Enhancing Lexicographic Work with Terminological Methods

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Abstract

This paper explores the potential impact of terminology science on lexicographers' daily activities and, consequently, on the quality of dictionaries. With a focus on lexicographic purposes, we aim to demonstrate how terminological methods can enhance the organization, structure, and description of terms in general language dictionaries. Specifically, we differentiate between lexical units and terms, employing a terminology-based methodology to represent and organize knowledge and describe terms in both conceptual and linguistic dimensions. By incorporating these methods, lexicographers can improve the accuracy and clarity of dictionary definitions and explanations.

Our study uses examples from the field of Geology, including various related concepts such as <ChronostratigraphicUnit> and <GeochronologicUnit>, sourced from the *Dicionário da Língua Portuguesa Contemporânea* (DLPC), and updated in the *Dicionário da Língua Portuguesa* (DLP). Through the application of terminological methods to these concepts, we illustrate their impact on refining lexicographic content. This research contributes to the ongoing discourse on enhancing the scientificity and uniformity of specialized lexicographic content within general language dictionaries, providing insights that can inform future lexicographic practices.

Keywords: dictionary; lexicography; standards; terminology.

1. Introduction

The exploration of the synergistic complementarity between lexicography and terminology, particularly the application of terminological methods within general language dictionaries, forms the cornerstone of this study. Motivated by the need to enhance the treatment of terms in such dictionaries, we address critical issues inherent in their analysis and treatment.

Previous research, exemplified by studies such as Rey (1985), Béjoint (1988), Tournier (1992), Cabré (1994), Paz Battaner (1996), Estopà (1998), Boulanger (2001), Roberts (2004), Nomdedeu Rull (2008), has extensively examined the presence and analysis of terms in dictionaries. However, despite this body of work, widespread recognition of inconsistencies in terms of uniformity and scientific rigor persists in the treatment of specialized lexicographic

content, as noted by Ptaszyński (2010). These inconsistencies underscore the necessity of structuring lexicographic data and organizing knowledge systematically.

To address these challenges, we advocate for the application of terminological methods in lexicography. By doing so, we aim to provide an effective strategy for overcoming identified inconsistencies and improving the quality and scientific validity of lexicographic content.

2. Background

The fields of Lexicography and Terminology are interconnected yet distinct, each with unique methodologies tailored to address diverse linguistic needs. Terminology, as elucidated by Costa (2013), encompasses both linguistic and conceptual dimensions, focusing on the study of concepts and their designated terms within specialized domains. In contrast, Lexicography primarily focuses on analysing, describing, and documenting the meanings and usage of lexical units, typically within a semasiological framework. On the other hand, Terminology sets itself apart by its central aim of establishing and maintaining consistent terminology within specialized fields. Terminologists undertake the task of identifying the relationship between terms and their corresponding concepts (semasiology) or between concepts and the terms used to represent them (onomasiology) within specialized fields. Despite these distinct approaches, both disciplines converge on a shared focus – terms and related information. This convergence offers opportunities for mutual enrichment when lexicographers are faced with specialised content.

3. Academia das Ciências de Lisboa dictionary

Our case study focuses on the *Dicionário da Língua Portuguesa* (DLP), a scholarly Portuguese dictionary published by the Academia das Ciências de Lisboa (ACL). The DLP's first digital edition was launched in April 2023, following lexicographic efforts undertaken within the Instituto de Lexicologia e Lexicografia da Língua Portuguesa.

The ACL has produced three printed dictionaries to date. Two earlier dictionaries, published in 1793 and 1976, remained incomplete, covering only the letter A. The third dictionary, the *Dicionário da Língua Portuguesa Contemporânea* (DLPC), was released in two volumes, spanning from A–F and G–Z. The DLPC served as the foundation for the ongoing development of the digital edition, achieved through meticulous retro-digitization efforts (Simões et al., 2016).

In April 2023, the DLP was officially made available online (Salgado et al., 2023), representing a partially revised version of the DLPC content. This endeavor expanded the dictionary by over 30,000 entries, with partial content revisions, aiming to grow the database to encompass 100,000 entries and 194,683 senses.

