rodríguez–García (2020) summarize the state of knowledge of the Chocó–Panamá Arc, presenting the petrographic, lithogeochemical, and geochronological characteristics of the vulcanites and plutons that constitute it and, for the first time, a segment to the south formed by the Timbiquí Formation and Napi Tonalite. This synthesis allows the authors to define, with greater precision, this geological block exposed on the western flank of the Western Cordillera between the border with Panamá and the Nariño Department.

Montes & Hoyos (2020) present, in chapter 15, a review of the geology of the basement of the Isthmus of Panamá. They indicate that tectonic deformation is the main factor controlling the sites and modes of Cenozoic sedimentation and the geological evolution of the isthmus. They also propose an evolutionary geological process.

In chapter 16, Urueña–Suárez et al. (2020) describe how the determination of crystallization and the cooling ages of detrital zircons in ancient sedimentary rocks or modern river sediments can be used to identify the sediments provenance and the exhumation of orogenic belts. To support these considerations, they present the results of U–Pb dating and fission tracks in the zircons of sedimentary units of the Eastern Cordillera and sediments of modern rivers that drain both flanks of this mountain range and the eastern flank of the Central Cordillera. The authors highlight the advantages and limitations of using U–Pb dating and fission tracks for provenance studies, including the identification of original source areas, the recycling of sediments, and the difficulty in detecting amagmatic orogens in the detrital zircon record.

With fission tracks data in apatites and zircons from crystalline rocks and thermal history modeling Amaya–Ferreira et al. (2020) present, in chapter 17, a thermal history in four stages for the Santander Massif in the Eastern Cordillera of Colombia. At 60 million years, a burial heating from the Late Jurassic to the Late Cretaceous was followed by three cooling phases that began at approximately 65–60 Ma, related to regional tectonic events.

4.4. Volume 4 Quaternary

Volume 4 presents the chapters on the Quaternary and was written mainly by researchers from the SGC (Gómez & Pinilla–Pachon, 2020b). On the cover is the Alsacia Volcano, a monogenetic volcanic center that is reported for the first time in *The Geology of Colombia*.

The tectonic history of the intermountain basin of the Cauca River valley, described in chapter 1 by López & Toro–Toro (2020), exhibits alternating compressional and extensional phases in the Miocene – Quaternary interval. These phases are reflected in the Miocene – Pliocene La Paila Formation depos-

ited during an extensional phase influenced by arc volcanism, and the Pleistocene Zarzal Formation and Quaternary deposits that record compressive tectonic activity that initiated after the accretion of the Isthmus of Panamá.

In chapter 2, Hooghiemstra & Flantua (2019) summarize sixty years of palynological research in the Colombian territory. The authors present an overview of Quaternary history through the identification of environmental and climate changes characterized by a set of glacial–interglacial cycles very well–documented in the Quaternary sedimentary record of Colombia.

Following the review of existing information, Monsalve–Bustamante (2020) describes, in chapter 3, the most relevant characteristics of Colombia's active volcanic front, the identified volcanic centers, the tectonic context, and the historical and recent activity. The author states that the systematic study of active volcanoes and continuous monitoring by the SGC has made it possible to advance knowledge about the most superficial processes, stratigraphy, and eruptive history of the volcanic front. The author proposes topics for future research on volcanism in Colombia.

In chapter 4, the Paipa geothermal system is classified as unusual by Alfaro–Valero et al. (2020) due to its location in the Cretaceous sedimentary environment of the Eastern Cordillera, associated with rhyolitic to trachydacite volcanic activity of the Neogene – Quaternary. This chapter proposes a conceptual model of this system based on geological, geophysical, and geochemical studies conducted by the Grupo de Exploración de Recursos Geotérmicos of the SGC.

Pulgarín–Alzate et al. (2020), in chapter 5, present the constitution and origin of the Paramillo de Santa Rosa Volcanic Complex, located in the Central Cordillera. The authors interpret it as the result of a succession of events related to a subduction zone in an active continental margin between the early Pleistocene and the Holocene. This knowledge contributes to the assessment of the volcanic hazard in this region of the Colombian territory.

In chapter 6, written by Correa–Tamayo et al. (2020), the Nevado del Huila Volcanic Complex located in the Central Cordillera is studied. The authors divide the eruptive activity of this volcano into three stages: Pre–Huila, Old Huila, and Recent Huila, that began in the early Pleistocene and produced two main volcanic edifices (Pre–Huila and Huila).

Recent research, integrated with previous studies and geochronological, petrographic, and geochemical data, helped Ceballos–Hernández et al. (2020) define, in chapter 7, the Nevado del Ruiz Volcanic Complex, located in the Northern Volcanic Segment of the active volcanism of Colombia, and expose the geological evolution that produced it. The authors identified four major eruptive periods characterized by the construction and destruction of volcanic edifices: The Pre–Ruiz eruptive period, the First eruptive period Ruiz, the Intermediate eruptive period Ruiz, and the Second eruptive period Ruiz. On 13 November 1985, an eruption of the Nevado del Ruiz resulted in the disappearance of the city of Armero and the death of 23 000 people.

The Cerro Machín Volcano, located on the eastern flank of the Central Cordillera, is an active volcano that generated explosive eruptions over the last 10 000 years that, according to Cortés–Jiménez (2020) in chapter 8, originated thick deposits of pyroclastic material. The pyroclasts were mixed with water of diverse origin, forming torrential flows (lahars) that were mobilized to areas more than 100 km away from the volcano to the Magdalena River Valley. The lahars constitute one of the greatest threats of this volcano.

The origin of the Quindío–Risaralda Quaternary deposit described in chapter 9 occurred, according to Espinosa–Baquero (2020), in two major phases: A constructive phase associated with the strong volcanic activity of the Paramillo de Santa Rosa and the Nevado del Quindío, which corresponds to the accumulation of proximal fans, and another destructive phase controlled by the final uplift of the Central Cordillera along large fault systems, which produced intermediate and distal fans. Over this deposit were built Armenia and numerous towns of the Quindío and Risaralda Departments.

Monsalve–Bustamante et al. (2020), in chapter 10, locate and describe 36 monogenetic volcanoes, 22 of which are reported for the first time in *The Geology of Colombia*. This chapter is considered to be informative and a call to investigate the presence and mechanisms that produced these volcanic manifestations concentrated in certain regions of the national territory, with very particular geological conditions, where there are populated centers and expansive agricultural development.

In chapter 11, Vargas (2020) explains how, from seismological, geodetic, and geophysical information, he estimated tomograms of anomalies of seismic velocity, the depth of the Curie point, and the stress field along the western margin of South America to explain the geometry and the subduction process of the Caribbean and Nazca Plates under the South American Plate.

The Algeciras Fault System is presented in chapter 12. This tectonic system is considered by Diederix et al. (2020a) to be the largest active fault system in Colombia. The authors state that their study is essential for understanding the geodynamics of the northern Andes. The great seismic activity of the past and present suggest to the authors that the Algeciras Fault System is the most dangerous in Colombia and is capable of generating large–scale earthquakes in the future.

The recent results of neotectonics, paleoseismology, and paleomagnetism allowed Diederix et al. (2020b), in chapter 13, to quantitatively corroborate the quaternary activity of the Bucaramanga Fault. The authors report that recent activity is not reflected in instrumental seismicity, while geomorphological

expression suggests high displacement rates during the Pleistocene. They confirm that the analysis of eight seismic events during the Holocene yields a displacement rate of 2.5 mm/y and that the paleomagnetism in sediments of the Bucaramanga alluvial fan indicates a similar movement rate.

