Capítulo 2

https://doi.org/10.32685/pub.esp.39.2023.02
Publicado en línea el 5 de mayo de 2023

What You Should Know When Writing Scientific Papers in Geosciences Part 2: Geological and Scientific Terms

María Paula Marroquín–Gómez[1], Jorge Gómez Tapias[2]*, and María Fernanda Almanza–Meléndez[3]

1 mpmarroquing@arizona.edu
The University of Arizona
Department of Geosciences
Tucson, Arizona, 85721, EE. UU.

2 mapageo@sgc.gov.co
Servicio Geológico Colombiano
Dirección de Geociencias Básicas
Grupo de cartografía geológica
Diagonal 53 n.° 34–53
Bogotá, Colombia

3 mfalmanza@sgc.gov.co
Servicio Geológico Colombiano
Dirección de Geociencias Básicas
Grupo de cartografía geológica
Diagonal 53 n.° 34–53
Bogotá, Colombia

* Autor de correspondencia

Abstract As part of the editorial workflow of *The Geology of Colombia: Multivolume book*, a complete editorial guideline was developed to ensure editorial consistency and the correct use of scientific and geological terms. The guideline contains rules and recommendations from the best and most broadly renowned manuals of style and geological publications, such as guides carefully selected to guarantee the suitability of the adopted rules. Additionally, it was enhanced by the previous editorial experience of the Mapa Geológico de Colombia Team of the Servicio Geológico Colombiano. This guideline is a unique compilation work in terms of the synthesis and quality of information. The present two–part chapters aims to condense the most relevant information gained during the construction of the aforementioned editorial guideline and to give geoscientists a complete and reliable source of recommendations for writing clearer, unambiguously, and delivering more precise contributions. Specifically, this second part aims to share recommendations related to the correct writing of scientific terms, specifically terms of use in geosciences.

Keywords: *editorial guideline, The Geology of Colombia: Multivolume book, preciseness, clarity, Ma, my.*

Resumen no técnico Durante la elaboración de la obra *The Geology of Colombia* se desarrolló un manual o guía editorial completo en inglés para garantizar la consistencia y homogeneidad a lo largo de la publicación. La pauta contiene reglas y recomendaciones de los mejores y más reconocidos manuales de estilo y publicaciones geológicas, así como guías cuidadosamente seleccionadas para garantizar la idoneidad de las reglas adoptadas. La pauta pretende condensar la información y brinda a los profesionales de las geociencias una fuente completa y confiable de recomendaciones para escribir contribuciones más claras, precisas y evitar ambigüedades. En este capítulo, que corresponde a la segunda parte del manuscrito dedicado a las recomendaciones para escribir artículos científicos, se presentan consejos relacionados con la escritura correcta de términos de uso en geociencias.

Resumen Como parte de la realización de la obra multivolumen *The Geology of Colombia* se desarrolló una pauta editorial completa para garantizar la consistencia editorial y el uso

Citación: Marroquín–Gómez, M.P., Gómez, J. & Almanza–Meléndez, M.F. 2023. What you should know when writing scientific papers in geosciences part 2: Geological and scientific terms. En: Gómez, J. & Mateus–Zabala, D. (editores), Consejos de escritura y edición de artículos científicos. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 39, 15 p. Bogotá. https://doi.org/10.32685/pub.esp.39.2023.02

correcto de términos científicos y geológicos. La pauta contiene reglas y recomendaciones de los mejores y más reconocidos manuales de estilo y publicaciones geológicas, como guías cuidadosamente seleccionadas para garantizar la idoneidad de las reglas adoptadas. Además, se nutrió de la experiencia editorial previa del Grupo Mapa Geológico de Colombia del Servicio Geológico Colombiano. La pauta es un trabajo de recopilación único en términos de síntesis y calidad de la información. Este trabajo de dos partes pretende condensar la información más relevante obtenida durante la construcción de la pauta editorial mencionada y brindar a los geocientíficos una fuente completa y confiable de recomendaciones para escribir contribuciones más claras, precisas y evitar ambigüedades. Específicamente, esta segunda parte tiene como objetivo compartir recomendaciones relacionadas con la escritura correcta de términos científicos, puntualmente términos de uso en geociencias.

Palabras clave: *pauta editorial, obra multivolumen The Geology of Colombia, precisión, claridad, Ma, my.*

1. Introduction

The correct usage of terminology in contributions improves communication, saves time, and prevents misunderstandings. Through the production of the edition of *The Geology of Colombia: Multivolume book* (TGCMB) (Gómez & Pinilla–Pachon, 2020a, b; Gómez & Mateus–Zabala, 2020a, b), the editors' major interest was that the focus of the reader is on the ideas, arguments, and means of demonstration developed in the papers; however, sometimes these were overshadowed because of communication breakdown caused by, e.g., vocabulary ambiguity and impreciseness, that distracts and bores the reader and may even prevent communication at all. After the editorial board of TGCMB noticed that some authors had ignored critical rules —something that occurred more often than was thought— a compilation of recommendations and norms was prepared and shown together with the editorial guideline. That compilation allowed us to make quick, logical, and defensible decisions during the editorial review of the chapters and is part of the editorial style of the books.

The recommendations and rules shared in this article are the result of meticulous work and were obtained from numerous manuals and guides of scientific communication and geological terminology. Most of the examples used to clarify the norms are taken from examples found in TGCMB during editorial workflow and, accordingly, frequent mistakes or misunderstandings were cited as well.

2. Theoretical Framework: Manuals and Guides

Manuals related to the discipline were consulted to ensure the correct use of scientific and geological terms. For example, the correct use of stratigraphic terminology was based on *The International Stratigraphic Guide* (Salvador, 2013) and the *North American Stratigraphic Code* (NACSN, 2021), both recognized, widely used, distributed, and part of international agreements achieved through decades of discussion. The North American Commission of Stratigraphic Nomenclature guides were very helpful as well. The "Thinking of deep time" paper (Aubry, 2009) explains the differences between date/duration abbreviations (Ma/my) for geological time expressions. Additionally, explanations about the proper use of adjectives for time/time–rock units (early/lower) and capitalization of formal and informal terms were found in "How to use stratigraphic terminology in papers, illustrations, and talks" by Donald E. Owen (Owen, 2009).

Books from the International Union of Geological Sciences were also taken into account, such as *Igneous Rocks: A Classification and Glossary of Terms* (Le Maitre, 2002) and *Metamorphic Rocks: A Classification and Glossary of Terms* (Fettes & Desmons, 2007), which were used in regard to spelling doubts and to corroborate meanings and for classification purposes. Additionally, the *International Code of Zoological Nomenclature* (ICZN, 1999) and the *International Code of Nomenclature for algae, fungi, and plants* (Turland et al., 2018) were used for the correct writing of taxonomic names.

Readers will find throughout the article that although the mentioned references are the primary sources, some other documents were consulted to complete a lack of information or make the explanations more understandable. These are also reliable sources and can be found in the reference list.

3. Results

As a result of the editorial experience of the Mapa Geológico de Colombia Team in the making up of TGCMB and previous projects, a complete guideline for writing scientific papers in geoscience was prepared. This section aims to present in a clear and condensed way the most important rules and recommendations referring to the correct usage of scientific and geological terms; we feel they will be of great utility to colleagues in any professional stage.

3.1. Precision, accuracy, and clarity

The International Stratigraphic Guide noted in the purpose section: "all in the interest of improved accuracy and precision in

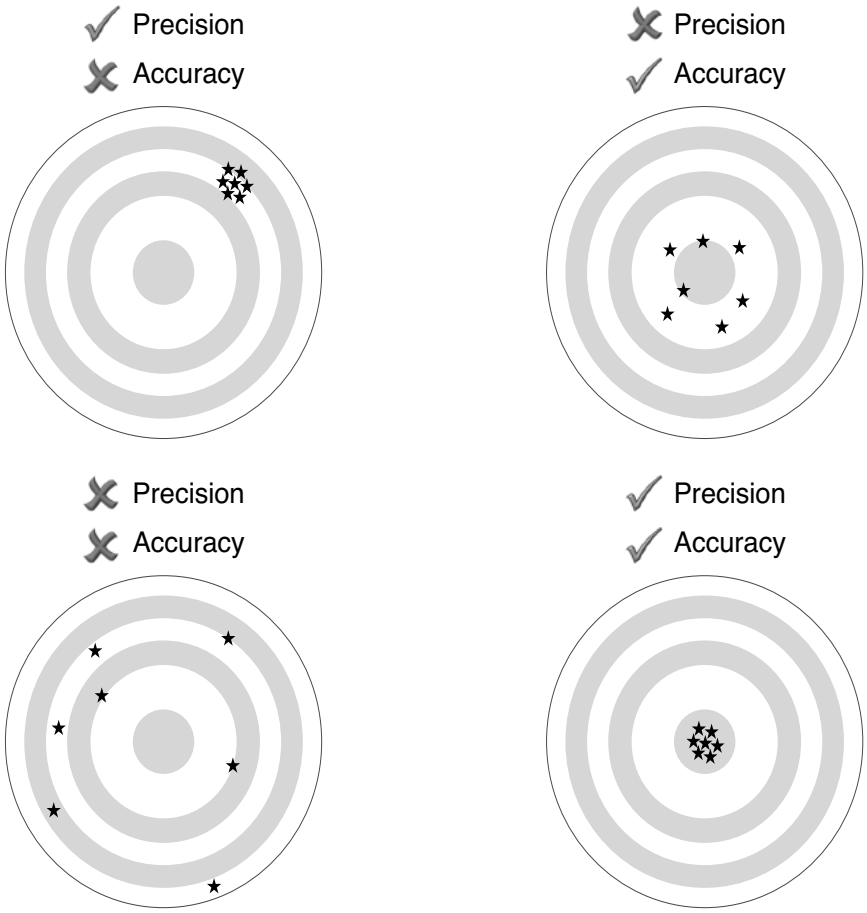

Figure 1. Visual example to illustrate the differences between precision and accuracy.