This case study offers insights into the evolution of lexicographic efforts and the digital transformation of scholarly dictionaries, underscoring the ongoing commitment to enhancing lexicographic resources.

4. Terms in general language dictionaries and critical issues

General language dictionaries serve to encompass both everyday lexical units and specialized units or terms, catering to a diverse range of linguistic needs. Lexical units span the breadth of vocabulary used in everyday language, while terms denote specialized vocabulary within specific domains. Terms are often accompanied by domain labels (Salgado et al., 2019), a type of diasystematic marking found in lexicographic articles, which implies that 'a certain lexical item deviates in a certain respect from the main bulk of items described in a dictionary' (Svensén, 2009, p. 315).

Traditionally, printed editions prominently display these labels in the front matter (Figure 1) or within lexicographic definitions themselves. However, their static nature, alphabetical arrangement, and lack of interrelations among related terms pose challenges in contemporary digital environments.

CLASSIFICAÇÃO DO VOCABULÁRIO QUANTO À REPARTIÇÃO POR CIÊNCIAS, TÉCNICAS E FORMAS DE ACTIVIDADE

a

Acúst. = Acústica.
Aeron. = Aeronáutica.
Agr. = Agricultura.
Álg. = Álgebra.
Alveit. = Alveitaria.
Alven. = Alvenaria.
Anat. = Anatomia.
Antr. = Antropologia.
Apic. = Apicultura.
Arit. = Aritmética.
Arm. = Armaria.
Arqueol. = Arqueologia.
Arquit. = Arquitectura.
Artilh. = Artilharia.
Astr. = Astronomia.
Astronáut. = Astronáutica.
Astrol. = Astrologia.
Autom. = Automobilismo.

b

Bact. = Bacteriologia.
Balíst. = Balística.
B.-Art. = Belas-Artes.
Biol. = Biologia (Citologia, Histologia).
Bot. = Botânica.
Bromat. = Bromatologia.

c

Des. = Desenho.
Desp. = Desporto.
Diplom. = Diplomática.
Dir. = Direito.
Dir. Can. = Direito Canónico.
Dir. Civil = Direito Civil.
Dir. Comerc. = Direito Comercial.
Dir. Fiscal = Direito Fiscal.
Dir. Intern. = Direito Internacional.
Dir. Marít. = Direito Marítimo.

e

Ecl. = Eclesiástico.
Econ. = Economia.
Econ. Pol. = Economia Política.
Electr. = Electricidade.
Electrotéc. = Electrotécnica.
Embr. = Embriologia.
Encad. = Encadernação.
Eng. = Engenharia.
Equit. = Equitação.
Esc. = Escolar.
Escol. = Escolástica.
Escult. = Escultura.
Esgr. = Esgrima.
Espir. = Espiritualismo.
Estát. = Estática.
Ética.
Etnog. = Etnografia.

Figure 1: *Fragment of the DLPC list.*

While advancements in technology offer vast potential, online resources often mirror the structures of printed dictionaries, hindering the establishment of connections between related lexicographic articles.

In the contemporary digital landscape, lexicography encounters the dual challenge of embracing new computational methods while simultaneously diverging from traditional methodologies. Despite the vast potential offered by advanced technology, resources often fail to establish connections between related lexicographic articles. Even when accessing online lexicographic resources, end-users frequently encounter structures that closely resemble those found in printed dictionaries. Conversely, within a digital humanities framework, such as retrodigitized or born-digital dictionaries, labels present a formidable obstacle to ensuring the interoperability of lexicographic datasets.

4.1 Geological terms

To illustrate our approach, we initiated an analysis of geological terms, meticulously examining the placement of labels associated with geological domains within specific classification systems (Salgado et al., 2022). Notably, domains encompassed within the DLPC, such as Geology, Crystallography, Mineralogy, and Paleontology – all pertaining to the broader domain of Earth Sciences – reveal inherent relationships and connections not readily discernible within the dictionary itself. Our analysis focused on stratigraphical vocabulary, specifically chronostratigraphic and their corresponding geochronologic units labelled with the Geology domain label.