Chapter 14 describes the geodetic satellite measurements obtained by the GeoRED project of the SGC. Mora–Páez et al. (2020a) explain how this project contributes to the understanding of regional tectonics in the northern Andes and the southwest of the Caribbean, including the seismic hazards in the Colombian trench, the Caribbean margin, the fault system of the eastern foothills of the Eastern Cordillera, and the collision zone of Panamá in northwestern Colombia, as well as the deformation of Colombian volcanoes.

Based on data obtained by GeoRED, Sagiya & Mora–Páez (2020) report, in chapter 15, how is the coupling between tectonic plates in the Nazca subduction zone, along the Pacific coast of Colombia and Ecuador, where earthquakes of great magnitude frequently occur, to evaluate the future seismic potential of the region. The results of the analyses show 4 main locked patches. Based on the seismic moment accumulation rate, researchers estimate that the recurrence interval for the 1979 earthquake is approximately 124 years.

In chapter 16, Mora–Páez et al. (2020b) analyze land subsidence in the urban area of Bogotá, where more than 7 million inhabitants live. With the analyses performed, using radar images, subsidence values were obtained in the central area of the city on the order of 3.3 cm/y.

Based on the analysis of focal mechanisms and GPS measurements, Arcila & Muñoz–Martín (2020) describe, in chapter 17, the stress regime in Colombia and formulate a seismotectonic model for the NW corner of South America, characterized by the displacement towards the SE of the Caribbean Plate, the convergence of the Andean, Coiba, and Panamá Blocks in NW Colombia, and the W–E convergence of the Nazca and South American Plates.

5. Outreach Strategy of the Work *The Geology of Colombia* for the Specialized Public

With the aim of presenting the state of knowledge on the geological evolution of Colombia and the surrounding regions to the international geoscientific community, the editorial team of *The Geology of Colombia* organized three sessions in annual meetings that include a considerable number of geoscientists from various parts of the world. The sessions promoted interdisciplinary exchanges and debates on Colombian geology in the framework of the geology of the northwestern corner of South America and provided new research approaches and opportunities for research collaborations.

5.1. Participation in the GSA Annual Meeting 2018

From 4 to 7 November 2018, the GSA Meeting 2018 was held in Indianapolis, Indiana, USA, an event with 5628 attendees. The editorial team of *The Geology of Colombia* chose this annual meeting and the exhibition of the Geological Society of America for conducting the first special session on the geology of Colombia: Session "T183. The Geology of Colombia" (Figure 10).

The session had 12 oral conferences and 6 posters that were presented mostly by researchers linked to the editorial work as authors (https://bit.ly/2zJNdL4). In addition to leading the session, the editorial team presented two oral presentations: "The Geology of Colombia Book: A journey through the geological history of Colombia" and "The social appropriation of geological knowledge from the Colombian Geological Survey: The successful case of The Geology of Colombia Book" to present the content of the 4 volumes of the editorial work and the outreach strategy that was designed in the project. The team also presented a poster on the volcanism of the Combia Formation, the main theme of one of the chapters.

5.2. Participation in the AGU Fall Meeting 2019

From 9 to 13 December 2019, the AGU Fall Meeting 2019 of the American Geophysical Union was held in San Francisco, California, USA, an event that was attended by more than 30 000 scientists and decision–makers from all over the world. In this, the biggest international meeting of Earth sciences in the world, the editorial team led two sessions on Colombian geology (Figure 11).

The first session, "T13B. New Advances on the Geologic and Tectonic Framework of Colombia and Its Surrounding Regions I", included oral presentations. In total, seven talks were presented about the tectonic setting of the northwestern corner of South America based on relocated seismic events and new ideas on the construction of the Eastern Cordillera from the sedimentary record.

Likewise, the Cenozoic tectonic evolution of the Sierra Nevada de Santa Marta, the magmatic record in Colombia of the collision of the Panamá Arc and the subduction of the Nazca Plate, the geometry of subduction in Colombia, and the late Silurian exhumation of the proto–Andean margin and the uplift of the northern Andes were discussed.

The second session, "T21E. New Advances on the Geologic and Tectonic Framework of Colombia and Its Surrounding Regions II", included poster presentations. The seismicity along the subduction zone in Colombia, the geochemical evolution of arc magmatism across Panamá and Colombia, and the axis rotations associated with inverted

Figure 10. Official photograph of session "T183. The Geology of Colombia".

Figure 11. Attendees at the session "T13B. New Advances on the Geologic and Tectonic Framework of Colombia and Its Surrounding Regions I" of the AGU Fall Meeting 2019.

faults in the Colombian Eastern Cordillera were some of the 11 topics developed by the researchers in this session (https://bit.ly/2QE0mOU). In addition, in this space, the editorial team presented the contributions of the SGC to the state of knowledge of Colombian geology, including the work *The Geology of Colombia* (Figure 12).

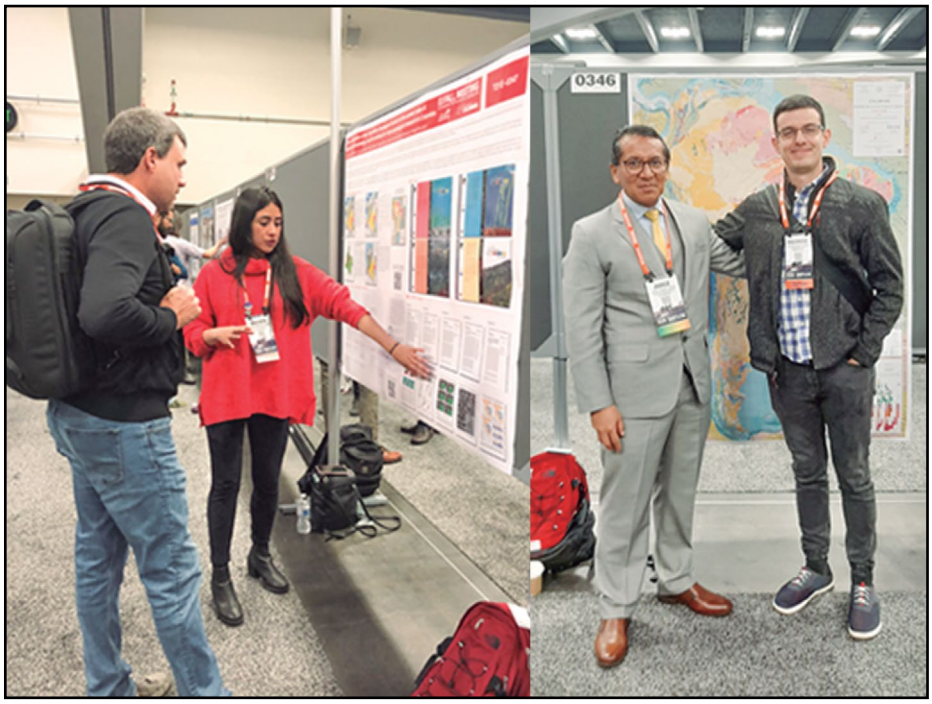


Figure 12. Participation of the editorial team in the session "T21E. New Advances on the Geologic and Tectonic Framework of Colombia and Its Surrounding Regions II".

6. Outreach Strategy of the Work *The Geology of Colombia* for the Lay Public

Because *The Geology of Colombia* brings together current knowledge on the formation and evolution of the national territory, its mineral resources, and its geological hazards, information that is relevant to the social and economic development of the country, it was important that the research, findings, and interpretations presented in the publication be comprehensible to people not specialized in geosciences.

Aware of this situation, the members of the editorial group of the work and the executives of the SGC considered it essential to create an outreach strategy for disseminating geoscientific knowledge aimed at the lay public. The planning for this strategy started in 2017, and the outreach was launched in 2018. The design and implementation were carried out by a multidisciplinary team consisting of a scientific journalist, a geologist, an audiovisual producer, and a graphic designer. This group was led by the senior geologist and principal editor of *The Geology of Colombia*.