international communication, coordination, and understanding" (Murphy & Salvador, 1999). These valuable concepts, *accuracy* and *precision*, in scientific communication will be defined before proceeding due to the need to take these concepts seriously during writing in order to make our information, whatever we are attempting to share, fully understandable.

Both accuracy and precision are sometimes used as synonyms; however, their meanings are far from being equal (Figure 1). Almanza et al. (2015) described *precision* as the use of a concept, idea, or information in a sense that is accepted by the majority of the geological community, while *accuracy* refers to using concepts, ideas, and information in the right way, considering the right way as conforming to the truth. In this sense, a precise concept is the one in which most scientists use to explain a phenomenon, while an accurate concept is the one in which the concept is used with correctness and is true from a scientific point of view. A precise concept could be inaccurate, and an accurate concept may be imprecise. If having to choose, it is necessary to be ALWAYS clear; therefore, we should use the critical concept and explain the sense of it being used. Frequently, it may be useful to include the equivalent precise and/or accurate concept. It is mandatory to have clear arguments that justify why we use one or the other. Authors working in a particular field of work know which concepts may cause confusion and must be explained, especially considering international impact texts with a considerably broad audience. The use of confusing concepts without making them clear is a serious error.

Another important term is *effectiveness*. An effective document is the one that is successful in sharing what authors want to communicate. It presents readable ideas and information in a way that readers find them fully understandable. For a document to be effective, it should be clear, which means avoiding ambiguity. A clear text does not leave room for readers to have misunderstandings or to understand something different than the original idea of the author. Similarly, precision and accuracy make communication more effective. The preciseness and accuracy in the text are given by the correct usage of the terms, from the ones related to the scientific endeavor to the ones of the discipline (geosciences). All these mentioned characteristics should be present in the document to guarantee the main aim: sharing your work in a highly readable way.

To sum up, a text should be **clear** and authors have to use **precise** and **accurate** terms to guarantee the article's effectiveness; otherwise, misunderstandings may cause all the effort to be worthless. The clarity in the text is often an effect of an extensive understanding of the subject matter, as well as correct and mastery using the language and discursive tools. Additionally, there

are standards for certain types of information that, if followed, make their presentation clear. These standards were previously designed and internationally approved, e.g., the ones consolidated in the *International System of Units* (Newell & Tiesinga, 2019).

3.2. Geographic names

Geographic terms have a correct spelling that should be checked in national geographic dictionaries or official websites or national official grids, sometimes detailed scales are more useful. Since this is not a common practice, there may be several names for the same place that could cause confusion and errors in stratigraphic names. Additionally, there may be a difference between the official name and the one used; thus, it might be a good idea to include both, as what is critical is to locate readers effectively.

To guarantee the preciseness and accuracy of geographic terms, the TGCMB editorial board reviewed the *Diccionario geográfico de Colombia* (Igac, s.f.), a resource with more than 200 000 toponyms (place names) and geographic terms of the Instituto Geográfico Agustín Codazzi as well as *Colombia en mapas* where national grids can be found. Authors should determine that terms are used correctly by using an authoritative publication. For example, when referring to a peninsula located in northern Colombia, we found in scientific texts both *Guajira Peninsula* and *La Guajira Peninsula*; however, according to the *Diccionario geográfico de Colombia*, the correct toponym is *La Guajira Peninsula* since the term *Guajira* is used for other places such as a creek and a stream.

After reviewing the correctness, there are some style recommendations to follow. According to Hansen (1991), the words considered part of a proper geographic name are capitalized, including adjectives, common nouns, and the definite article, which is opposite to the Spanish procedure. Look at the following examples:

- Magdalena River
- Eastern Cordillera
- La Guajira Peninsula

Note that in the last item, the Spanish article "La" is also capitalized since it is the definite article and is part of the proper name.

In addition, when mentioning different geographic names with the same common noun, treat them as a group and make the common name at the end of the list plural and capitalized:

- Eastern, Central, and Western Cordilleras.
- Cauca and Magdalena Valleys.

However, if you are using a geographic term in a descriptive sense, it should not be capitalized. For example, "the fieldtrip was carried out in the Cauca River *valley*" or "the samples were taken along the Pacific *coast*"; both *valley* and *coast* are used in these specific examples not as part of the geographic name but as a description of the geographic place where the actions were taken.

3.3. Coordinates

Consider always using geographic coordinates in the form of degrees, minutes, and seconds. Since this system is recognized worldwide, this will make it easier for readers of your work to locate the point in question.

To write coordinates, follow the recommendation of the *International System of Units* (Newell & Tiesinga, 2019): do not leave a space between the symbol (°, ', and ") and the number, e.g., 75° 10' 37". In addition, there are other guidelines for coordinates, most of which are from T*he Chicago Manual of Style* (TUCPES, 2017):

- In a table, when giving the location, write first the latitude and then the longitude.
- In the text, separate the latitude and longitude with a comma and place the compass symbol at the end, e.g., 30° 22' N, 30° 22' W.
- Possible abbreviations could be lat. and long.
- Compass points are written without periods: N, E, S, W, NE, SE, SW, NW, NNE, ENE, or ESE.

3.4. Geological terms

This section aims to summarize the rules and recommendations for writing and describing geological terms. Most of them are standardized by guides and manuals and pretend to provide consistency and precision in the use of the terms. Authors must be particularly rigorous by using these terms correctly.

The main consulted documents for stratigraphic nomenclature were *The International Stratigraphic Guide* (Salvador, 2013) and *North American Stratigraphic Code* (NACSN, 2005), which are strongly recommended. *The Guide* is an internationally accepted document written by more than 75 worldwide members; thus, its application is global. In contrast, *the Code* has a regional application leading the rules for the USA, Canada, and Mexico, but it is also widely used in Colombia and is updated to 2021. Although there are relevant differences between *the Guide* and *the Code*, some of them will be mentioned here. *The Code* noted that a guiding principle has been to be as consistent as possible with *the Guide*.

Publications by the Subcomissions of the International Union of Geological Sciences, together with some from the United States Geological Survey, were also deeply consulted to clarify doubts concerning correct usage of mineralogical and petrological terminologies. Rules for non–stratigraphic nomenclature are not completely clear and does not exist a manual such as *the Guide* or *the Code*. Other recommendations were taken from the extensive experience of the Mapa Geológico de Colombia Team.

3.5. Stratigraphic terminology

According to *The International Stratigraphic Guide* (Murphy & Salvador, 1999), "Stratigraphy" comes from the Latin *Stratum* + Greek *graphia* and is **the description of all rock bodies in the**

Earth's crust. Thus, stratigraphy must be considered for all rock bodies (consolidated and unconsolidated), and that includes igneous, metamorphic, and sedimentary rocks. In this sense, stratigraphic terminology encompasses all rock body names.

Most stratigraphic names are binomial; that is, they are made up of two nouns. The first term is usually the noun of a geographic location, and the second term is a rank term (also called unit terms), for example, the Timbiquí Formation. In the case of binomial naming, the spelling of the geographic component must be used in the original language (never translate it!), in contrast to the rank term (unit term) that must be translated to the writing language (e.g., formation, stage, chronozone, or biozone).

It is recommended to always use the stratigraphic name as it was established to avoid confusion and the proliferation of different names for a single geological unit, something common in Colombian geology. It is also important to make the distinction between formal and informal terms by using quotation marks or lower case letters.

