

# Approaching Metaphorical Terms in Subject-specific Terminologies (Geologic and Geodetic): Semantic and Structural Aspects

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## Abstract

Terminological metaphors appear as a result of terminologisation, the process when commonly used words acquire special meaning, specific to a certain area of science. The mechanism of metaphoric representation of subject-specific concepts is based on certain associations (form, shape, function, structure, etc.). Terminological metaphors constitute an essential part of professional vocabulary being the means that help to facilitate nomination and understanding of subject-specific concepts, objects and processes for both specialists and non-professionals. This paper examines metaphorical terms in the domain of two subject-specific terminologies – geodetic and geological. The main objective of the research is to analyze terminological units of metaphorical character extracted from dictionaries and related reference literature in geodesy and geology, to determine their structural and semantic peculiarities, as well as their productivity. Metaphors under study have been investigated in accordance with semantic, structural and morphological approaches. The quantitative analysis and the method of calculations have been applied to establish the productivity of different semantic and structural models of the terms. It has been found out that anthropological metaphorical terms prevail in geodetic and geologic terminologies. The vocabulary under study comprises one-stem terms, compound terms and terminological word combinations of metaphorical character. The latter ones turned out to be dominant. The results of the data analysis indicate that the number of noun models exceeds in both terminological systems.

**Keywords:** metaphorical terms, geodetic terminology, geological terminology, terminologization, anthropological and non-anthropological metaphors, structural models of metaphorical terms

## 1. Introduction

### 1.1 Statement of the Problem

The rapid development of science and modern technologies causes intensive changes which take place in different professional fields and are reflected in specialized languages, which are integral parts of a national language. Fruitful cooperation and communication among professionals require deep knowledge and understanding of terminological units which are the main components of specialized terminologies. They are means of concepts representations and information transfer.

Present-day subject-specific terminologies are characterized by accurate, professional vocabulary aimed at delivering precise and univocal information on the one hand. On the other hand, they comprise a great number of more expressive language units, namely metaphors, to make new concepts more understandable. Active and continuous development of specialized terminological systems determines the up-to-date processes professional language undergoes, and calls for new approaches to the analysis of subject-specific terms, namely metaphorical ones. The study of terminological metaphors is pivotal because it contributes to more effective communication between specialists as well as between non-professionals. Structural and semantic analysis of metaphors in subject-specific terminologies of geodesy and geology with further comparative analysis of their productivity has both theoretical (is relevant for linguistic studies) and practical (the results of the investigation are significant for teaching, translation,

and professional activities) application.

Linguistic research has shown that metaphoric transfer of meaning is a crucial tool for the creation of terms aimed at designation of new subject-specific concepts (Kyiak, 2000; Pavel, 1993). Terminological metaphors have been thoroughly studied by scientists, specialized in cognitive linguistics (Johnson & Lakoff, 2003; Ortony, 1979), besides, they were studied within specialized languages such as economy (Chudinov, 2001), medicine (Oliveira, 2009; Temirgazina, Akosheva, Yrysgul, Shakaman, Y, Shaharman A, Kurmanova, & Kairova, 2019), politics (Datsyshyn, 2001), computer science (Meyer, 1997), architecture (Caballero, 2003), military sphere (Riabov, 2010), etc.

Very few of studies, however, are devoted to structural and cognitive features of metaphorical terms in the sphere of geology and geodesy, a gap which our paper attempts to fill. Bessonova (1985) has analyzed the semantic and structural features of general geology terminology. Sultanova (2013) has conducted comparative analysis of geological terminology in Russian and Tajik languages. Zhuravleva (1991) has studied the key methods of nomination and lexical-semantic processes in modern French geological terminology. English geologic and geodetic terminologies, in particular the layer of their metaphorical terms, have not yet been the subject of modern linguistic research.