The *International Stratigraphic Guide*[1] (Salvador, 1994–2013) provides recommendations for various chronostratigraphic terms and their geochronologic equivalents, facilitating the expression of units of differing rank or temporal scope (Figure 2):

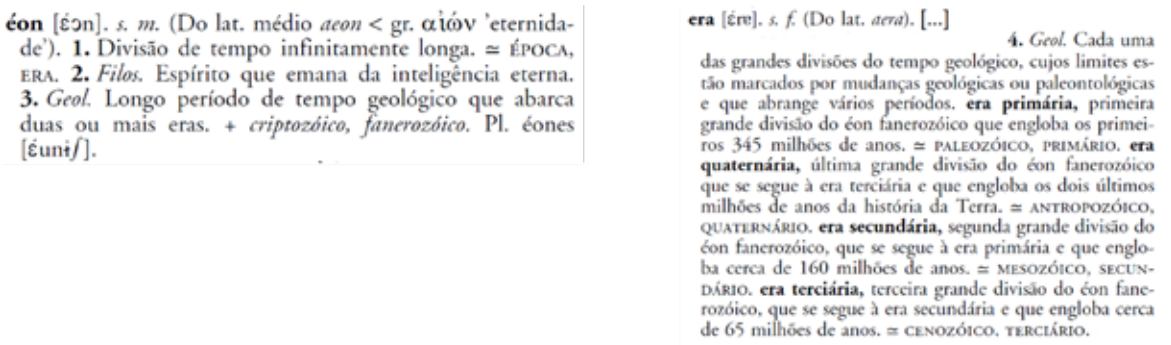
Rocks **Chronostratigraphic Units**	**Time** **Geochronologic Units**
Eonothem (*Eonotema*)	Eon (*Eon*)
Erathem (*Eratema*)	Era (*Era*)
System (*Sistema*)*	Period (*Período*)
Series (*Série*)*	Epoch (*Época*)
Stage (*Andar*)**	Age (*Idade*)
Substage (*Subandar*)/Chronozone (*Cronozona*)	Subage (*Subidade*)/Chron (*Crono*)

Figure 2: *Conventional hierarchy of the chronostratigraphic/geochronologic units.*

Chronostratigraphic units represent tangible stratigraphic units in the field, comprising a set of strata formed during a specified interval of geologic time, while geochronologic units denote the time intervals during which chronostratigraphic units were formed.

In this article, we focus on two geochronologic units, **éon** [eon] and **era** [era], extracted from the DLPC, to elucidate our approach (Figure 3):

1 The Abridged Version of the International Stratigraphic Guide can be found at: https://stratigraphy.org/guide/.



éon [éɔn]. *s. m.* (Do lat. médio *aeon* < gr. αἰών 'eternidade'). **1.** Divisão de tempo infinitamente longa. = ÉPOCA, ERA. **2.** *Filos.* Espírito que emana da inteligência eterna. **3.** *Geol.* Longo período de tempo geológico que abarca duas ou mais eras. + *criptozóico, fanerozóico.* Pl. éones [éuniʃ].

era [éɾɐ]. *s. f.* (Do lat. *aera*). [...]
4. *Geol.* Cada uma das grandes divisões do tempo geológico, cujos limites estão marcados por mudanças geológicas ou paleontológicas e que abrange vários períodos. **era primária,** primeira grande divisão do éon fanerozóico que engloba os primeiros 345 milhões de anos. = PALEOZÓICO, PRIMÁRIO. **era quaternária,** última grande divisão do éon fanerozóico que se segue à era terciária e que engloba os dois últimos milhões de anos da história da Terra. = ANTROPOZÓICO, QUATERNÁRIO. **era secundária,** segunda grande divisão do éon fanerozóico, que se segue à era primária e que engloba cerca de 160 milhões de anos. = MESOZÓICO, SECUNDÁRIO. **era terciária,** terceira grande divisão do éon fanerozóico, que se segue à era secundária e que engloba cerca de 65 milhões de anos. = CENOZÓICO, TERCIÁRIO.