The strategy consisted of generating text and multimedia content from the chapters of the editorial work with the most media impact or with the highest impact on society in terms of risk and environmental management, tourism, economy, or with new contributions to scientific knowledge. These were published in national newspapers, magazines, and radio and on social networks and websites so that they became familiar to government entities for their decision making and the community for taking ownership of their environment and expanding their knowledge about the geology of Colombia.

Publications emerging from this strategy included newspaper articles, videos, photo galleries, photo publications, and specific messages on social networks (Facebook, Twitter, Instagram, and YouTube) and comics with geological cartoons. The stages for the generation of informative products are described below:

1. Selection of the chapters of the work *The Geology of Colombia* with novel, timely issues and, importantly, with social relevance. The selection was made considering that not all the topics investigated by geoscientists are relevant to the lay public.
2. An invitation to the authors of the selected chapters to participate in a field trip with a journalistic focus. In cases where the author was unable to attend, an interview was conducted, and the supporting photographs and videos, which were usually acquired in the field, were provided by the author. With the confirmation of the author, the journalist began reading the chapter and reference documentation. As part of the journalistic investigation, she contacted the author and relied on the geologist of the group for explanations of the topic. The chapter was carefully broken down, and the central theme of the outreach strategy was defined. Then, a dialogue was established from the journalistic and geological approaches to specify the terminol-

Figure 13. Field trip to Aguadas, Caldas with professor Agustín CARDONA in the serpentinites of Pácora. Topic: Evolution of the Central Cordillera of Colombia.

ogy and establish a script for the entire team involved in the execution of the communicative pieces.

3. Field trip to the area where the investigation of the selected chapter was carried out. Before the videos were recorded and the images were captured, a pre–production stage was carried out in which the researcher prepared a simple explanatory discourse about their research (different from that usually used in the scientific world) and instructions to record the video (Figure 13). In this stage, it was borne in mind that what is interesting to a geologist may not be equally interesting when translated into journalistic content. The author was the protagonist of the story, and as such, his or her active participation was required.

   The field trips were also opportunities to exchange knowledge with the inhabitants of the area. In addition to talking with the community, the team went to the local media (Figure 14), visited government authorities, schools (Figure 15), and the national police to involve them in the activities, to tell them what is being studied in the area, and to listen to their knowledge of the territory, positions, and concerns.

   The team that accompanied the researcher on the field trip was composed of a scientific journalist, one or more geologists, and an audiovisual producer. With their different areas of expertise, these professionals collected material presented by the researcher, recorded audio and video, and took photographs in the field. The journalist asked the researcher questions that were previously discussed and aimed at content production. A friendly professional work environment was created to encourage the researcher to express the results of their studies in a pleasant storytelling style (Figure 16).

   During the field trips, interviews and high–quality videos and photographs were obtained using professional photographic equipment, filters, and specialized lenses for landscape photography, as well as for capturing video and documentary photography. The variety of optics and the technical capacity of the teams generated rich visual narratives, resulting in aesthetically pleasing images to entice the viewer.

4. Writing of the newspaper article. In this phase, the scientific journalist wrote the first version of the article; then, the researchers and some of the geologists of the editorial group reviewed the article, clarified concepts, and added or removed information without changing the journalistic style. Thus, a final version was produced. This way of working brought excellent results. Past experience of researchers working with journalists has not been ideal because press releases and articles do not usually include a final review by the scientist, which has resulted in publications lacking technical rigor. The fact that the researcher could validate the accuracy of the data and concepts before publication yielded good results.

Figure 14. The volcanologist Gloria Patricia CORTÉS with the journalist Lisbeth FOG and journalists from El Nuevo Día newspaper in the city of Ibagué, talking about the Cerro Machín Volcano.

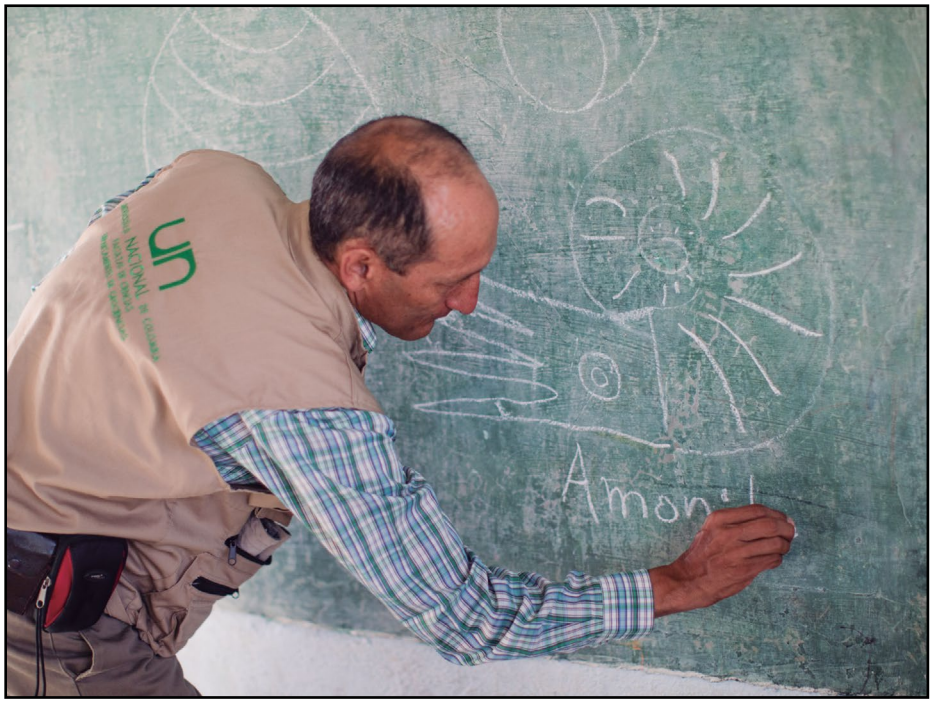


Figure 15. Professor Pedro PATARROYO, in a rural school in La Guajira, explains to students the extinct Cretaceous marine fauna and its importance in the study of the evolution of species and climate changes.

5. Production of a video lasting from three to seven minutes to expand upon the explanation of the topic addressed in the newspaper article. For this, a video script was generated, and the approach was determined. The videographer began the production of the video, framed within a specific editorial line for each topic and that provided an identity for the product. In addition to the video footage in the field, maps, graphics, and animations designed by

Figure 16. Geologist Alberto NÚÑEZ TELLO in the Huila Department explaining what monogenetic volcanoes are. Most monogenetic volcanoes are tourist destinations, but more often than not neither the inhabitants nor the tourists know that these mountains are volcanoes.

the geologist of the group were used to help exemplify the topics covered in the videos. The videos were published on the YouTube channel of the SGC. These highlighted the question that the researchers are solving with their studies, the geological importance of the places visited in the field trip, and the human side of the researchers.

6. Generation of photo reports. For each of the social networks, a set of ten photographs of the field trip was chosen that could tell a story, in the same line of the newspaper article and the video of the selected chapter. Additionally, simple texts were written with a clear message to accompany each photograph. The texts helped to spin the story, just as the images were adapted according to the social network. By way of the photo reports, the public was guided through different emotional and scientific moments of the subject to be shared. The photo reports were posted on the Facebook, Instagram, and Twitter accounts of the SGC (Figure 17).
7. Creation of geological cartoons. In parallel with the production of the mentioned products, the Familia Piedrahita was created, a Colombian family of rocks, minerals, and fossils (Figure 18). For its creation, representative samples of Colombian geology were selected, most of them from the Museo Geológico José Royo y Gómez of the SGC. Then, they were photographed and digitally manipulated. Finally, the different personalities of each character were generated. With these characters, comics were constructed, and graphics and stickers were designed to address concepts about the geology of Colombia and the project *The Geology of Colombia*.