### *1.2 Research Significance*

Global exploration of the Earth, growing demand for the production of its resources caused rapid and dynamic development of geologic and geodetic sciences in the XXI century. This process is reflected in their terminologies that constitute a significant part of the Earth science, which focuses on the overall study of earth's resources, its structure and shape. The insufficient linguistic analysis of geologic and geodetic terminological systems has led to the choice of these terminologies as the subject of the current research. It should be noted that one of the features of modern subject-specific terminologies is metaphorization of terminological nature, that is the presence of many metaphorical terms formed as a result of secondary nomination, based on the associativity of human thinking. The significance of the research is predetermined by the growing interest of linguists to the investigation of metaphorization as a productive mechanism of enriching the vocabulary of specialized terminological systems.

### *1.3 Research Questions*

The study is intended to increase understanding of terminological metaphors by addressing the following research questions:

- what are key peculiarities of geologic and geodetic terms metaphorization?
- what semantic types of metaphorical terms prevail in geologic and geodetic subject-specific terminologies?
- what metaphorical terms proved to be more frequent depending on the nature of metaphorization of their constituents?
- how are metaphorical terms under study classified according to their structural characteristics?
- what makes metaphorical terminological word combinations dominant in geologic and geodetic terminological systems?
- do the noun models show the best productivity in the process of metaphorical nomination?

### *1.4 Research Objectives*

The main objectives of the research are:

- to determine the theoretical and methodological basis of the study;
- to establish peculiarities of geologic and geodetic terms metaphorization;
- to construct, systemize and describe the main structural and semantic metaphorical models of terminological units under study;
- to identify structural features of geologic and geodetic metaphorical terms;
- to consider the productivity of the analyzed metaphorical models.

The article is organized as follows. Firstly, we give an overview of basic concepts in linguistics and terminology, concerning metaphorisation and metaphorical terms. Then we describe the methodology of the presented study, the way of terms extraction, and analysis. Afterward, we show and discuss the overall results of the conducted research in detail. Finally, the major conclusions drawn from this study are presented.

## 2. Literature Review

The theory of terminology is generally regarded from the point of view of three different dimensions:

1. the cognitive dimension, which examines the concept relations and thereby how the concepts constitute structured sets of knowledge units or concept systems in every area of human knowledge, as well as the representation of concepts by definitions and terms;
2. the linguistic dimension, which examines existing as well as potential linguistic forms that can be created to name new concepts;
3. the communicative dimension, which examines the use of terms as a means of transferring knowledge to different categories of recipients in a variety of communicative situations and covers the activities of compilation, processing, and dissemination of terminological data in the form of specialized dictionaries, glossaries or terminological databases, etc. (Sager, 1990, p. 13). The presented article focuses mainly on linguistic and cognitive dimensions of terminology, as far as it is aimed at investigating geological and geodetical terms of metaphorical character from the point of view of their semantic and structural peculiarities.

The formation of metaphorical terms is closely connected to the process of terminologization, which is defined by Valeontis and Mantzari as “a general procedure through which a word or phrase from general language is transformed into a term designating a concept in a special language” (Valeontis & Mantzari, 2006, p. 7).

Metaphors in terminology differ from metaphors in commonly used language, as within a particular subject-specific field they are mechanisms of knowledge categorization and conceptualization. Metaphorical terms are created by metaphorical transfer of meaning of already existing in the general language concept to a new specialized concept, based on corresponding associations of human memory. They help to understand unknown concepts with the help of the known ones, besides they are, in most cases, brief, accurate, easy to comprehend and remember.