Figure 3: *Entry 'éon' and 'era' in the DLPC (ACL).*

Despite their significance in denoting geological time, the lexicographic definitions lack explicit acknowledgment of their status as geochronologic units, leading to inconsistencies when comparing these closely related terms. For instance, while **éon** is defined as a 'Longo período de tempo geológico que abarca duas ou mais eras' [Long period of geological time that encompasses two or more eras], **era** is defined as 'Cada uma das grandes divisões do tempo geológico, cujos limites estão marcados por mudanças geológicas ou paleontológicas e que abrange vários períodos' [Each of the major divisions of geological time, marked by geological or paleontological changes and spanning several periods]. This lack of precision in definitions becomes apparent as they neither explicitly reference the concepts they define nor eliminate unnecessary characteristics, as in the case of **era**. Moreover, the DLPC do not register terms such as **eonotema** [eonothem] and **eratema** [erathem], which are corresponding chronostratigraphic units. Thus, besides detecting inconsistencies in definitions, our analysis highlights the omission of equivalents, underscoring the importance of prior organization of specialized knowledge and its respective terms in general language dictionaries.

To address these challenges, we employ terminological methods to refine the treatment of terms, emphasizing the dual dimension inherent in terminology.

5 Application of terminological methods within general language dictionaries

Our methodology employed a mixed approach, integrating both semasiological and onomasiological perspectives in a systematic manner. Initially, we adopted a semasiological approach, focusing on the analysis of terms included in the DLPC. However, it's essential to know that these terms designate concepts, forming the basis of terminological analysis. Our method is grounded in the principle that terms serve as lexical designations of these underlying concepts. This aspect is often overlooked by lexicographers who typically start their analysis from the word level, neglecting the crucial interplay between terms and their associated conceptual frameworks.

Moreover, our research extends beyond linguistic analysis to involve extralinguistic tasks within a conceptual realm, particularly in knowledge organisation. Specifically, we

conducted an exhaustive analysis of the Geology domain, scrutinising the allocation of labels related to geological domains within specific classification systems, as mentioned earlier. Our research (Salgado et al., 2022) proposes a methodology for representing domains associated with Earth Sciences in general language dictionaries. Within this framework, Earth Sciences constitute a superdomain[2] in, encompassing the domain of Geology, which further comprises various subdomains.

5.1 Terminological methods in action

To ensure methodological consistency in line with terminological principles, we referenced ISO TC 37 standards, particularly ISO 704 and 1087. It is noteworthy that lexicographers often lack expertise in the specific domains they document. Therefore, collaborative engagement with domain experts played a crucial role in validating the integrity of our data.

The onomasiological perspective guides our analysis towards the conceptual landscape. Here, we identify, isolate, and delineate the characteristics of a given concept, distinguishing it from others within the same conceptual system. Following these principles, the lexicographer proposes a definition only after establishing robust conceptual relationships, a process validated through consultation with domain experts.

5.1.1 Conceptual relations

We made practical use of Unified Modelling Language (UML) notation as prescribed by the ISO 704 standard, employing concept diagrams to categorize concepts based on their relational types. Within this framework, the Figure 4 illustrates <GeochronologicUnit> as the generic or superordinate concept, with <Eon> and <Era> representing specific or subordinate concepts. The establishment of conceptual relations is clarified using the marker is_a_type_of, which structures the hierarchical relationship between generic and specific concepts. Specifically, <Eon> and <Era> are categorized as types of geochronologic units, with specific concepts inheriting characteristics from their generic superordinate concept.

Our semasiological approach also facilitates the identification of semantic relations such as hypernym-hyponym connections. In this context, “éon” and “era” function as hyponyms of the hypernym “unidade geocronológica,” associated with the superordinate concept <GeochronologicUnit>. Notably, the term “unidade geocronológica” is not defined in the DLPC, and “cronostratigráfico” does not appear as a headword. These terms were registered in the updated digital version, the DLP.

2 ISO 1087 (2019) defines a domain as a ‘field of special knowledge’. By ‘superdomain’ we mean a higher-level field of special knowledge within a hierarchical naming system.