   The comics used humor and everyday events to generate empathy for geology on the part of the lay public. For its production, the social dissemination of the knowledge team as a whole conceptually analyzed the idea that the story would tell, the characters that were going to appear were chosen, and dialogues were created to finally assemble the story (Figure 19). The comics or images with the characters of the Familia Piedrahita were published on the social networks of the SGC. The first comics explained the origin of each character from the geological point of view. Then, geological concepts or topics previously published in press articles were explained. Additionally, a geological glossary was generated with the Familia Piedrahita.

Figure 20 summarizes the stages for generating the dissemination products in the outreach strategy.

6.1. The results

The results and impact of this outreach strategy for disseminating knowledge to lay audiences were quantitatively evaluated through the analytics of the SGC social networks and the reach of readers of national newspapers. Additionally, the results and impact were qualitatively evaluated based on how each type of

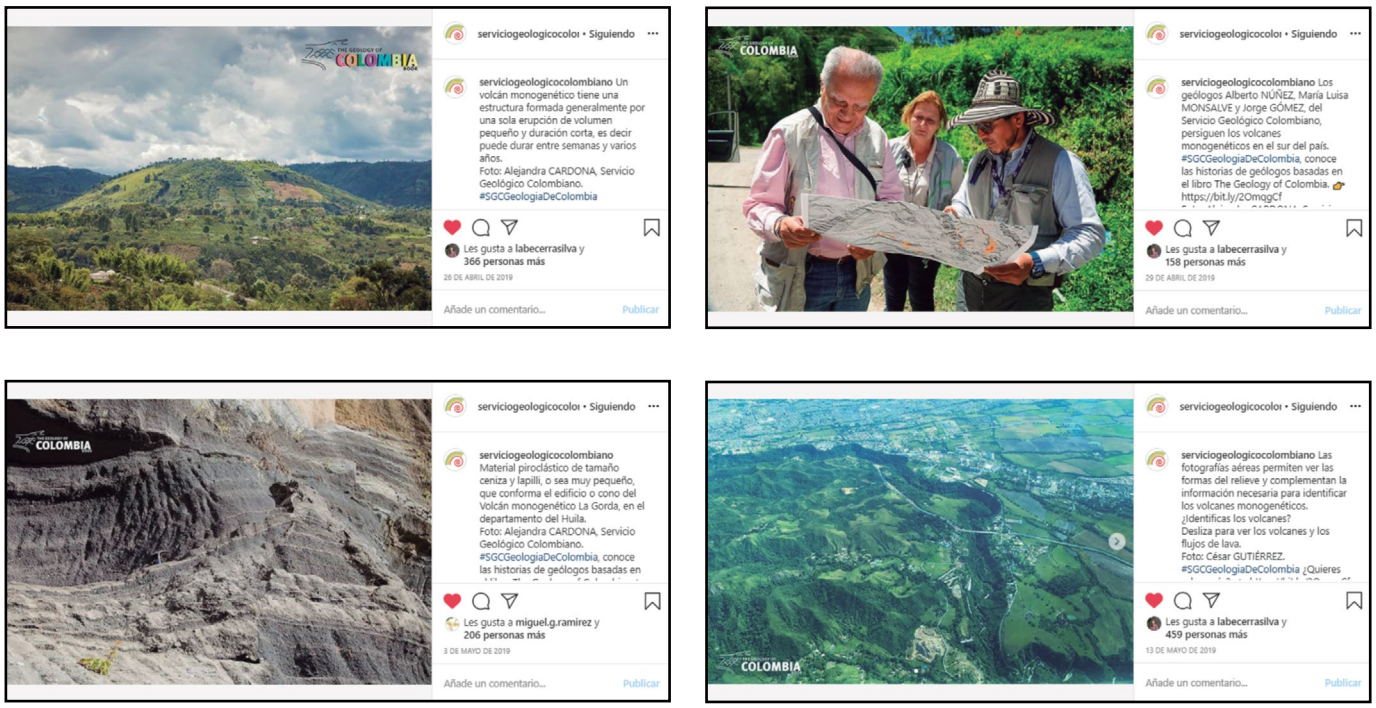


Figure 17. Instagram posts about monogenetic volcanoes.

Figure 18. Members of the Familia Piedrahita. **(a)** Father Gneiss Piedrahita, **(b)** mother Flo Piedrahita, **(c)** grandmother Concha Piedrahita, **(d)** aunt Calca Piedrahita, **(e)** son Xilo Piedrahita, **(f)** daughter Pili Piedrahita, and **(g)** the pet Amón Piedrahita.

content was received, which was reflected in the comments left by users on each published content. The results by product with a January 2020 cutoff are as follows:

Twelve articles in national media: Eight in the newspaper *El Tiempo* (print and web), two in the magazine *Semana* (web), and two in the newspaper *El Espectador* (print and web), where one was covered in the print edition of Sunday 10 June 2018 (Figure 21). Each article had an average of 200 000 readers in print and more than 13 000 readers in the digital publication. The web pages for consulting the articles are presented in Table 1.