The problems of metaphorization have always been in the center of interest for scientists and language researchers. Stern (2008), Telia (1988), Dudetstka (2007), Yesypenko, Yankovets, O., Beshlei, Yankovets, A. & Bloschynskyi (2021) and others highlight main peculiarities of a metaphor as the most creative and productive way of secondary nomination. Humar (2021) and Arutiunova (1978) focus their attention on the typology of metaphorical terms. Metaphor as a unique instrument for term formation in different terminologies like political, oil and gas, military was investigated in detail by Datsyshyn (2005), Kerimov (2005), Tsisar (2009), Khachmafova, Ostrovskaya & Skhalyakho (2021) and other linguists. Metaphor as a cognitive tool is thoroughly analyzed by Johnson and Lakoff (2003). The nature of metaphorization, different metaphorical models are reflected in the works of Baranov (1991), Chudinov (2001). Lakoff and Johnson (2003) regarded metaphorical nomination as an integral part of our everyday life and claimed that “we are surrounded by metaphorical universes” (Lakoff & Johnson, 2003). According to the scientists, whom we fully support, metaphoric thought is a mechanism of thought that is constantly used for communication among people and besides for comprehension of the world (Lakoff & Johnson, 2003). As Faber and L'Homme (2014) state: “both general and specialized lexical items can be regarded as conceptual categories of distinct yet related meaning that exhibit typicality effects” (Faber & L'Homme, 2014, p. 144).

Modern linguistics is characterized by the increasing interest of scientists in the problems of cognitive, semantic, and structural approaches to the study of language in general and terminological sub-systems in particular with the emphasis on conceptual meaning of terminological units and metaphors as integral parts of specialized languages (Butiurca, 2015; English, 1998; Faber & L'Homme, 2014; Isaeva, 2019; Kittay, 1987; Temmerman, 2000; Valeontis & Mantzari, 2006). Representatives of traditional terminology regarded metaphors as undesirable units in terminological systems, while Temmerman (2000), whom we support, and her new approach in modern terminology argues that metaphor is of great importance for lexicalization process (Temmerman, 2000). Its productivity can be used as a tool to reveal the degree of metaphoricity of its linguistic instantiations (Siqueira, de Oliveira, Hubert, de Almeida & Brangel, 2009, p. 163). Semantic motivation, suggesting the principles of correlation between semantic groups/meaning and evidence that derivatives of each gender have the following semantic segments (notions of people, administration and social stratification for masculine suffixes; abstractions, feelings and emotions, traits of character and activities for feminine ones, and structures, locations and lifeless objects for neuter suffixes) were revealed by (Soloviova, Bloschynskyi, Tsviak, Voitiuk & Mysechko, 2021).

Today terminologists express much interest in metaphors and regard them as important integral parts of specialized terminologies. Isaeva underlines that “in the language for special purposes, conceptual metaphors occur in the form of metaphorical terms. The cognitive potential of metaphor in terminology lies in its ability to model the content and structure of new scientific concepts by analogy with familiar concepts from other knowledge domains or everyday

life” (Isaeva, 2019, p. 67). D’Hanis (2002) states that “one of the first properties of metaphors that drew attention is their capacity of filling gaps in the lexicon. It often happens that when a new concept is developed, there is no way of naming it, other than using a metaphor” (D’Hanis, 2002, p. 216). Baltrunaite (1998) adds that “metaphorical terms are motivated words. Not only do they nominate the desired object but also the object’s relation to other objects is determined, and the most important properties of the object are defined” (Baltrunaite, 1998, p. 39).

It is worth pointing out that metaphors are becoming increasingly frequent in specialized domains because of the tendency towards user-friendliness in everything. Meyer (1998) stresses that since metaphors express unfamiliar concepts in terms of familiar ones, they play an important role in user-friendly communication (Meyer, 1998, p. 524). Metaphor informativeness is one more reason why metaphorical terms are tolerated in scientific texts (Andrade de, 2010, p. 125).

Metaphorical terms as components of English geodetic and geologic terminological systems and instruments of enriching their vocabulary, are studied following the contemporary theory of metaphor, introduced by Johnson and Lakoff (2003), according to which they are the means of concepts comprehension. Lakoff (1993) argues that “the metaphor is a cognitive tool we use to comprehend abstract concepts and perform abstract reasoning (Lakoff 1993, p. 244). According to Lakoff and Johnson (2003), the essence of the metaphor is understanding and experiencing one kind of thing in terms of another (Lakoff & Johnson, 2003, p. 5).