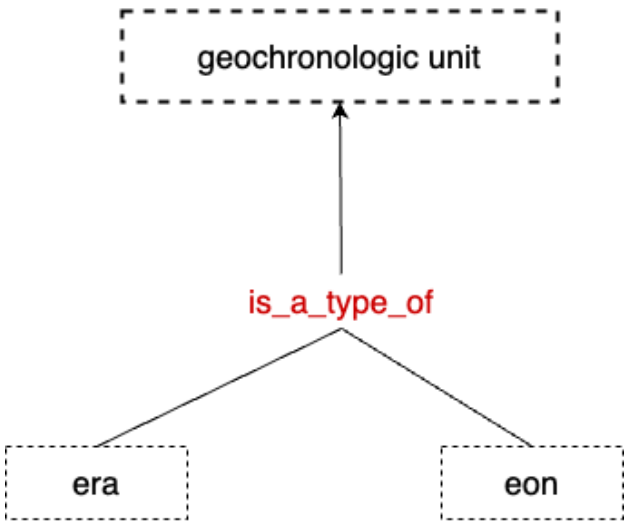


Figure 4: *Representation of a generic relation using the concept of <ChronostratigraphicUnit>.*

To illustrate a partitive concept relation, we again turn to geological concepts corresponding to the <GeochronologicUnit>. As previously observed, the terms denoting these concepts designate temporal relations, precisely when the rocks were formed. The primary means by which geological time information is conveyed is through the Geological Time Scale and its units. Thus, all these units are part of the <GeologicalTimeScale>. This is represented in Figure 5:

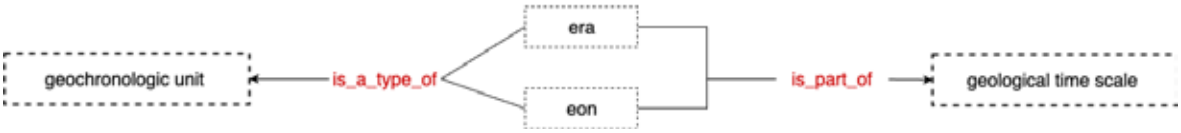


Figure 5: *Representation of a partitive relation using the concepts <GeochronologicUnit> and <Geological-TimeScale>.*

The conceptual relationship between the broader concept and its parts is made explicit through the conceptual marker part_of. Contrary to what was observed in generic relations, the principle of inheritance does not apply here, i.e., the concepts in a partitive relation do not inherit the characteristics of the superordinate concepts, but do inherit their parts. While the <GeologicalTimeScale> stands as a comprehensive concept, each identified subordinate concept represents distinct parts of the whole, characterised by unique attributes concerning the related comprehensive concept. Discerning these essential characteristics is pivotal for defining a given concept, thereby delimiting its position relative to other concepts. Thus, the identification of the delimiting characteristic is imperative to differentiate the subordinate concepts.

To illustrate an associative concept relation, we extend our analysis to the concept of <GeochronologicUnit>. To grasp this concept fully, a comprehensive understanding

of <Time> and <Geochronology> is indispensable. These foundational concepts, in turn, necessitate consideration of related concepts such as <Rock>, <Chronostratigraphy> and <ChronostratigraphicUnit>. Geochronology serves to elucidate the timing or age of events throughout Earth's history. However, it also plays a crucial role in characterizing rock bodies, whether stratified or unstratified, with respect to the time intervals during which they formed. Concurrently, chronostratigraphic units are classified based on the duration of time they represent. In essence, it can be posited that the chronostratigraphic units used to denote contemporaneously formed rock bodies correspond to the geochronologic units employed to delineate the intervals of their formation. These relationships represent what are commonly termed complex relationships, which are contingent upon the domain and application context – this constitutes an associative conceptual relation (Figure 6).