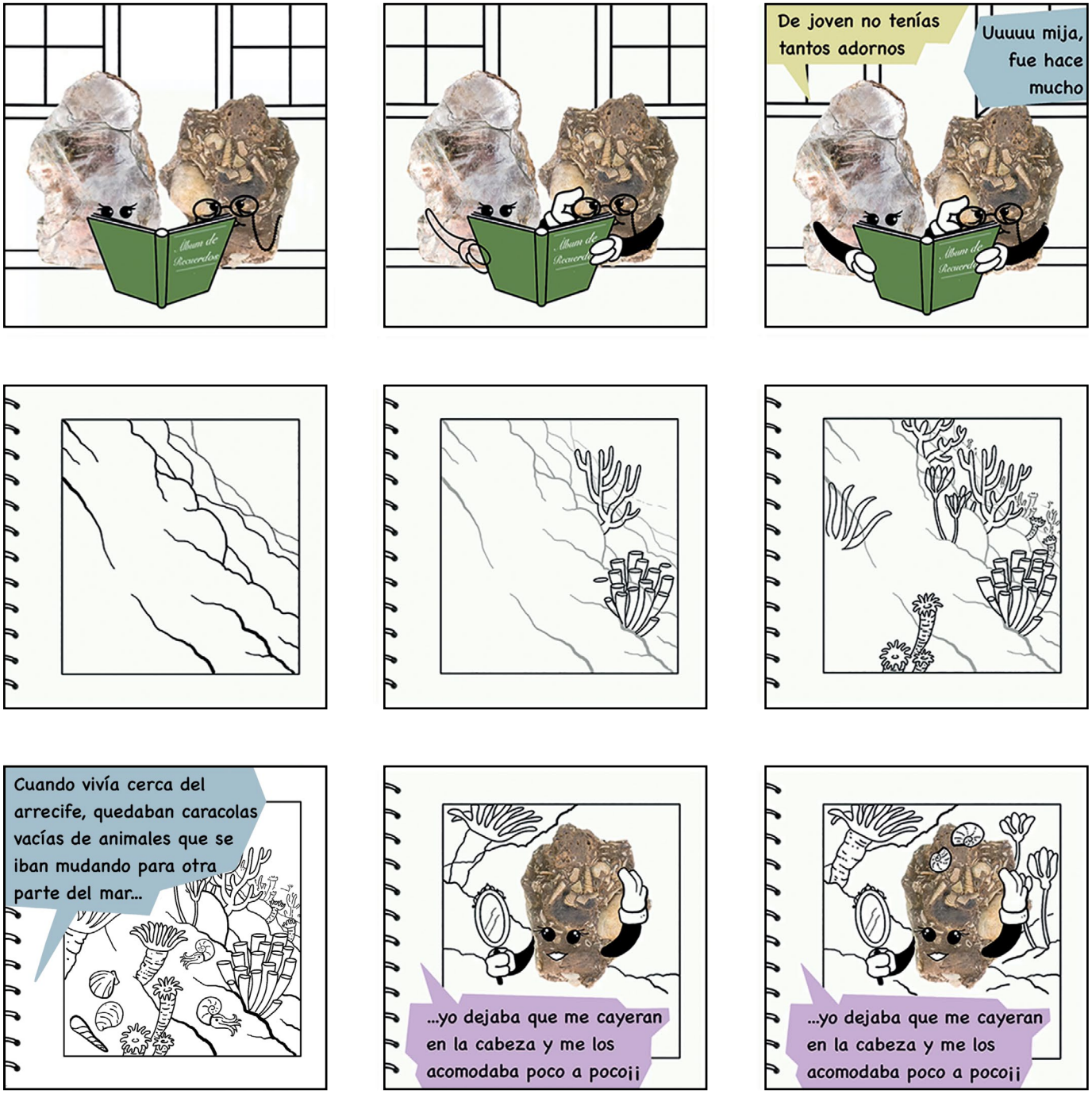


Figure 19. Creation process of the Familia Piedrahita comics.

A total of 114 posts were published on Facebook, 121 on Instagram, and 135 on Twitter, with an average reach of between 10 000 and 13 000 views for each publication. The publications of the campaign can be filtered on the SGC social networks using the hashtag #SGCGeologiaDeColombia. Some examples can also be accessed at https://www2.sgc.gov.co/LibroGeologiaColombia/Paginas/Social_Media.aspx. The creative content, with good graphic and textual quality, had a positive impact on the number of followers of the SGC social media accounts, especially on Instagram, and inspired other groups of the SGC to begin sharing the results of their research in this format.

A total of ten videos were published on YouTube averaging 2200 views for each video (Table 2).

Ten comics of the Familia Piedrahita were published (Figure 22) as well as 31 stickers that can be downloaded free of charge at https://www2.sgc.gov.co/LibroGeologiaColombia/Paginas/historias-de-geologia.aspx

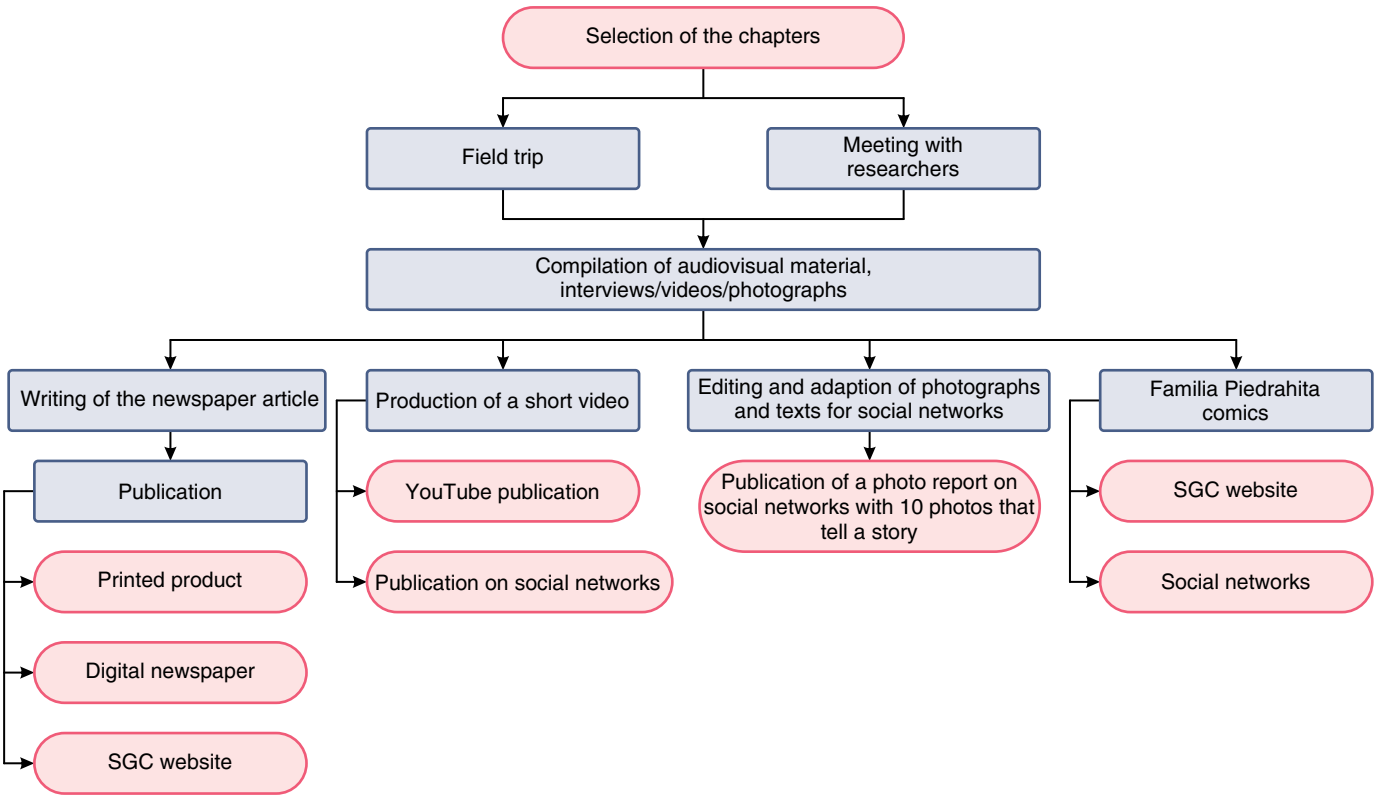


Figure 20. Flow chart of the stages of the outreach strategy for disseminating geoscientific knowledge from the work *The Geology of Colombia*.

Finally, to measure whether there was an audience that watched posts on social media and wanted to learn more about the work *The Geology of Colombia,* the number of website visits was used. From 1 June 2018 to 16 September 2019, the page reached 26 651 visits.

Although the strategy for disseminating the work *The Geology of Colombia* to the lay public is framed within the institutional policy of Social Appropriation of Geoscientific Knowledge (Apropiación Social de Conocimiento Geocientífico) that the SGC has been developing for several years, it is a pioneering strategy. In addition to being an organized and intentional process that involved the participation of different actors, among other scientists, local communities, and communicators, the strategy included several innovative components that resulted in quality products and impact.

Among the distinctive factors of this strategy, the constitution of a multidisciplinary team to design and develop the process stands out; this team conducted field trips that facilitated the presentation of the activities that geoscientists perform daily to the public, facilitated efficient and respectful communication between the geoscientific world and journalism, planned and prepared content with specific objectives, and produced high–quality graphic and textual pieces.

Social networks and the website played a key role within the strategy because they allowed for greater reach, mapping the audiences that consulted each social network, which provided knowledge with their interests and facilitated refinement of the material that was published. For each platform, the type of photographic content that had the greatest impact or interactions was studied.

The strategy was presented at the following national and international scientific events: XIII Technical Week of Geology, Geological Engineering and Geosciences in Manizales, Colombia; GSA Annual Meeting 2018 in Indianapolis, Indiana, USA; International Congress of Science and Technology Governance in Bogotá, Colombia; 5thYES Congress 2019 "Rocking Earth's Future" in Berlin, Germany; AGU Fall Meeting 2019 in San Francisco, USA. In the presentations, the feedback was received from geoscientists, communicators, and scientists from other disciplines, in addition to inspiring professionals interested in the dissemination of science.

Additionally, with the strategy, some limitations of communication of science through digital media could be identified, the future path or activities recommended for measuring the continuity and loyalty of the audience could be determined, and the knowledge that has penetrated the users could be calculated. It is expected that *The Geology of Colombia*'s public outreach strategy will be a model and a motivation for more researchers to disseminate their knowledge.