### **3. Methodology**

#### *3.1 Data Collection and Description*

While generating the study material, with the help of the method of continuous sampling, a total of 1463 nominations of metaphorical origin (288 geodetic and 1175 geologic ones) were selected from the corpus of English reference literature in geodesy and geology. The sources of the material under study were corresponding specialized online and printed dictionaries, encyclopedic dictionaries, glossaries, state standards (see Text Source). That particular reference literature was chosen for the practical analysis as far as they are up-to-date publications, containing the vocabulary in the sphere of geodesy, surveying, geology, and related sciences. Since this paper focuses on the study of terminological metaphors in professional fields of geodesy and geology, their semantic and structural peculiarities, the extraction of terms was mainly done from dictionaries – reference publications in the studied areas, which embrace correspondent subject-specific vocabulary, along with its translation and definition of terminological units.

The difference between the number of extracted metaphorical terms in geology and geodesy could be partially accounted by the available reference literature (geological dominates here) and by the origin of the two sciences (geology is considered to be the older one). According to the Encyclopedia Britannica (2013), geology is “the field of study concerned with the solid Earth. Included are sciences such as mineralogy, geodesy, and stratigraphy”, that is geodesy is a part of geology that studies the structure of the earth, its scientific objective is “to determine the size and shape of the Earth” and practical role – “to provide a network of accurately surveyed points on the Earth’s surface, the vertical elevations and geographic positions of which are precisely known and, in turn, may be incorporated in maps” (Encyclopedia Britannica, 2013). Geology as a science emerged earlier, covers much wider areas of investigation and a much broader vocabulary than geodesy. These two sciences are interrelated, have much in common, belong to the same field of study – the Earth Science, embrace similar inter-disciplinary vocabulary, though both have their subject-specific terminological units.

#### *3.2 The Procedure of Investigation*

In order to analyze and describe the main metaphorical models in geologic and geodetic terminologies we followed systematic procedures for organization and representation of the studied material: term selection, observation, description of metaphoric term constituents and their interpretation, classification into terminological models, contrastive analysis to find out similarities and differences between structural and semantic models of metaphorical terms in two interrelated terminologies, evaluation of the data obtained.

The conducted research is based on a complex investigation of the extracted vocabulary applying the following key approaches: analysis of the words definition and meaning, structural and morphological analysis, quantitative analysis of data, etc. It includes five main steps. The first step of the research involved analysis of the basic approaches to the study of professional language units, functioning in subject-specific terminological systems, with the emphasis on metaphorical terms as components of specialized terminologies. It was carried out employing general scientific methods, based on the study of the scientific works and reference resources in general and applied linguistics, terminology, semantics, to work out definitions of the linguistic concepts, covered in the article. The search for metaphorical terms was carried out through manual inspection of the content of the studied sources, which

involved analysis of terms, definitions and translation, identification of metaphorical terms by determining the literal meaning of the word in commonly used language and its meaning in the field of geology and geodesy. The process involved contrasting the specific scientific and technical meaning of the lexical unit with its non-metaphorical meaning to verify metaphorical nature of the extracted term. The essence of the third step was to analyze semantic features of geologic and geodetic metaphorical terms and to classify them according to the nature of metaphorisation of their components. This implied application of the semantic and definitional analysis as well as the following methods: descriptive, comparative, and qualitative analysis of metaphors. The next step, which involved application of structural and morphological analysis, was devoted to the classification of the extracted metaphorical terms following their structural characteristics and parts of speech to which they or their components belong. Thus, metaphorical terms under study have been classified into one-stem terms, compound terms and terminological word combinations (two-component and three-component). To determine the productivity of the semantic types and structural models of the metaphorical terms under study (which was the final step in our research) quantitative data analysis and method of calculations were applied.