3.5.1. Formal and informal terms

A **formal stratigraphic term** is the name of a unit that has been correctly established —to see the procedures for establishing and revising stratigraphic units, consult *the Guide*—. *The Guide* indicates that the first letters of all words used as formal stratigraphic units must be capitalized (Murphy & Salvador, 1999). For example, the following are some Colombian formal stratigraphic units: Paja Formation, Tibú Member, *Nicklesia puchella* Biozone or Ibagué Batholith. Although all of them are formally defined, we can see that the biostratigraphic unit is written in a different way.

Biostratigraphic units are not binomial but have two parts: the taxonomic name and the stratigraphic rank term (unit term). The taxonomic name defining the unit should be written according to the rules laid down in international codes endorsed by the *International Union of Biological Sciences* (such as ICZN, 1999 or Turland et al., 2018), which is why in the unit *Nicklesia pulchella* Biozone, the first part is italicized, the genus is in uppercase, and the species name is in lowercase. In this document, section 3.11 reviews the correct usage of taxonomic scientific names.

When referring to more than one formal unit with the same rank term, treat the units as a group and keep the rank term at the end in plural and capitalized (as in geographic names), e.g., Timbiquí, Paja, and Cuervo Formations.

In contrast, **informal stratigraphic terms** are those that have not been previously established according to the norm. These terms could include defined unit terms but in a descriptive sense, not as part of a formal classification. Some authors use the lower case capitalization rule or quotation marks to point out the informality of the term. The capitalization rule consists in the first letter of the first word of the compound term capitalized, but the first letter of the other second term in lowercase, e.g., Monserrate formation (Hansen, 1991). On the other hand, other authors use the binomial term included in quotation marks, e.g., "Monserrate Formation".

Most stratigraphic terms that are informal have been designated solely by color (e.g., vary–colored mudstone interval), lithology (e.g., arenaceous conglomeratic unit), position (e.g., upper member), type of deposit, letter, or number. Although informal stratigraphic terms are widely used and have great utility, for example, in economic geology (wire lines, B6 sandstone, productive strata, or 16 coal mantle), *the Guide* strongly discourages the use of formal unit names in an informal sense: "if a stratigraphic unit merits a name, it merits proper definition and description" (Salvador, 2013). In addition, informal names in scientific papers contribute to a lower level of reliability.

3.5.2. Unit term or rank of units

There are many divisions of stratigraphic units presented by different guides of stratigraphic classification that could be useful depending on the contribution and aim of the research. For example, *the Guide* and *the Code*, the main documents consulted here, have relevant differences in their proposed categories; one of them is that *the Guide* considers a lithostratigraphic unit as any unit classified based on the lithological properties of the rock bodies, while *the Code* divides this category into lithostratigraphic and lithodemic units, the last one includes all rock bodies that do not conform to the Law of Superposition. It is the author's responsibility to choose the classification that best fits their purpose but also to let readers know which one they are using.

3.5.3. Simplification of stratigraphic terms

Simplification of stratigraphic terms is possible only if it does not cause ambiguity. To avoid misunderstandings, it is important to be consistent in the way the simplification is conducted but to also be careful so that there is no room for doubt. The first mention of a term must be complete. Nevertheless, when an author is referring frequently to a formal name, this could be simplified by omitting one part of the name, for example:

> "The oldest sedimentary unit of the Floresta Massif is *El Tíbet Formation* which consists of a succession of conglomerates, sandstones, and gray–colored interbedded shales. *El Tíbet* was initially included by Cediel (1969) as a member of the Floresta Formation but was later established as a separate formation by Mojica & Villarroel (1984)".

In this example, the *El Tíbet Formation* and *El Tíbet* are terms used to indicate the same geological unit.

Another method of simplification is the use of abbreviations. The *Suggestions to Authors of the Reports of the United States Geological Survey* (Hansen, 1991) recommends the following abbreviations for Group, Member, and Formation: Gp., Mbr.,

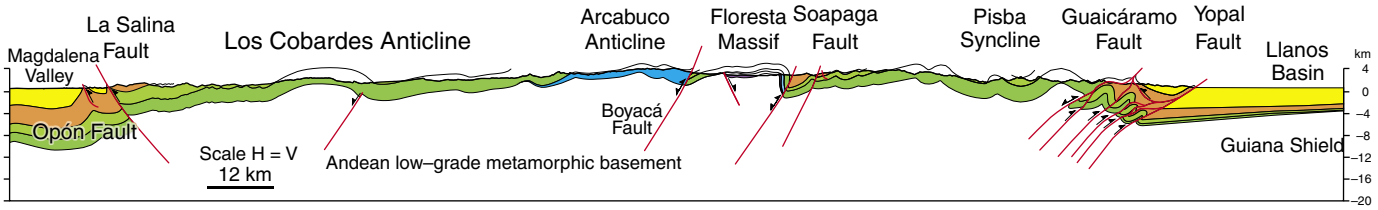

Figure 2. Examples of non–stratigraphic terminology written following the recommendation of this document. Taken from Kammer et al. (2020).

and Fm., respectively. Always use the same abbreviated term, so there will be no confusion.

The Guide also notes that after the initial usage of a formal biostratigraphic term, a simplified version may be used. For example, instead of the *Nicklesia pulchella* Biozone, authors may refer to the *Nicklesia pulchella* Zone.

3.6. Non–stratigraphic terminology

The designation of correct usage for non–stratigraphic terminology such as faults, bends, volcanoes, anticlines, basins, and other structures does not have international agreement that would allow a formal classification schema, such as *the Guide*. According to Hansen (1991), this kind of term, when having geographic significance, is viewed as a proper name and is written following the capitalization rules for formal names. However, it is difficult to know exactly when there is geographic significance, and several non–stratigraphic terms are relevant for geological descriptions. Thus, the TGCMB editorial board decided that all such terms should be capitalized (e.g., those shown in Table 1) when accompanied by a proper name, usually a geographic component, similar to the stratigraphic terms. The plural form is capitalized as well. Note that if the term is used only as a generic name, without a proper name next to it, it should be presented in lowercase letters. Figure 2 is an example of applying this in figures of TGCMB.

Table 1. Geological non–stratigraphic terms capitalized in TGCMB.

Term	Example
anticline	Zipaquirá Anticline
arc	Chocó–Panamá Arc
basin	Llanos Foreland Basin
block	Chortis Block
fault	Uramita Fault
foreland	Llanos Foreland Basin
massif	Garzón Massif
plate	Nazca Plate
rift	San Andres Rift
shield	Guiana Shield
syncline	Guaduas Syncline
terrane	Calima Terrane
volcano	Puracé Volcano

3.7. Mineralogical terminology

Mineral names are abundant in geoscientific articles, and so are their misspellings. The *Suggestions to Authors of the Reports of the United States Geological Survey* (Hansen, 1991) has a section about recommendations for authors who plan to write about optical, physical, crystallographic, or chemical properties of either existing minerals or proposed new minerals.

Hansen (1991) recommended *Fleischer's Glossary of Mineral Species*, a complete compilation of mineral names updated every four years that can be found only in printed versions. At the moment of preparing this contribution, the glossary is in its 13th edition and lists 5739 species, each of them with formula, type locality, crystal system, references, and relationships to other species (Back, 2022). However, the International Mineralogical Association (IMA) also publishes a regularly updated list of minerals that is intended to be the primary and official source, and the fact that it is available online makes it highly recommended. This list currently contains 5809 mineral species with their IMA status, approved formula, IMA No/Year, country, and references; it can be found here: http://cnmnc.units.it.

Abbreviated forms of minerals are helpful for many purposes, including compound rock names, phase diagrams, and databases. That is why it is useful to set consistent mineral abbreviations for using them throughout text, figures, and tables. A widely known and recommended set of mineral abbreviations is the one developed by Siivola & Schmid (2007), which lists abbreviations for 240 mineral species, series, subgroups, and groups. The list is found in *Metamorphic rocks: A classification and glossary of terms* (Fettes & Desmons, 2007). In the case that the required mineral is not listed, the document also explains the rules for expanding the list with prefixes, subfixes, etc. Table 2 shows some of the mineral abbreviations presented in Siivola & Schmid (2007). Authors who use this list should point it out (in the reference section, for example), and those who do not should be aware of the potential confusion caused by mineral abbreviations.

3.8. Petrological terminology

The International Union of Geological Sciences has had as one of its main purposes fostering communication and cooperation between colleagues around the world. However, a major challenge has been the lack of international agreement in the usage of geological terminology. There are many terms related to igneous and met-

Table 2. List of the most commonly used mineral abbreviations.