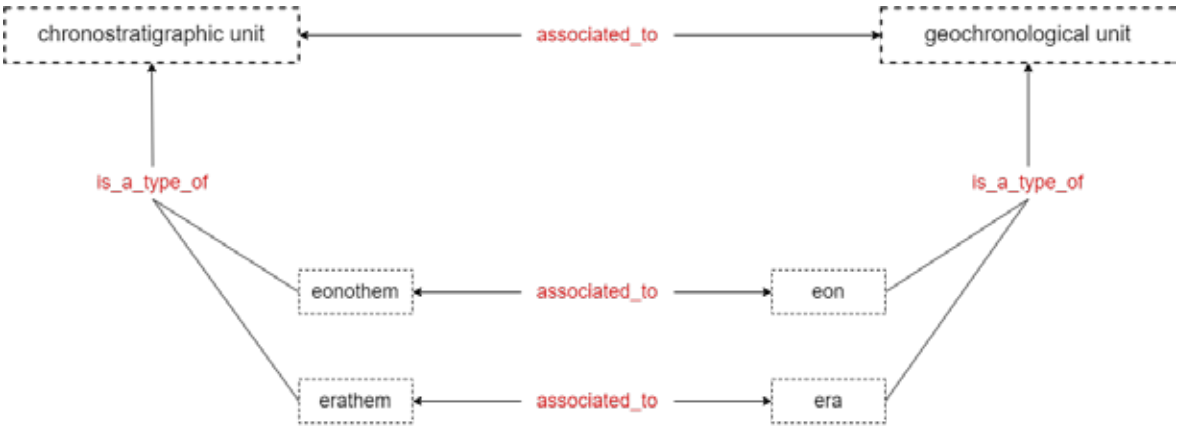


Figure 6: *Representation of an associative relationship with the concepts of <ChronostratigraphicUnit> and <GeochronologicUnit> with generic and partitive relations – a mixed concept system.*

Having analysed the conceptual systems and their relationships, we proceed in the next section to the question of defining the terms.

5.1.2 Defining concepts in general language dictionaries

The ISO standards (ISO 704, 2009; ISO 1087, 2009) distinguish between intensional[3] and extensional definitions. Intensional definitions list the immediate superordinate concept and delimit the characteristics of the defined concept, while extensional definitions list its subordinate or partitive concepts. Preference is given to intensional definitions, as they make essential characteristics explicit and position the concept within a concept system. This approach aligns with the perspective of Löckinger, Kockaert and Budin (2015), who consider intensional definitions the 'standard way of illustrating concepts' (p. 66).

Intensional definitions based on generic associations include the superordinate concept (*genus*), followed by the distinctive characteristics (*differentia*) within a concept sys-

3 An intensional definition is defined as 'definition that conveys the intension of a concept by stating the immediate generic concept and the delimiting characteristic(s)' (ISO 1087, 2019, p. 7).

tem. The intensional definition does not contain features belonging to other superordinate or subordinate concepts: it (1) clarifies only the class to which the defined concept belongs; (2) specifies what distinguishes it from other concepts situated in the same class; and (3) lists all its essential features.

To illustrate this, Table 1 presents the two selected terms extracted from the DLPC and compares them with the definitions written by us after modelling the concept systems. All of them define a type of <GeochronologicUnit>, revealing a pattern of uniformization and refinement compared to the previous edition. The new definition of **éon** is 'intervalo de tempo geológico (unidade geocronológica) durante o qual se formou um eonotema (unidade cronostratigráfica)' [geological time interval (geochronologic unit) during which an eonothem (chronostratigraphic unit) formed], and for **era** 'intervalo de tempo geológico (unidade geocronológica) durante o qual se formou um eratema (unidade cronostratigráfica)' [geological time interval (geochronologic unit) during which an erathem (chronostratigraphic unit) formed].

Headword	**DLPC (2001)**	**DLP (2024)**
éon [eon]	*Geol.* Longo período de tempo geológico que abarca duas ou mais eras	intervalo de tempo geológico (unidade geocronológica) durante o qual se formou um eonotema (unidade cronostratigráfica) Notas: 1) Na escala do tempo geológico, o éon é a categoria hierárquica mais elevada. 2) O éon integra várias eras.
era [era]	*Geol.* cada uma das grandes divisões do tempo geológico, cujos limites estão marcados por mudanças geológicas ou paleontológicas e que abrange vários períodos	intervalo de tempo geológico (unidade geocronológica) durante o qual se formou um eratema (unidade cronostratigráfica) Notas: 1) Na escala do tempo geológico, a era é hierarquicamente superior ao período e inferior ao éon. 2) A era integra vários períodos.