#### 4. Results

Terminological systems of geodesy and geology are regarded by us as integral parts of the English language. Like other scientific terminologies, these subsystems cover different layers of vocabulary, including commonly used words, which in the process of terminologization changed their meanings and acquired special, professional meaning within the above-mentioned terminological systems and became terms. They nominate particular subject-specific objects and are determined as terminological metaphors. Specialized terms like commonly used language words, belong to the lexical system of language and perform a nominative function (Temirgazina et al., 2019, p. 144). It should be mentioned that though subject-specific terminological systems are components of the national language, their vocabulary greatly differs from the general one, as it is characterized by precision, conciseness and tendency to unambiguity, besides one of its main functions is to denote special, scientific concepts which “require formal notation and definition, but may also need metaphorical description and explanation” (English, 1998, p. 8). It is vital to note that metaphors in specialized languages are to be considered as complex processes and phenomena, showing different semiotic natures and functions (Rossi, 2017, p. 153). They are important tools of knowledge categorization and conceptualization.

The metaphorical use of language is an effective means of creating new language structures with the help of the already existing ones, which are rather understandable and easy to remember. It is characteristic for specialized terminologies, which apply commonly used words for nomination of subject-specific concepts, the result is the formation of terminological metaphors. In the process of term metaphorisation, one specialized object or process is named by the title of another one, which is often used in common language based on the similarity of form, size, colour, function, structure, etc. Baltrūnaitė (1998) accentuates that sometimes “a concept itself provides freedom for title motivation selection, and preference is not always given to essential properties. Nomination can be impacted by accidental associations, vivid imagination of the creator” (Baltrūnaitė, 1998, p. 38).

The semantic approach to metaphorical terms in the structure of English geodetic and geological terminologies has shown that metaphorical processes here are based on certain associative resemblances like appearance-to-appearance (geology: *bookshelf fault*; geodesy: *leveling shoe*), shape-to-shape (geology: *knee fold*; geodesy: *knee of curve*), colour-to-colour (geology: *ink stone*; geodesy: *red magnetism*), function-to-function (geology: *mouth*; geodesy: *key to grids*), structure-to-structure (geology: *sugar stone*; geodesy: *sponge*) resemblance.

Metaphorical terms have been classified by us into anthropological (which reflect general qualities of a human) and non-anthropological ones (related to the reality, which is surrounding a human, including names of animals, plants, concepts of economic and social sphere (economics, sport, music, religion, etc.)). As it can be observed from the data provided below (see Table 1), both geological and geodetic “human” metaphorical terms are strikingly abundant.

Table 1. The percentage representation of semantic types of metaphorical terms in geological and geodetic subject-specific terminologies

Semantic types of metaphorical terms	Geological terminology	Geodetic terminology
Human	27, 8%	54,2%
Textile	7,2%	4,5%
Architecture	16,4%	2,8%
Household items	4,5%	13,6%
Transport	3,1%	0,7%
Gastronomy	6,5%	1%
Flora	2,2%	1%
Fauna	11,7%	4,9%
Social and economic sphere	20,6%	17,3%

A considerable number of anthropological metaphors in the structure of studied terminologies can be explained by their productive potential and character (direct relationship to a human). According to Telia (1988), “the choice of a basis for metaphor is related to the ability of a man to measure everything new to him by similarity with himself or by the objects of space which man deals in practical experience with” (Telia, 1988, p. 182). As Chudinov (2001) states “God created man based on his image, so man metaphorically creates (conceptualizes) reality in the form of his body, organs, his physiological and other actions and needs, his genetic and other connections with relatives” (Chudinov, 2001, p. 35). Rakhilina (2002) also notes that in the process of metaphORIZATION “a person, parts of his body, location in space and movement are widely used” as a source for creation of new terms (Rakhilina, 2002, p. 381).

Anthropological metaphors in the studied terminological systems occur when the names of the parts of a human body become specialized terms in their metaphorical meaning, for example, the word *body* has a meaning “*the entire physical structure of an animal or human being*”, while in the sphere of geodesy *body* of map indicates “*that area of a map, contained within the neatlines*”. The word *blind* means “*unable to see, slightless*”, while as a geological term, *blind coal*, is used to describe “*coal that burns without flame*”.