In conclusion, all the efforts made in the dissemination of science are satisfactory and help achieve a more equitable so-

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D Domingo

ESTE EJEMPLAR FUE IMPRESO CON TINTAS ECOLÓGICAS

AN ENVIRONMENTALLY FRIENDLY INK SYSTEM AGRI-WEB A trademark of Flint Group

El volcán que nadie ve

A propósito de la tragedia en Guatemala por el volcán de Fuego, expertos del Servicio Geológico Colombiano nos explicaron por qué el volcán Machín, en el departamento del Tolima, lleva miles de años anunciando un peligro similar sin que sus habitantes le presten suficiente atención. / Vivir p. 18

Un niño en el cráter del volcán Machín. Parece un potrero cualquiera, pero guarda una fuerza natural cuyas avalanchas han dejado huella sobre el río Coello. / Alejandra Cardona, Servicio Geológico Colombiano

Protagonistas de novela de la mafia en Argentina

Un excapo perseguido hace 20 años por EE. UU., reputados empresarios, un exfutbolista y familiares de Pablo Escobar forman parte del reparto. **p. 4**

¿Quiénes aconsejan a los candidatos presidenciales?

Les mostramos el organigrama de las campañas de Iván Duque y Gustavo Petro. Estos asesores serán personajes influyentes del próximo gobierno. **p. 6**

¿Criptomonedas de papas criollas colombianas?

La misma tecnología del bitcoin permite representar este y prácticamente cualquier activo, innovación que brindará al país nuevas oportunidades de financiamiento. **p. 12**

Trump-Kim Jong-un: el esperado encuentro

Análisis de la trascendencia de la reunión entre los presidentes de Estados Unidos y de Corea del Norte, prevista para mañana en Singapur. **p. 15**

Todos en modo Mundial de Fútbol

Un abrebocas a Rusia 2018 con los retos que enfrentan Messi, Cristiano Ronaldo, Neymar y James Rodríguez, y la presentación de los enviados especiales y analistas de **El Espectador**. **p. 58**

Figure 21. Journal articles of the outreach strategy of *The Geology of Colombia* published in national newspapers and magazines.

ciety. Scientific research does not end with the publication of a paper but when the information is known and applied by both the scientific community and the lay public.

7. Conclusions

The Geology of Colombia is the result of collaborative work between authors with different specialties and experience in the study of processes, specific periods of the geological time, and particular regions of Colombia, and a multidisciplinary editorial team supported by the executives of the SGC. The support offered to authors since the first stages of the project to improve the graphic and textual quality of the chapters (training, adjustment and elaboration of figures, translations, etc.) became a novel factor in editorial processes of this type and allowed having a number of chapters (58) submitted that tripled the initial expectations.

Table 1. Articles and web pages published as of January 2020 that can be viewed as part of the strategy for the dissemination of the work *The Geology of Colombia*.

nº	Title	Newspaper/ magazine	Date of publication	Consultation link
1	How the plesiosaur of Villa de Leyva found its head (De cómo el plesiosaurio de Villa de Leyva encontró su cabeza)	*Semana*	6 April 2018	https://www.semana.com/educacion/articulo/servicio-geologico-colombiano-recupero-el-plesiosaurio-encontrado-en-villa-de-leyva/562660
2	La Guajira and the Mediterranean were connected (La Guajira y el Mediterráneo estuvieron conectados)	*El Tiempo*	24 April 2018	https://www.eltiempo.com/vida/ciencia/la-guajira-y-el-mediterraneo-estuvieron-conectados-hace-125-millones-de-anos-208694
3	The evolution of planet Earth as seen through plants (La evolución del planeta Tierra vista a través de las plantas)	*Semana*	17 May 2018	https://www.semana.com/cultura/articulo/la-evolucion-del-planeta-tierra-vista-a-traves-de-las-plantas/567419
4	Gorgonilla rocks speak of what happened 66 million years ago (Rocas de Gorgonilla hablan de lo que sucedió hace 66 millones de años)	*El Tiempo*	31 May 2018	https://www.eltiempo.com/vida/ciencia/rocas-de-gorgonilla-hablan-de-lo-que-sucedio-hace-66-millones-de-anos-225102
5	The warnings of the Machín Volcano (Los avisos del Volcán Machín)	*El Espectador*	9 June 2018	https://www.elespectador.com/noticias/ciencia/los-avisos-del-volcan-machin/
6	The marine fauna of Boyacá from 125 million years ago (La fauna marina boyacense de hace 125 millones de años)	*El Tiempo*	26 July 2018	https://www.eltiempo.com/vida/ciencia/fauna-marina-boyacense-de-hace-millones-de-anos-247522
7	Small volcanoes that blend into the landscape (Pequeños volcanes que se mimetizan en el paisaje)	*El Tiempo*	9 September 2018	https://www.eltiempo.com/vida/ciencia/que-son-los-volcanes-monogeneticos-y-donde-se-localizan-265608
8	The Central Cordillera emerged from an ocean full of volcanoes (La cordillera Central surgió de un océano plagado de volcanes)	*El Tiempo*	31 October 2018	https://www.eltiempo.com/vida/ciencia/formacion-de-la-cordillera-central-de-los-andes-288224
9	The Colombian Andes sail northeast (Los Andes colombianos navegan hacia el noreste)	*El Tiempo*	27 November 2018	https://www.eltiempo.com/vida/ciencia/estudio-sobre-los-movimientos-de-colombia-298616
10	The enigmatic heat source of the Paipa hot springs (Boyacá) (La enigmática fuente de calor de los termales de Paipa (Boyacá))	*El Espectador*	12 March 2019	https://www.elespectador.com/noticias/medio-ambiente/la-enigmatica-fuente-de-calor-de-los-termales-de-paipa-boyaca/
11	The adolescent Cordillera Oriental continues to grow (La adolescente cordillera Oriental sigue creciendo)	*El Tiempo*	12 August 2019	https://www.eltiempo.com/vida/ciencia/estudio-revela-crecimiento-de-la-cordillera-oriental-en-colombia-399748
12	Ancient pollen hints at the evolution of the planet's climate (El polen antiguo da pistas sobre la evolución del clima del planeta)	*El Tiempo*	1 January 2020	https://www.eltiempo.com/vida/ciencia/el-polen-antiguo-da-pistas-sobre-la-evolucion-del-clima-del-planeta-448046?fbclid=IwAR2FemxgWcFN5BoW5KBJvHr7IBMa4ad9DYCC5qDJJpSItHs5lGs09solmHI

- One of the factors that allowed for a successful convening and development of a targeted editorial process was that the editorial team had knowledge of the geology of Colombia and fulfilled its work of collaborating with the authors during the different stages of the editorial process. The advice offered by the Scientific Committee, geoscientists with experience in the editorial field, and two Colombian associations for research and scientific and technological development of the country, allowed to build an organized editorial process that was evaluated and improved during the advance of the project.

- *The Geology of Colombia* brings together the knowledge that has been built up over years. So, the inclusion, presentation, and verification of bibliographical references and citations were one of the details that the editorial team cared. The citation style used for the work is an adaptation that responds to the particularities of the type of publications generated in the country (conferences summaries, explanatory reports, internal reports). The standardization of bibliographic references was carried out based on 10 different categories of scientific documents; for each one was established a standard format.