Mineral Name	Abbreviation
Albite	Ab
Actinolite	Act
Amphibole	Am
Apatite	Ap
Biotite	Bt
Clinopyroxene	Cpx
Fluorite	Fl
Garnet	Grt
Hornblende	Hbl
K–feldspar	Kfs
Muscovite	Ms
Quartz	Qtz
Zircon	Zrn

amorphic petrology that are used and understood differently across countries. The task of establishing a systematization in terminology and rock definitions was carried out by the Subcommission on the Systematics of Metamorphic Rocks and the Subcommission on the Systematics of Igneous Rocks; both groups produced major books where it was possible to portray their efforts.

Igneous Rocks: A Classification and Glossary of Terms (Le Maitre, 2002) and *Metamorphic Rocks: A Classification and Glossary of Terms* (Fettes & Desmons, 2007) are authoritative references for studying and writing about igneous and metamorphic rocks. They are intended to present recommendations of a classification and nomenclature scheme for geologists to make possible the use and designation of logical and intuitive names.

The book basis of classification comprises the use and understanding of root names. However, root names are not enough to describe specific rocks, and it is necessary to use qualifiers that, according to Le Maitre (2002), may be mineral names (e.g., biotite granite), textural terms (e.g., porphyritic granite), chemical terms (e.g., Sr–rich granite), genetic terms (e.g., anatectic granite), or tectonic terms (e.g., postorogenic granite). In the case of adding mineral names, one of the most common qualifiers, there should not be a space between minerals but an en dash. Likewise, the list of mineral abbreviations mentioned in the previous section could be very helpful in this nomenclature. For example, the **biotite–quartz–plagioclase gneiss** could also be written as **bt–qtz–fsp gneiss**.

We encourage authors to follow the recommendations for igneous and metamorphic rocks by the IUGS when preparing manuscripts, because it will improve the reference to a specific rock; thus, we will all be "speaking the same language".

3.9. Uncertainty and time span

When there is doubt about the identification of a stratigraphic unit (name, age, or time of deposition), the uncertainty should be expressed following the conventions given by the *International Stratigraphic Guide* (Salvador, 2013):

- Use a question mark to express doubt in the age. Do not include parenthesis nor a space between the geological age and the question mark, e.g., Devonian**?**.
- In the same way, use a question mark to indicate doubt in the recognition of the unit, e.g., Timbiquí**?** Formation or the rank term in case there is any doubt, e.g., Timbiquí Formation**?**.
- The time span is also represented by specific nomenclature: Use "to" or en dash for continuous deposition or time; for example, Ordovician to Devonian or Ordovician – Devonian, which includes Ordovician, Silurian, and Devonian.
- Use "and" to exclude the intermediate time and make both terms undifferentiated; for example, Ordovician and Devonian means a description that includes both, but excludes Silurian.
- Use "or" to indicate a doubt in the assignation, this means that it could be either one term or the other; for example, Ordovician or Devonian shows uncertainty as to the correct age and it could be either Ordovician or Devonian, but not both.

3.10. Geological time

The study of the Earth cannot be possible without considering geological time. Geologists think about time in a very different way than other sciences. Thus, geologists created some conventions; for instance, dividing geological time into subunits with specific names and characteristics or differencing between the time in which an event occurred (geochronological unit) and the age of a body of rock (chronostratigraphic unit).

This section compiles the concepts and recommendations about geological time to avoid ambiguities and imprecision.

3.10.1. Chronostratigraphic vs. geochronological units

Surely, you did not wake up "lower" this morning, nor did you organize your books in the "late" part of the library stand. It is clear we cannot use place words when we are talking about time and vice versa. However, in geological papers, this seems to be a common mistake; you can find studies that incorrectly use **Upper** Jurassic to **Lower** Cretaceous events or **Late** Cretaceous rocks. This is something to be careful about; therefore, before using a term, ask yourself if the adjective phrase is referring to time or if it is referring to material features.

The first thing to consider is the difference between chronostratigraphic (time–rock) units and geochronologic (time) units. A chronostratigraphic unit is a particular body of rock, something you can touch and is placed in a spatial position. In contrast, a geochronologic unit is represented by the equivalent interval of time when the rock formation formed (Hounslow, 2021). The first one is divided into lower, middle, and upper parts, and the

Table 3. Chronostratigraphic vs. geochronologic units. Modified from Haile (1987).

Chronostratigraphic Unit (time–rock)	Geochronologic Unit (time)
Consists of all rocks of the same age as the type section	Applied to all events which occurred within the defined time
Appropriate for designating the age of rocks and relationships observable at present	Appropriate for designating the time of occurrence of geological events
E.g., strata, formations, biostratigraphic zones, unconformities, seismic reflectors, and seismic sequences	E.g., depositional and erosional episodes, folding, faulting, faunal extinctions, mineralization, oil generation and migration
Unit has a base and top	Unit has a beginning and end
Part or all of the unit may be absent in any specific location	Unit, being a defined period of time, was ubiquitous and unvaried
Divided into lower, (middle), upper	Divided into early, (middle or medial), late

second one into early, middle, and late parts. Some other differences to help identify these types of units are placed in Table 3.

It is important to not only know the distinction between chronostratigraphic and geochronologic units in the text but also in figures. Figures 3 and 4 are some examples of correct usage of position and time adjectives. In Figure 3, the authors wanted to explain the evolution of Tumaco Basin; therefore, every stage of its evolution is considered as an event (geochronologic unit); thus, they are written with time adjectives (Early Miocene, Middle–Late Miocene). Figure 4 represents something very common in geological articles; that is, the comparison of strata as stratigraphic units. It is surprising the frequency of seeing this type of figure with time adjectives when the comparison is between chronostratigraphic units.

3.10.2. Exceptions

There are some cases in which, although we are talking about rocks, the correct adjectives will be early, middle, and late. These are lithodemic units and terraces.

The **lithodemic units** are mentioned in *the Code*. These are rock bodies that do not generally conform to the Law of Superposition; they are generally related to intrusive, highly metamorphic rocks, or intensely deformed rocks (NACSN, 2005). For these units, relative ages are given by crosscutting relationships rather than superposition. Additionally, it is very common to use isotopic methods in these units for numerical ages (Owen, 2009). In Figure 5, there is a clear example of why chronostratigraphic terms should be avoided for these units: most of the Early Cretaceous porphyritic intrusion (97 Ma) is under sedimentary rocks of 120 Ma; thus, although the intrusive body is in a "lower" position, it is younger than the sedimentary layer above it; thus, using the position term could be confusing.

The geological construction of **terraces** causes their deposition in a different way. Since they are filling a valley, every new input will be in a lower position than the previous one, which makes the older terraces lie topographically above the younger terraces (Owen, 2009). Thus, using position terms could be confusing, so late Cenozoic–age terraces are conventionally referred to by time terms (early, middle, and late). In Figure 6, this is clearly shown. The basement is in an upper position compared with the current fluvial deposits, and according to Cortés–Jiménez (2020), the chronological order of the terraces from oldest to most recent is El Guamo Hyperconcentrated Flow Deposit ($HCFD_2$), Chicoral Debris Flow Deposit (DFD_2), and Carmen Debris Flow Deposit (DFD_1).

Referring to **fossils** is a special exception. According to Owen (2009), we should make a distinction between discussing the age relationship of fossils and discussing living organisms that later became fossils. In the first case, we are talking about something you can find in fieldwork and consequently touch. Thus, the clearest terminology would be lower, middle, and upper, as in Upper Cretaceous fossils. In the second case, we are referring to what was happening at a certain time; therefore, the clearest terminology would be early, middle, and late, as in Late Cretaceous dinosaur behavior.

3.10.3. Divisions of geological time

Geological time is shown in "The International Chronostratigraphic Chart" (Cohen et al., 2013, updated v2022/02), in which every division has a formal term that should be capitalized (except for those in italics). The major divisions of "the Chart" are presented in Table 4 with their geochronologic equivalent. When using some of the divisions with their corresponding hierarchical term, the last one is also capitalized, e.g., the Paleozoic Era, Devonian System, Upper Devonian Series, or Famennian Stage.