Table 1: *Comparison of definitions 'éon', 'era' in DLPC (2001) and DLP (2024).*

Parentheses in definitions relating to chronostratigraphic and geochronological units serve a purposeful lexicographic principle, suggesting consultation of other dictionary terms for further clarification.

The same methodology was applied to terms relating to chronostratigraphic units, positioning individual units within the geological hierarchy based on the time interval they represent (Figure 7):

Figure 7: *Definitions of 'eonotema' and 'eratema' in DLP (2024).*

The introduction of the terms **eonotema** and **eratema**[4] is justified for methodological reasons and because those units are included in geology textbooks. Following the presented methodology will avoid this type of lapse in the future since we defend the treatment of terms by the relationship they establish with each other and not precisely by planning a dictionary revision based on alphabetical ordering.

In addition to the definitions, we aim to comment on the use of notes in Table 1 and Figure 7. Our proposed definitions contain only the characteristics that are necessary to identify the concepts. Any additional information is included as a note as happens in **éon**, for instance, 'Notas: 1) Na escala do tempo geológico, o éon é a categoria hierárquica mais elevada. 2) O éon integra várias eras.' [Notes: 1) In the geological time scale, the eon is the highest hierarchical category. 2) The eon integrates several eras.], or in **eonotema** 'Na escala cronostratigráfica, o eonotema é a categoria hierárquica mais elevada.' [In the chronostratigraphic scale, the eonothem is the highest hierarchical category.]

The results obtained from this process are indicative of a substantial improvement in definition accuracy and overall quality. Notably, our focus extends to the utilization of concept systems in the DLP to create natural language definitions. This innovative approach is grounded in the intensional definition model, which articulates the immediate generic concept alongside the delimiting characteristics of the defined concept. By embracing this model, our study seeks to enhance the precision and clarity of definitions, thereby contributing to the ongoing efforts to elevate the standards of lexicographic practice.

6 Conclusion

In conclusion, this article underscores the importance of adopting a terminology-based approach to enhance the quality of lexicographic products. Integrating conceptual and linguistic dimensions in our methodology provides a structured framework for lexicographers, contributing to improved definition writing and overall accuracy.

The significance of domain organisation and hierarchy cannot be overstated, as it not only aids in refining labelling systems but also facilitates a deeper understanding of the relationships between concepts. By offering clarity and structure, our proposed methodology

4 The proposed definitions as shown on Figure 7 are: 'a set of rocks (chronostratigraphic unit) formed during an eon (geochronological unit); [Note] 'On the chronostratigraphic scale, the eonothem is the highest hierarchical category' for eonothem, and 'a set of rocks (chronostratigraphic unit) formed during a geological era (geochronological unit); [Note] On the chronostratigraphic scale, the erathem is hierarchically superior to the system and inferior to the eonothem' for erathem.

equips lexicographers to navigate the complexities of various domains, ultimately benefiting end-users seeking comprehensive insights into the dictionary's content.

Looking ahead, our commitment extends to testing the applicability of the methodology across diverse fields. Addressing problematic issues such as multiple labels within domains and unlabelled equivalent headwords is a crucial step towards refining and validating the efficacy of our approach. Through this ongoing testing process, we aim to establish the versatility and robustness of our methodology, positioning it as a valuable tool for improving lexicographic practices across a wide spectrum of domains.

In summary, the amalgamation of a terminology-based approach, a well-organised domain hierarchy, and a systematic methodology holds promise for advancing lexicography. The collaborative efforts of lexicographers, coupled with the adaptability of our proposed approach, are poised to contribute significantly to the ongoing evolution and enhancement of lexicographic products.

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Acknowledgements

This work is supported by (1) the MORDigital – Digitalização do Diccionario da Lingua Portugueza de António de Morais Silva [PTDC/LLT-LIN/6841/2020] project financed by the Portuguese National Funding through the FCT – Fundação para a Ciência e Tecnologia (2) Portuguese National Funding through the FCT – Fundação para a Ciência e Tecnologia as part of the project Centro de Linguística da Universidade NOVA de Lisboa – UID/LIN/03213/2020.