Table 2. Videos published on YouTube of *The Geology of Colombia* outreach strategy.

nº	Name	Description	Consultation link
1	Pedro PATARROYO/Cerro Yuruma in La Guajira (Cerro Yuruma en La Guajira)	In La Guajira Department, the geologist Pedro PATARROYO of the Universidad Nacional de Colombia climbed Cerro Yuruma step–by–step, finding in each layer key information confirming the evidence of the Barremian era in our territory.	https://youtu.be/7RyviRyhipQ
2	Marcela GÓMEZ/Environment of Villa de Leyva (Ambiente de Villa de Leyva)	What was the landscape like in Villa de Leyva, Sutamarchán, and Sáchica 125 million years ago? It was a warm sea, approximately one hundred meters deep with abundant and diverse fauna, including giant reptiles, according to paleontologist Marcela GÓMEZ.	https://youtu.be/rOTHHnTgnrw
3	Leslie NOÈ/Pliosaurs (Pliosaurios)	The marine reptiles that lived in the sea of what is now Villa de Leyva shared the landscape with dinosaurs 125 million years ago. Among them are giant tortoises, plesiosaurs, and pliosaurs. What were the latter like?	https://youtu.be/bZ1W8c3gDEo
4	Carlos JARAMILLO/Plant evolution (Evolución plantas)	Although plants already existed, the first fossil record of a flower is from 140 million years ago. When a meteorite hits the Yucatán Peninsula and the extinction of many species occurs –65 million years ago– flowering plants start taking over the landscape.	https://youtu.be/LYvr_JP1D_o
5	Gloria Patricia CORTÉS/Machín lahars (Lahares Machín)	In the Coello River (Tolima, Colombia), geologists have found the tracks left by the eruptions of the Cerro Machín Volcano, one of the most dangerous in the country in the last ten thousand years: Devastating avalanches that have even reached the Magdalena River in Cundinamarca.	https://youtu.be/rij3bhiSwAM
6	The geological secrets of Gorgonilla Island (Los secretos geológicos de la isla Gorgonilla)	How can one imagine that 66 million years ago, the island of Gorgonilla was submerged two kilometers below sea level and that fragments of glass arrived in these depths produced by the meteorite that collided with what is now the Yucatán Peninsula?	https://youtu.be/qWhtbp77fXw
7	The origin of the Central Cordillera (El origen de la cordillera Central)	The planet Earth is transformed by the action of earthquakes, tsunamis, volcanoes… In the more than 70 million years that the Cretaceous lasted, changes occurred. From being submerged in an ocean, our Colombia began to form its mountains.	https://youtu.be/d_Zgz8LaQAE
8	Héctor MORA/GeoRED	More than 120 geodetic stations measure the motion of tectonic plates found under Colombian territory. From Bogotá, a group of scientists and technicians of GeoRED track the incoming data from each of them second–by–second.	https://youtu.be/lxo-zv7FvaI
9	Monogenetic volcanoes (Volcanes monogenéticos)	South of the Colombian Andes, geologists have discovered more than 20 monogenetic volcanoes (which means that they erupt only once); after eruption, these volcanoes blend into the mountainous landscape, making it difficult to identify them.	https://youtu.be/hLDZefUNMRY
10	The origin of the Paipa hot springs (El origen de las aguas termales de Paipa)	The remnants of a volcano that last erupted a million years ago are found in the depths of the Paipa soil, in Boyacá. Researchers from the Servicio Geológico Colombiano study this source that heats the relaxing Paipa hot springs.	https://youtu.be/xUdgGzDmjoE

- In a publication, the figures synthesize and group much of the information and the ideas of the text. They are a means to facilitate the transmission of the message that the author wants to deliver. For this reason, *The Geology of Colombia*'s chapters had no restriction on the number of figures. These were made in full color and edited based on concepts and visual hierarchies that the Grupo Mapa Geológico de Colombia of the SGC has been working on for several years to guarantee legibility and clarity.
- The editorial guidelines for *The Geology of Colombia* were based on the best articles, guides, and manuals of style for international use, like the suite of Chicago Guides to Writing, Editing and Publishing; this allowed us to take right, logical, and defensible decisions. The adjustment of the chapters to the editorial guideline was a careful work that involved training and dedication. The most important part of this task was to convert 58 publications from different authors into a single work by ensuring a consistent style throughout the whole multivolume book.
- During the development of the editorial process to produce *The Geology of Colombia,* the work team participated in national and international scientific events. These conferences and the organization of topical sessions about Colombian geology allow to promoting the research presented in the editorial work and encouraged interdisciplinary exchanges and debates on Colombian geology in a local and regional context. These spaces also served to elucidate new research approaches and opportunities for research collaborations.
- Communicating science makes it materialize in daily life. The outreach strategy of the geoscience knowledge for a lay public derive from *The Geology of Colombia* estab-

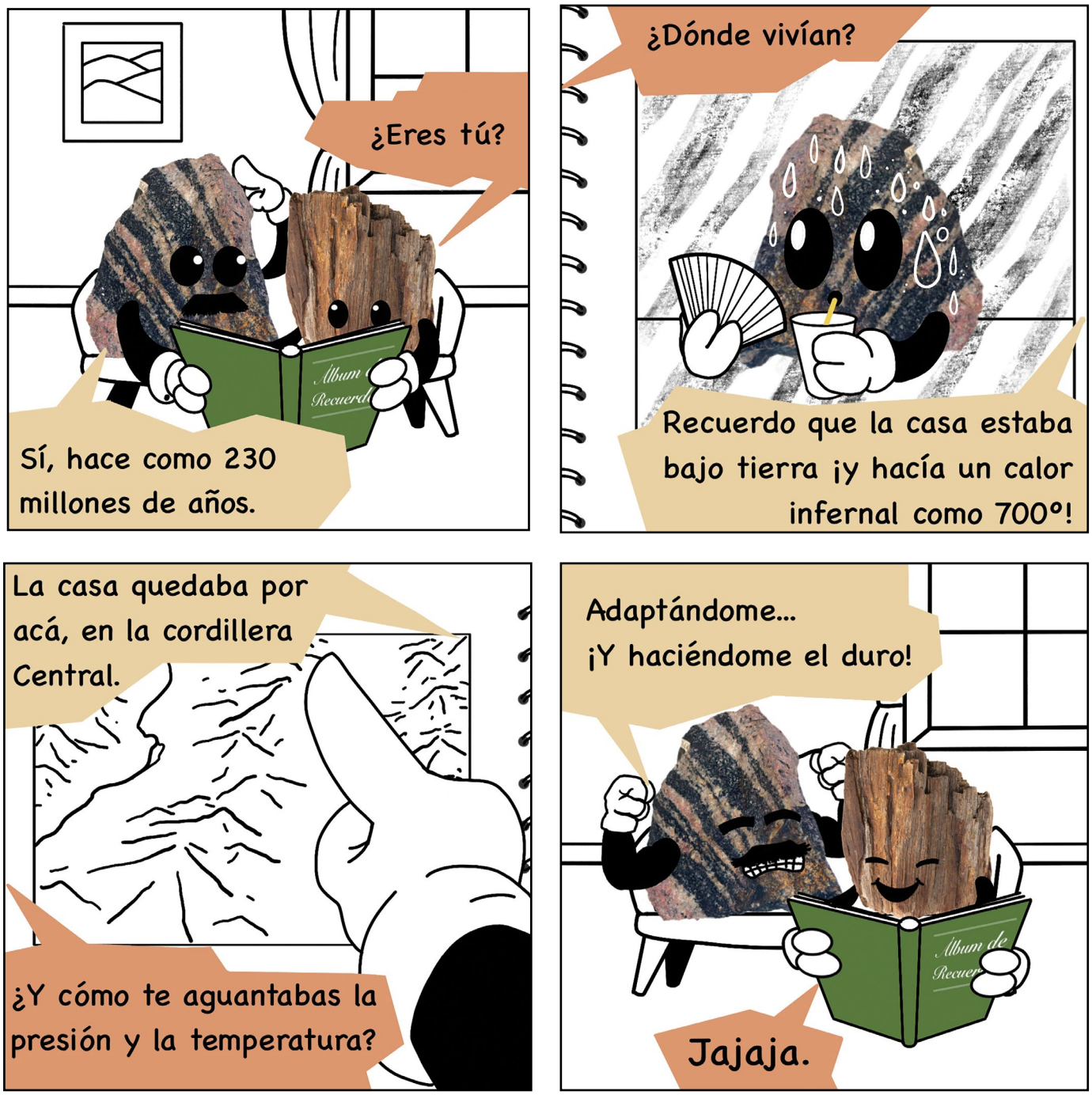

Figure 22. Example of the comics with characters from the Familia Piedrahita.

lished the need and importance of taking science out of the laboratories and into sensory experiences that involve a broad and diverse public.