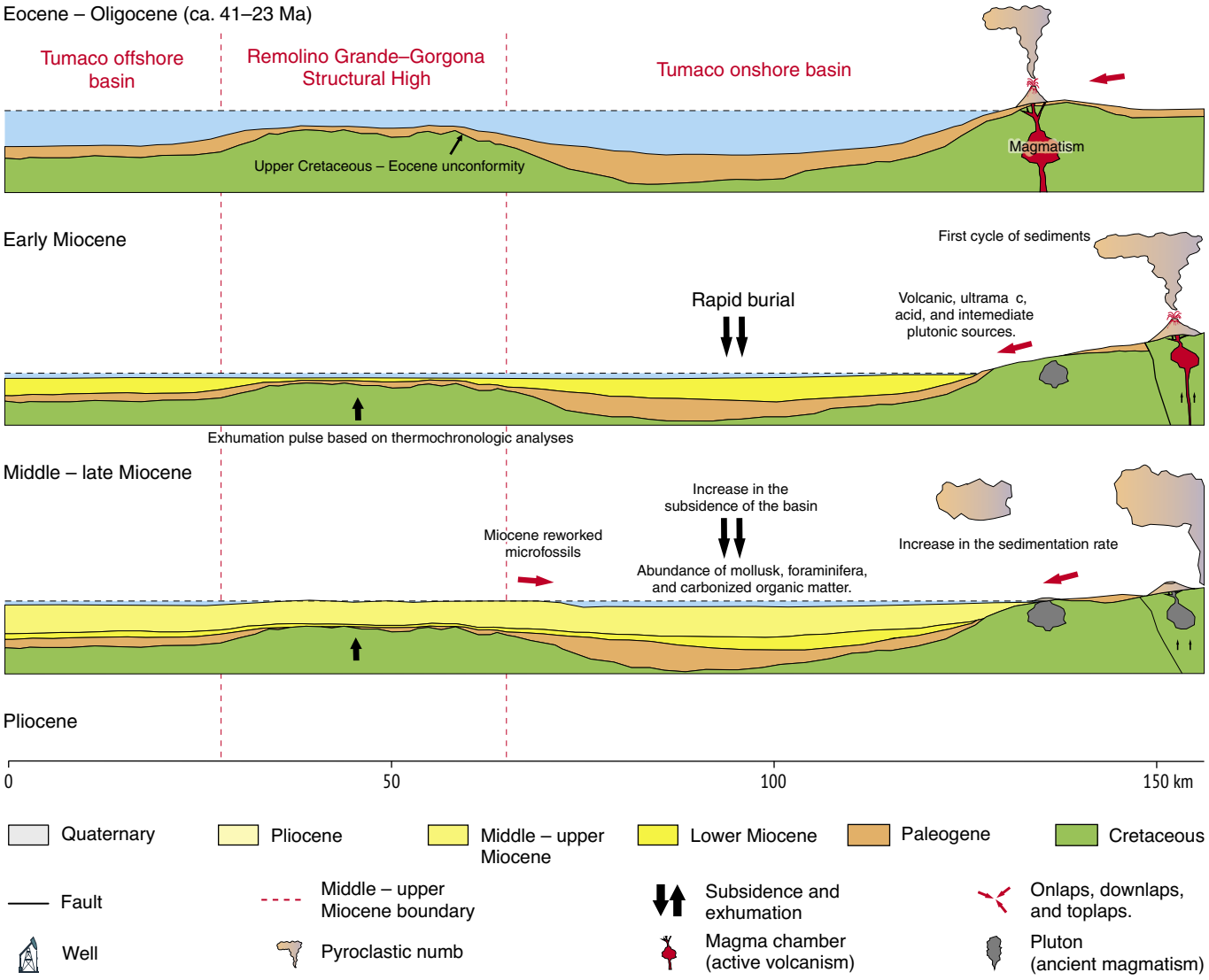

Figure 3. First example of the correct usage of position and time adjectives in chronostratigraphic and geochronologic units. Modified from Pardo–Trujillo et al. (2020).

The Ordovician, Devonian, Triassic, Jurassic, and Cretaceous —Cretaceous System/Period has only the Lower/Early and Upper/Late divisions— are system/periods formally divided into lower/early, middle, and upper/late. In those cases, terms such as Lower Triassic, Early Jurassic, and Middle Devonian should have their first letters capitalized. The other systems/periods are properly divided into proper rank terms; however, someone can mention the lower Cambrian by always taking into account that "lower", in this case, is not a formal division and thus should be in lowercase, and the formal term is Terreneuvian. Additionally, other adjective phrases may be used, such as "first middle part of", "ending", or using absolute age ranges, to avoid confusion by using formal terms in an informal sense.

It is also critical to clarify the version of "The International Chronostratigraphic Chart" used, since every year many new versions are published. Thus, some formal names could be changed or updated. For example, at the moment of preparing this article, the last version of "the Chart" included ratified subseries/subepochs for Miocene and Pliocene Series/Epochs for the first time.

3.10.4. Ma or my

Ma (Mega–annum) and my (million years) are some of the most misused abbreviations in geology —you can refer to the article "Thinking of Deep Time" by Marie–Pierre AUBRY (Aubry, 2009) for a more extensive explanation—. Frequently, these terms are used indifferently, but they have different connotations. The correct usage for **Ma** is for dates, points in time that refer to the age of a stratigraphic unit or the time of a geological event (NACSN, 2005); they always reference the present —thus it is redundant to use words such as "ago" and "before present" with them— and are commonly determined by numerical dating or by reference to a calibrated time scale. In contrast, **my** is

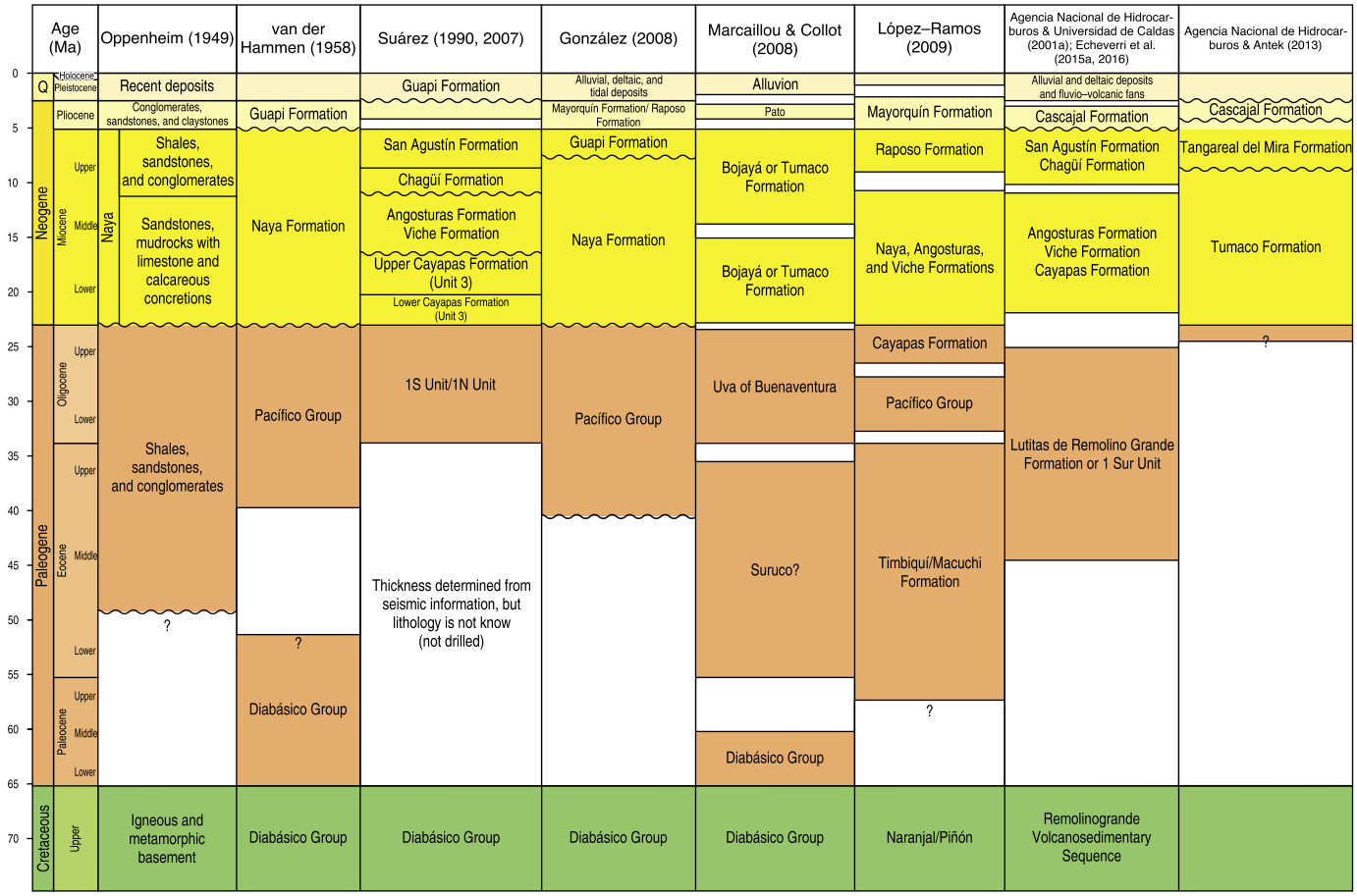

Figure 4. Second example of the correct usage of position and time adjectives in chronostratigraphic and geochronologic units. From Pardo–Trujillo et al. (2020).