As we can observe, geological and geodetic terms of metaphorical character, that are based on association related to the objects created by people like buildings, furniture, clothes, things of daily usage are also often used in the English language for making technical terms, because it is easy for the term creator to trace the similarity between the new concept and the simple word, to denote this concept and to make this term user friendly. For example, we can trace in the specialized English language of geology the following metaphorical terms, like *scissors fault* “*a geological fault in which there is increasing displacement along the strike from an initial point of no displacement*”, *wallpaper effect* “*the effect of warping and splitting into blocks during water absorption, inherent in clay minerals*”, etc. Whereas in geodetic terminology such terms as *ceiling* “*the greatest (upper) height*”, *pinpoint* “*a point on a map marking a precise location or target*” are present.

Non-anthropological metaphors (related to geography, economics, politics, phytomorphic, zoomorphic metaphors, etc) are represented by an insignificant number of terms. However, they also play an important role in the nomination of new concepts. A vivid example of a non-anthropological metaphor is the geologic term *soapstone* that means “*a metamorphic rock that consists primarily of talc with varying amounts of other minerals such as micas, chlorite, amphiboles, pyroxenes, and carbonates*”. The direct meaning of the word *soap* is “*a cleaning or emulsifying agent made by reacting animal or vegetable fats or oils with potassium or sodium hydroxide*”.

More examples of metaphorical terms in English geological and geodetic terminologies with the focus on the semantic transfer of meaning are illustrated below:

- Human creature – *mother* (direct meaning: “*a female who has given birth to offspring*”), *mother rock* (geological metaphorical term: “*the original rock from which younger rock or soil is formed*”); *heel* (direct meaning: “*the back part of the human foot from the instep to the lower part of the ankle*”), *heel* (geodetic metaphorical term: “*the lower, end or back section of a rod*”);
- Architecture – *fountain* (direct meaning: “*a structure from which such a jet or a number of such jets spurt, often incorporating figures, basins*”), *fire fountain* (geological metaphorical term: “*a form of pyroclastic eruption containing magma suspended in gas*”); *ceiling* (direct meaning: “*the inner upper surface of a room*”), *ceiling* (geodetic metaphorical term: “*the greatest (upper) height*”);
- Gastronomy – *onion skin* (direct meaning: “*the tissue forming the outer covering of a round vegetable that grows underground and has a strong, sharp smell and taste*”), *onion-skin weathering* (geological metaphorical term:

“the process of the layers of the rock being peeled off”); egg (direct meaning: “an oval object that is produced by a female bird and which contains a baby bird”), egg-shaped spheroid (geodetic metaphorical term: “ellipsoid of revolution which has an oval form, usually with one end larger than the other”);

- Flora – tulip (direct meaning: “any spring-blooming liliaceous plant of the temperate Eurasian genus Tulipa, having tapering bulbs, long broad pointed leaves, and single showy bell-shaped flowers”), tulip structure (geological metaphorical term: “strike-slip faults bound the basin on the two parallel sides of the stepover and normal faults bound the basin on the two end sides”); rose (direct meaning: “any shrub or climbing plant of the rosaceous genus Rosa, typically having prickly stems, compound leaves, and fragrant flowers”), wind rose (geodetic metaphorical term: “a diagram with radiating lines showing the frequency and strength of winds from each direction affecting a specific place”);

- Fauna – camel (direct meaning: “a large animal that lives in deserts and is used for carrying goods and people”), camel back mountain (geological metaphorical term: “the mountain is composed of a geologic unconformity between two separate rock formations”); frog (direct meaning: “a small creature with smooth skin, big eyes, and long back legs which it uses for jumping”), leap-frog trigonometric leveling (geodetic metaphorical term: “type of leveling applied with different sight distances to determine the optimum sight distances using the method of obtaining elevations of stations along a route between two base stations, or to obtain a closed loop of altimeter elevations”);