- As the geological processes occur in the subsoil or happened millions of years ago, it is difficult for lay audiences to imagine those events. It becomes even more challenging to succeed in strategies aimed to look for the appropriation of geological knowledge by them. However, many topics can become attractive, we must be creative and explore other worlds of communication, keeping in mind that to communicate science it is necessary to use clear and pleasant graphic content, and a language easy to understand that capture the curiosity of the audiences.
- Social media is an effective channel to communicate science to both lay public and researchers because it allows us to create collaborative networks on a topic of common interest. We must know the function and the public of each

social media channel to focus our contents and design them accordingly.

- The editorial work, the scientific outreach strategy, the guidelines, and lessons learned from the whole process shared in this chapter can serve as a reference not only for producing other technical or scientific works but also for the reader who is writing an academic article or who is contemplating scientific popularization activities in his or her project.
- Considering that the members of the Grupo Mapa Geológico de Colombia of the SGC have a great knowledge of the Colombian geology, the team will continue to produce publications on the geological origin and evolution of the national territory. These editorial production processes will have an adequate dissemination strategy that will allow bringing geoscientific research to all Colombians.

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Explanation of Acronyms, Abbreviations, and Symbols:

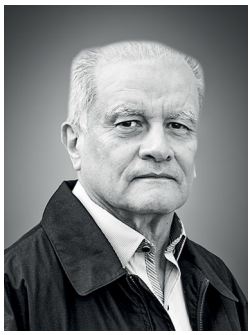
SGC Servicio Geológico Colombiano

Authors' Biographical Notes

Jorge GÓMEZ TAPIAS is a geologist and has worked as a cartographer at the Servicio Geológico Colombiano for 20 years, during which time, he has authored approximately 70 geological maps. He is the coordinator of the Grupo Mapa Geológico Colombiano of the Dirección de Geociencias Básicas, which was recognized by Colciencias as a research group in 2017. GÓMEZ is the first author of the Geological Map of Colombia at a scale of 1:1 M —editions 2007 and 2015— and of the 26 map sheets of the Geological Atlas of Colombia at a scale of 1:500 K and is the co–editor of the book *Compilando la geología de Colombia: Una visión a 2015*. Since February 2018, he has served as vice president for South America on the Commission for the Geological Map of the World. He was a co–coordinator and the first author of the Geological Map of South America at a scale of 1:5 M 2019. Since October 2020, he was elected as a member of the International Union of Geological Sciences (IUGS) Nominating Committee for the term 2020–2024. Currently, he is the editor–in–chief of *The Geology of Colombia*. GÓMEZ is in charge of coordinating all the activities related to the project and the editorial process.

Daniela MATEUS–ZABALA is a geologist who graduated from the Universidad Nacional de Colombia Sede Bogotá in 2016 and is a copyeditor of scientific and science outreach texts. She has participated in geological and geomorphological mapping projects, petrographic and geochemical characterization of rocks, and geochemical evaluation of soils. Since 2017, she has been part of the Grupo Mapa Geológico de Colombia and is a deputy editor of *The Geology of Colombia*. In this editorial project, she supported the coordination of the editorial process stages and coordinated the advisory work for the project provided by the Observatorio Colombiano de Ciencia y Tecnología and the Asociación Colombiana para el Avance de la Ciencia; she was also in charge of the writing and proofreading of texts written in Spanish and English and conducted the editorial review of the chapters.

Ana Oliva PINILLA–PACHON is a geologist who graduated from the Universidad Nacional de Colombia in 2018. PINILLA is the deputy editor of the book series *The Geology of Colombia*, and is in charge of establishing the book series' editorial guidelines based on the *Chicago Manual of Style*. Thereby, she ensures consistency throughout the entire work, fosters the correct use of grammar and bibliographic citations, and establishes a stringent hierarchization of the content.



Alberto NÚÑEZ–TELLO is a geologist who graduated from the Universidad Nacional de Colombia and is a specialist in environmental management and disaster prevention for the Universidad del Tolima. He has worked for 32 years at the Servicio Geológico Colombiano in different positions, including that of technical director. His main interest is in regional geological mapping and geological risk management.

Rubby Melissa LASSO–MUÑOZ is a geological engineer who graduated from the Universidad Nacional de Colombia Sede Medellín in 2016. LASSO has worked in the petroleum industry and conducted science outreach with communities. Since 2019, she has worked on the Grupo Mapa Geológico de Colombia in the Servicio Geológico Colombiano and has been in charge of coordinating the project promotion and the science outreach activities. She is also responsible for updating *The Geology of Colombia* website and producing text, graphics, and audiovisual content for it.

Fernando Alirio ALCÁRCEL–GUTIÉRREZ is a geologist who graduated from the Universidad Nacional de Colombia and is a specialist in geomatics graduated from the Universidad Militar Nueva Granada. He has been part of the Grupo Mapa Geológico de Colombia since 2012. He has co–authored several publications from the group, including the *Catálogo de dataciones radiométricas de Colombia en ArcGIS y Google Earth*, and he is also the first author of the informative Geological Map of Colombia 2019 at a scale of 1:2 M. ALCÁRCEL has extensive experience in the vectorization and digitization of graphic material for scientific publications, which is why he is the main graphic artist for *The Geology of Colombia* and is in charge of elaborating and improving the figures and maps.

Eliana MARÍN–RINCÓN is a geologist who graduated from the Universidad de Caldas in 2017. In the editorial process of *The Geology of Colombia*, she is in charge of preparing and adjusting the chapters' figures. MARÍN also supports the science outreach events through general logistics management and maintains the correspondence with and databases of participants.

María Paula MARROQUÍN–GÓMEZ is a geoscientist who graduated from the Universidad de los Andes in 2019, where she completed her studies with the financial support of *Bachilleres por Colombia Ecopetrol* scholarship. She has been part of the Grupo Mapa Geológico de Colombia since 2019, supporting the editorial and thematic reviews for *The Geology of Colombia* by ensuring the clarity and consistency of the chapters.

Lisbeth FOG–CORRADINE is a social communicator and journalist from the Universidad Jorge Tadeo Lozano who earned a Master of Science degree in science journalism from Boston University, United States, as a Fulbright scholar. In *The Geology of Colombia* project, she leads activities related to the social engagement of knowledge. FOG produces news articles in plain language based on the content of the chapters. These stories are then published in the Colombian media.

Alejandra CARDONA–MAYORGA is a graphic designer and specialist in photography from the Universidad Nacional de Colombia. CARDONA handles all visual aspects of the project, such as visual communications in printed and digital media. In addition, she is in charge of carrying out photographic and video documentation of all the activities related to the project, including taking photographs of the authors and establishing photographic records of the field trips, as well as developing the project's storytelling through audiovisual material.

Miguel Gerardo RAMÍREZ–LEAL is a graphic designer from the Universidad Nacional de Colombia with 14 years of experience in the fields of graphic design and illustration. In *The Geology of Colombia*, he is in charge of the layout, design, and printing of the book. In addition, he supports the layout of graphic pieces and is in charge of the illustration of the comic strips *Familia Piedrahita* as part of the project's science outreach strategy.