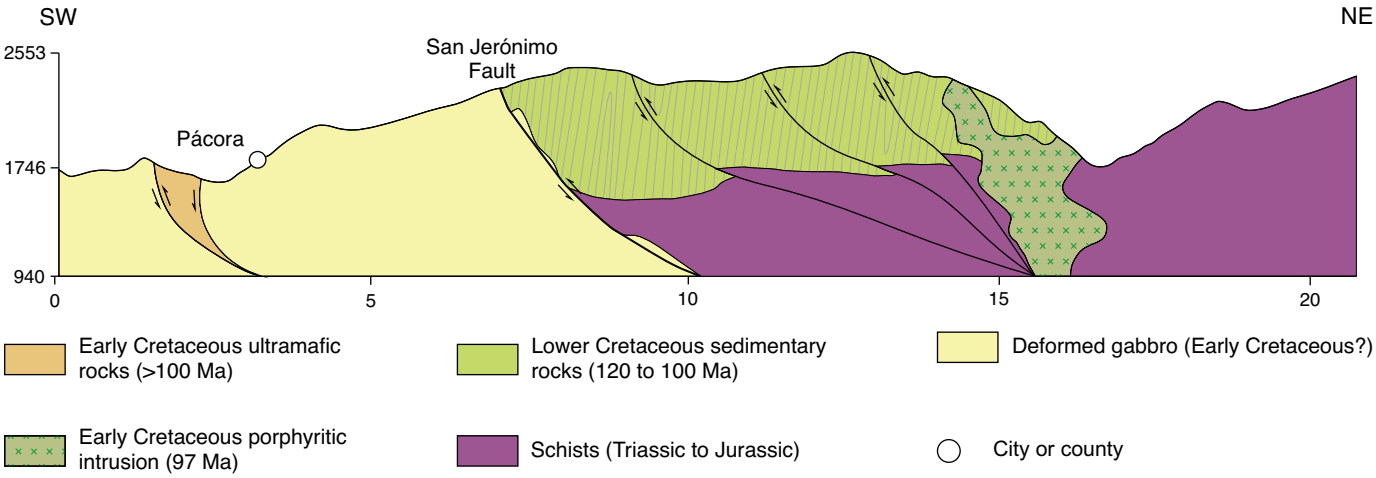

Figure 5. Lithodemic units in the geological section. Modified from Cardona et al. (2020).

correctly assigned for the duration of an interval of geological time (NACSN, 2005); it does not have a reference to the present and is an informal abbreviation. A good exercise to make the distinction between both terms is to look at Figure 7 and realize that the Late Cretaceous Epoch is currently calibrated between 100.5 and 66 **Ma**, but the interval of time represented by this epoch is 34.5 **my**.

In addition to Ma and my, there are other abbreviations for points in time and duration of time that can be found with their corresponding meaning in Table 5. Points in time use standard

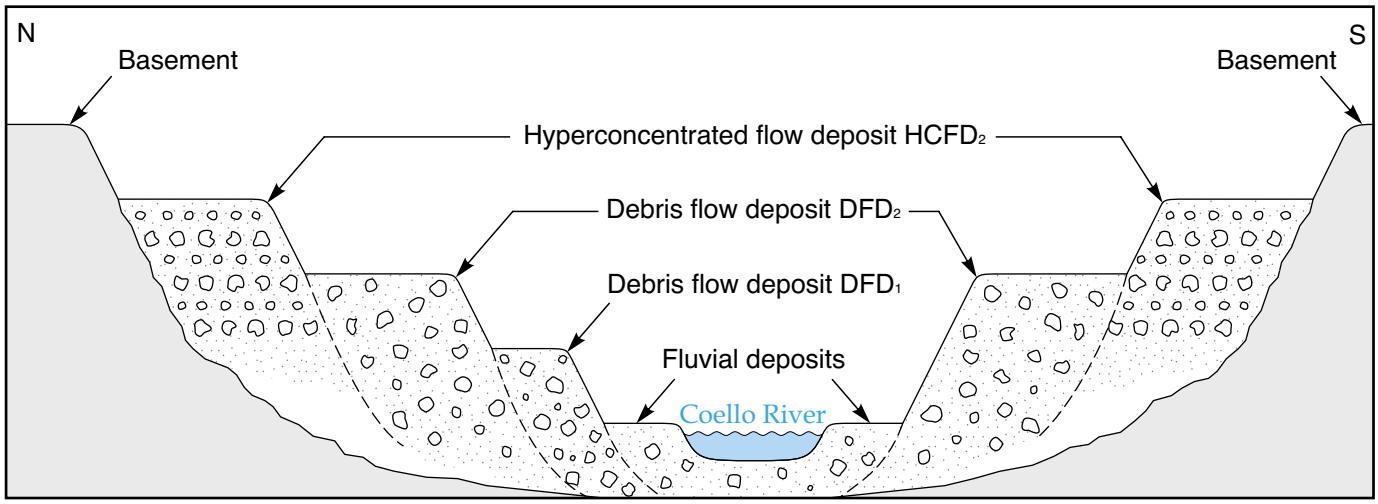

Figure 6. Terraces from Cerro Machín Volcano. Figure taken from Cortés–Jiménez (2020).

Table 4. Rank hierarchical terms of geological time.

Position (Chronostratigraphic units)	Time (Geochronologic units)
Eonothem	Eon
Erathem	Era
System	Period
Series	Epoch
Stage	Age

international symbols (see Table 7 in Newell & Tiesinga, 2019), which is why in the table the abbreviation for kilo–annum is lowercase, while the abbreviations for mega– and giga–annum are capitalized. Another important issue to point out from the table is the billion years interval, which is the equivalent of giga–annum (10^9 years ago); however, this is correct in the United States, where the billion is a thousand million or 1 000 000 000 or 10^9, but in other parts of the world that speak Spanish (including Colombia), a billion is a million million or 10^{12}. As this may be misleading, it is recommended to avoid the word billion; instead using numbers in scientific notation and corresponding units.

3.11. Scientific names: Naming taxa

Scientific names are mostly used in paleontological–related and stratigraphic papers. If authors are not familiar with the rules for writing them, they will find this section helpful.

The correct usage of scientific names is given by the *International Code of Zoological Nomenclature* (Ride, 1999), the *International Code of Nomenclature for algae, fungi, and plants* (Turland et al., 2018), the *International Code of Nomenclature of Prokaryotes* (Parker et al., 2019) and, less useful for geologists, *The International Code of Virus Classification and Nomenclature* (ICVCN, 2021), *Code of Nomenclature for Cultivated Plants* (Brickell, 2016), and *International Code of Phylogenetic Nomenclature* (Queiroz & Cantino, 2020). These documents are generated by commissions of the International Union of Biological Sciences (IUBS), whose common fundamental aim is "to provide the maximum universality and continuity in the scientific names of animals compatible with the freedom of scientists to classify animals according to taxonomic judgments" (ICZN, 1999). The scope of these documents includes **fossils and fossilized behavior of organisms** (ichnofossils). These codes include mandatory articles, as well as recommendations, notes, and examples. We cite some of the most useful for writing:

- Scientific names of genus and species should be written in singular and italics, which should not be used for names of higher ranks (phylum, class, order, and family). Generic names must begin with an uppercase letter, but species names always begin with a lowercase initial letter, regardless of how they were originally published, e.g., *Styrax californica*. Most names of organisms are in Latin; thus, names from other languages are latinized. There are some exceptions and depend on the code and on the year that the rule was established.
- Family names for animals (metazoa) are written in plural with an –ae ending and with the first letter in uppercase. Plants, algae, and fungi family names are also written with the first letter in uppercase but with an –aceae ending; additionally, –oideae for subfamily, –eae for tribe, and –inae for subtribe. Examples include Hominidae (metazoa family) and Styracaceae (plants family). Changing a family to a subfamily results in a name change, e.g., Pyrolaceae becomes Pyroloideae.
- Suprageneric names are treated as plural nouns in plants, algae, and fungi; thus, it is grammatically better to write "the Passifloraceae are" than "the Passifloraceae is".
  Phylum, class, order, family, and genus names always begin with an upper–case initial letter.

Table 5. Abbreviations for duration of time and points in time.

Duration of Time	Abbreviation	Points in Time	Abbreviation
Thousand year interval	ky	kiloannum (10^3 years ago)	ka
Million year interval	my	mega–annum (10^6 years ago)	Ma
Billion year interval*	by	giga–annum (10^9 years ago)	Ga

*Avoid using this term. See text for explanation.

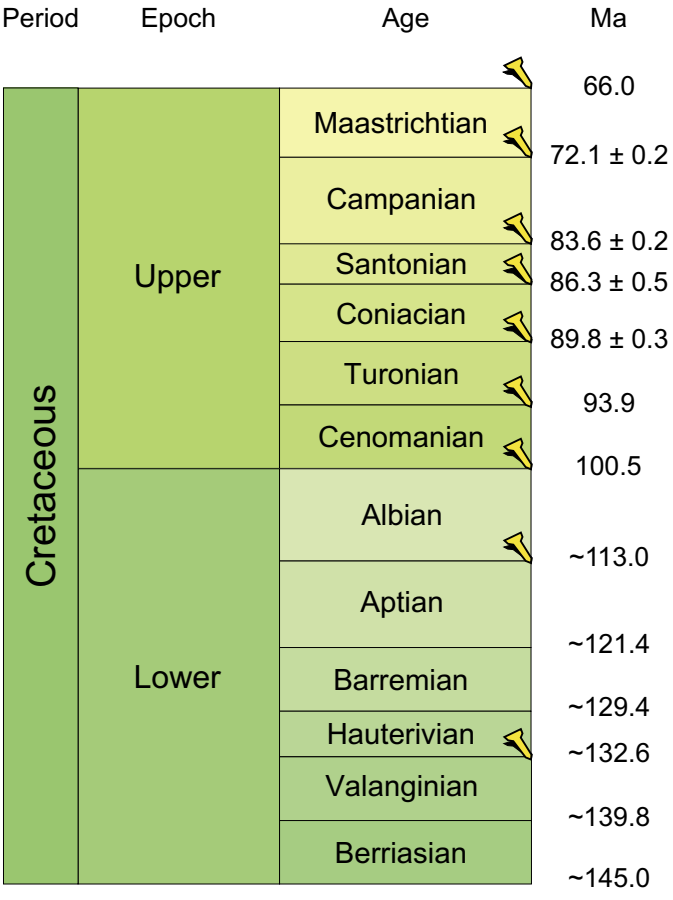

Figure 7. Divisions of the Cretaceous Period showing the difference between Ma and my (From Cohen et al., 2013, updated v2022/08).

- Typographic marks such as "?" and abbreviations such as "aff.", "prox.", "nov. sp.", "nom. cons.", "cf.", "subsp." or "nom. rej." are not part of the scientific names even when inserted between components of the name. Thus, when writing them, do not italicize abbreviations, e.g., *Acanthoptychoceras*? *trumpyi, Cactus cruciformis* Vell. 1829 nom. cons., or *Poa trivialis* subsp. *Sylvicola*.
- If two or more species of the same genus are listed, then the abbreviation for the genus is commonly written before each species name, e.g., *Kildinosphaera chagrinata, K. granulata*, and *K. lophostriata*.
- The question mark indicates uncertainty in assignation, and depending on the position place, the doubt, e.g., *Agenus*? *aspecies* (uncertainty about the genus) *Agenus aspecies*? (uncertainty about the species) *Agenus*? *aspecies*? (uncertainty about the genus and species).
- To cite the author and the publication date of the scientific name, which is very important for the sense in which the species name is used, separate the author's name from the publication date with a comma, e.g., *Acrioceras julivertii*, Etayo–Serna, 1968. Use parentheses when the species–group name cited was changed; the date should be enclosed within the same parentheses as the name of the original author, e.g., *Limax ater* Linnaeus, 1758 should be cited as *Arion ater* (Linnaeus, 1758) when the species is included in the genus *Arion*.
- There are some recommendations for plants, algae, and fungi abbreviations to rank taxa. For example, Class: cl., subclass: subcl., order: ord., suborder: subord., family: fam., subfamily: subfam., tribe: tr., subtribe: subtr., genus: gen., subgenus: subg., section: sect., subsection: subsect., series: ser., subseries: subser., species: sp., subspecies: subsp., variety: var., subvariety: subvar., form: f., and subform: subf.

4. Recommendations and Common Mistakes

Here are some of the most common mistakes found in articles and common doubts that can arise when writing manuscripts:

- Plural words: terms such as **strata, data**, and **spectra** are plural —according to the Merriam–Webster dictionary (Merriam–Webster, s.f.) data is plural in form but singular or plural in construction—. It is common to see grammatical mistakes when using this kind of words. Additionally, the word **facies** is singular and invariable in the plural; thus, "facie" does not exist. It is recommended to look at the Merriam–Webster dictionary when having doubts concerning plural forms, as well as authoritative corresponding publications.
- Abbreviations of formal names: to avoid ambiguity, always use the full formal names in the text; thus, do not use Cambro–Ordovician, instead opt for **Cambrian – Ordovician**. We recommend using an en dash and space before and after the hyphen.
- Sediments or sedimentites: According to the *Glossary of Geology* (Neuendorf et al., 2011), the word **sediments** refers to essentially unconsolidated materials, but some can easily be found in article statements such as "the oldest rocks are Jurassic sediments". The correct way in this case is to use the term **sedimentites** when referring to rocks. Examples such as this of misused geological words are common,

which is why it is strongly recommended to always look at glossaries of the discipline.

- Use of adjectives as nouns: In formal writing, adjectives must always accompany a noun; otherwise, they would be grammatically incorrect. However, it is usual to find expressions such as "this section contains a lot of volcanics", where the word "volcanics" refers to *volcanic rocks*. This is something common with adjectives such as *metamorphic* and *intrusive*. Authors should avoid this error which is improper and could cause confusion.

5. Conclusions

These compiled recommendations are intended to facilitate scientific communication between colleagues by making it more effective and clearer. By doing so, **the discussions can focus on procedures, conclusions, and hypotheses and not on misunderstandings caused by ambiguity and imprecision in contributions**. The guidelines, rules, and norms shared here should be followed in the main text as well as in figures (including graphics), tables, and supplementary material to guarantee consistency in the style of the contribution and avoid confusion.

Although this paper summarizes the main guidelines from the best manuals and guides applicable to geoscience writing, we strongly recommend consulting the sources quoted to clarify any doubt related to cases not included in the illustrative examples. Please remember that **authors who are uncaring about the discussed topics could project a perception of carelessness extending to data collection, analysis, interpretations, and conclusions**.

The Geology of Colombia: Multivolume book is a crowning achievement in the editorial work of the Mapa Geológico de Colombia Team. It included much expertise and experience on the subject but also consolidated knowledge and provided valuable lessons. Sharing this information and presenting it in the easiest and most comprehensible way is of capital importance for the group; therefore, everyone can use it, from students and early career scientists to senior professionals.

Acknowledgments

Special thanks go to Daniela MATEUS ZABALA for her continued contributions to many of the presented topics and to Eliana MARÍN RINCÓN for her support in figure preparation. Thanks to the Servicio Geológico Colombiano for financing this book.

References

Almanza, M.F., Gómez, J. & Cuéllar, A.L. 2015. Manual de publicaciones del Servicio Geológico Colombiano. Servicio Geológico Colombiano, 233 p. Bogotá. Id: 23008210500002468600000000.

Aubry, M.P. 2009. Thinking of deep time. Stratigraphy, 6(2), 93–99.

Back, M.E. 2022. Fleischer's glossary of mineral species 2022. Mineralogical Association of Canada, 431 p. Québec, Cánada.

Brickell, C.D., Alexander, C., Cubey, J.J., David, J.C., Hoffman, M.H.A., Leslie, A.C., Malécot, V. & Jin, X. 2016. International code of nomenclature for cultivated plants (ICNCP or cultivated plant code). Incorporating the rules and recommendations for naming plants in cultivation, 9.ª edición. International Union of Biological Sciences. International Commission for the Nomenclature of Cultivated Plants. The International Society for Horticultural Science, 190 p. Lovaina, Bélgica.

Cardona, A., León, S., Jaramillo, J.S., Valencia, V., Zapata, S., Pardo–Trujillo, A., Schmitt, A.K., Mejía, D. & Arenas, J.C. 2020. Cretaceous record from a Mariana– to an Andean–type margin in the Central Cordillera of the Colombian Andes. En: Gómez, J. & Pinilla–Pachon, A.O. (editores), The Geology of Colombia, Volume 2 Mesozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 36, p. 335–373. Bogotá. https://doi.org/10.32685/pub.esp.36.2019.10

Cediel, F. 1969. Geología del macizo de Floresta: Nota explicativa del mapa geológico. Escala 1:50000. Primer Congreso Colombiano de Geología. Memorias, p. 17–29. Bogotá, Colombia.

Cortés–Jiménez, G.P. 2020. Holocene lahar deposits associated with the eruptive activity of Cerro Machín Volcano, Colombia: Impact on landscape and associated potential hazard. En: Gómez, J. & Pinilla–Pachon, A.O. (editores), The Geology of Colombia, Volume 4 Quaternary. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 38, p. 297–331. Bogotá. https://doi.org/10.32685/pub.esp.38.2019.08

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

Etayo–Serna, F. 1968. Apuntaciones acerca de algunas amonitas interesantes del Hauteriviano y del Barremiano de la región de Villa de Leiva (Boyacá, Colombia, S. A.). Boletín de Geología, 24: 51–70.

Fettes, D. & Desmons, J., editores. 2007. Metamorphic Rocks: A Classification and Glossary of Terms. Recommendations of the International Union of Geological Sciences Subcommission on the Systematics of Metamorphic Rocks. Cambridge University Press, 244 p. Cambridge, Reino Unido.

Gómez, J. & Mateus–Zabala, D., editores. 2020a. The Geology of Colombia, Volume 1 Proterozoic – Paleozoic. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 35, 239 p. Bogotá. https://doi.org/10.32685/pub.esp.35.2019

Gómez, J. & Mateus–Zabala, D., editores. 2020b. The Geology of Colombia, Volume 3 Paleogene – Neogene. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 37, 507 p. Bogotá. https://doi.org/10.32685/pub.esp.37.2019

Gómez, J. & Pinilla–Pachon, A.O., editores. 2020a. The Geology of Colombia, Volume 2 Mesozoic. Servicio Geológico Colombiano,

Publicaciones Geológicas Especiales 36, 498 p. Bogotá. https://doi.org/10.32685/pub.esp.36.2019

Gómez, J. & Pinilla–Pachon, A.O., editores. 2020b. The Geology of Colombia, Volume 4 Quaternary. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 38, 569 p. Bogotá. https://doi.org/10.32685/pub.esp.38.2019

Haile, N.S. 1987. Time and age in geology: The use of Upper/Lower, late/early in stratigraphic nomenclature. Marine and Petroleum Geology, 4(3), 255–257. https://doi.org/10.1016/0264-8172(87)90048-1

Hansen, W., editor. 1991. Suggestions to authors of the reports of the United States Geological Survey. United States Geological Survey, 289 p. Reston, VA, EE. UU. https://doi.org/10.3133/7000088

Hounslow, M.W. 2021. Chronostratigraphy. En: Alderton, D. & Elias, S.A. (editores), Encyclopedia of Geology (4.ª edición). Academic Press. p. 96–106. https://doi.org/10.1016/B978-0-08-102908-4.00060-6

ICVCN. 2021. The international code of virus classification and nomenclature (ICVCN). Virology Division, International Union of Microbiological Societies. Consultado en mayo 20 de 2022. https://ictv.global/about/code

International Commission on Zoological Nomenclature (ICZN). 1999. International code of zoological nomenclature, 4.ª edición. The International Trust for Zoological Nomenclature, 401 p. Londres, Reino Unido.

Igac. S.f. Diccionario geográfico de Colombia. Consultado el 5 de junio de 2022, de https://diccionario.igac.gov.co

Kammer, A., Piraquive, A., Gómez, C., Mora, A., & Velásquez, A. 2020. Structural styles of the Eastern Cordillera of Colombia. En: Gómez, J. & Mateus–Zabala, D. (editores), The Geology of Colombia, Volume 3 Paleogene – Neogene. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 37, p. 143–183. Bogotá. https://doi.org/10.32685/pub.esp.37.2019.06

Le Maitre, R.W., Streckeisen, A., Zanettin, B., Le Bas, M.J., Bonin, B., Bateman, P., Bellieni, G., Dudek, A., Efremova, S., Keller, J., Lameyre, J., Sabine, P.A., Schmid, R., Sørensen, H. & Woolley, A.R., editores. 2002. Igneous rocks: A classification and glossary of terms. Recommendations of the International Union of Geological Sciences Subcommission on the systematics of igneous rocks. Cambridge University Press, 236 p. Cambridge, Reino Unido. https://doi.org/10.1017/CBO9780511535581

Merriam–Webster. S.f. Diccionario Merriam–Webster.com. Consultado el 12 de agosto de 2022, de https://www.merriam-webster.com

Mojica, J. & Villarroel, C. 1984. Contribución al conocimiento de las unidades paleozoicas del área de Floresta, cordillera Oriental colombiana, departamento de Boyacá; y en especial de la Formación Cuche. Geología Colombiana, (13): 55–79.

Murphy, M.A. & Salvador, A. 1999. International stratigraphic guide—an abridged version. Episodes: Journal of International Geoscience, 22(4): 255–271. https://doi.org/10.18814/epiiugs/1999/v22i4/002

Neuendorf, K.K.E., Mehl, Jr, J.P. & Jackson, J.A., editores. 2011. Glossary of geology, fifth edition, revised. American Geological Institute, 779 p. Alexandria, VA, EE. UU.

Newell, D.B. & Tiesinga, E., editores. 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

North American Commission on Stratigraphic Nomenclature (NACSN). 2005. North American Stratigraphic Code. American Association of Petroleum Geologists Bulletin, 89(11): 1547–1591. https://doi.org/10.1306/07050504129

Owen, D.E. 2009. How to use stratigraphic terminology in papers, illustrations, and talks. Stratigraphy, 6(2): 106–116.

Pardo–Trujillo, A., Echeverri, S., Borrero, C., Arenas, A., Vallejo, F., Trejos, R., Plata, Á., Flores, J.A., Cardona, A., Restrepo, S., Barbosa, Á., Murcia, H., Giraldo, C., Celis, S. & López, S.A. 2020. Cenozoic geologic evolution of the southern Tumaco Forearc Basin (SW Colombian Pacific). En: Gómez, J. & Mateus–Zabala, D. (editores), The Geology of Colombia, Volume 3 Paleogene – Neogene. Servicio Geológico Colombiano, Publicaciones Geológicas Especiales 37, p. 215–247. Bogotá. https://doi.org/10.32685/pub.esp.37.2019.08

Parker, C.T., Tindall, B.J. & Garrity, G.M., editores. 2019. International code of nomenclature of Prokaryotes. Prokaryotic Code (2008 Revision). International Union of Microbiological Societies 2019. Microbiology Society. International Journal of Systematics and Evolutionary Microbiology, 69(1A): S1–S111. https://doi.org/10.1099/ijsem.0.000778

Queiroz, K. & Cantino, P.D. 2020. International code of phylogenetic nomenclature (PhyloCode), 1.ª edición. International Society for Phylogenetic Nomenclature. Committee on Phylogenetic Nomenclature. CRC Press, 190 p. Boca Ratón, FL, EE. UU.

Ride, W.D.L., Cogger, H.G., Dupuis, C., Kraus, O., Minelli, A., Thompson, F.C. & Tubbs, P.K., editores. 1999. International code of zoological nomenclature. International Commission on Zoological Nomenclature, 4.ª edición. International Union of Biological Sciences. The International Trust for Zoological Nomenclature. Londres, Reino Unido.

Salvador, A. 1994. International stratigraphic guide: A guide to stratigraphic classification, terminology, and procedure, 2.ª edición. International Union of Geological Sciences and Geological Society of America, 214 p. Boulder, CO, EE. UU. https://doi.org/10.1130/9780813774022

Siivola, J. & Schmid, R. 2007. List of mineral abbreviations. En: Fettes, D. & Desmons, J. (editores), Metamorphic rocks: A classification and glossary of terms. Recommendations of the International Union of Geological Sciences Subcommission on the systematics of metamorphic rocks. Cambridge University Press, p. 93–110. Cambridge, Reino Unido.

The University of Chicago Press Editorial Staff (TUCPES). 2010. The Chicago Manual of Style, 16.ª edición. The University of Chicago Press, 1026 p. Chicago, IL, EE. UU.

Turland, N.J., Wiersema, J.H., Barrie, F.R., Greuter, W., Hawksworth, D.L., Herendeen, P.S., Knapp, S., Kusber, W.–H., Li, D.–Z., Marhold, K., May, T.W., McNeill, J., Monro, A.M., Prado, J., Price, M.J. & Smith, G.F., editores. 2018. International code of nomenclature for algae, fungi, and plants (Shenzhen Code) adopted by the Nineteenth International Botanical Congress Shenzhen, China, July 2017. Regnum Vegetabile 159. Glashütten: Koeltz Botanical Books. Pensoft Publishers, 196 p. Sofía, Bulgaria. https://doi.org/10.12705/Code.2018

Explanation of Acronyms, Abbreviations, and Symbols

ca.	*circa*, approximately
e.g.	*exempli gratia*, for example
i.e.	*id est*, that is
IMA	International Mineralogical Association
IUBS	International Union of Biological Sciences
IUGS	International Union of Geological Sciences
Ma	Mega–annum, million years
my	million year interval
s.f.	without date
TGCMB	*The Geology of Colombia: Multivolume book*
v	version
vs.	versus