- War – camouflage (direct meaning: “the exploitation of natural surroundings or artificial aids to conceal or disguise the presence of military units, equipment”), camouflage (geological metaphorical term: “replacement of the mineral-forming element by another element of the same valence”); shot (direct meaning: “the act or an instance of discharging a projectile”), side shot (geodetic metaphorical term: “a reading or measurement from a survey station to locate a point which is not intended to be used as a base for the extension of the survey”);

An essential feature of the metaphorical terms in the sphere of geology and geodesy, however, is not their quantitative ratio, but the nature of metaphorization. Our analysis of metaphorical terms showed the heterogeneity of the role of their constituent components in metaphorical reinterpretation (see Table 2). It is worth noting that metaphorical change of meaning can be subjected to both the whole term and any of its components. Thus, metaphorical terms in the structure of English geological and geodetic terminological systems have been classified into two general types – fully metaphorical terms, all components of which are metaphorical, and partly metaphorical terms, only some components of which are metaphorical. The latter ones are divided into two groups, depending on the position of a metaphorical word in their structure (metaphor+term and term+metaphor).

Table 2. The percentage representation of metaphorical compounds in geological and geodetic subject-specific terminologies according to the nature of metaphorization of their components

Types of metaphorical compounds according to the nature of metaphorization of their components	Geological terminology	Geodetic terminology
metaphor + metaphor (fully metaphorical terms)	56,5%	66,7%
term + metaphor (partly metaphorical terms)	4,8%	8,3%
metaphor + term (partly metaphorical terms)	38,7%	25%

The presented above data of the quantitative analysis of compound metaphorical terms in the structure of the studied terminologies show that fully metaphorical terms, all components of which acquire a new terminological meaning are dominant in both terminologies. For example, in geology the term gooseneck is used to denote “sinuous canyons and valleys that resemble the curved neck of a goose” and in geodesy we trace such a term as arrowhead meaning “part geodetic instrument with a wedge-shaped, pointed tip on an arrow”. In the structure of metaphorical compound terms of the “metaphor + term” type, the second component, as a rule, nominatively dominates and expresses the sphere of the goal, and the first component is used in metaphorical meaning. For example, geological term bloodstone implies “a dark-green variety of the silica mineral chalcedony that has nodules of bright-red jasper distributed throughout its mass” and the geodetic term footscrew stands for “an adjusting screw that serves as a foot”.

In geological and geodetic terminologies, we find compounds of the type “term + metaphor”, where the first component is represented by the term, and the second, metaphorical, expresses the characteristics of this concept and acts to denote the source sphere, but they are not very numerous. For example, the geological term baymouth meaning “a sandbank that partially or completely closes access to a bay”.

A characteristic feature of metaphorical word-combination terms is that its components affect the process of metaphorization in different ways. A metaphorical term consists of the main component, which is a categorical, generic concept, and a dependent component, which indicates more specific, qualitative, or quantitative features of the concept.

The analysis has revealed that the most common form of metaphor expression in geology and geodesy are two-component terms in which the first component is used in a metaphorical sense and characterizes the whole concept (61,1% and 75,5%, respectively) (see Table 3). The second component of such a term is usually terminological and relates to the field of geology and geodesy. For example, geology: *basement rock* “the rocks below a sedimentary platform or cover, or more generally any rock below sedimentary rocks or sedimentary basins that are metamorphic or igneous in origin”; geodesy: *silent map* “a contour map without any inscriptions and symbols”.

Table 3. The percentage representation of metaphorical terminological word combinations in geological and geodetic subject-specific terminologies according to the nature of metaphorization of their components

Types of metaphorical terminological word combinations according to the nature of metaphorization of their components	Geological terminology	Geodetic terminology
metaphor + metaphor (fully metaphorical terms)	8,7 %	16,1 %
term + metaphor (partly metaphorical terms)	30,2 %	8,4 %
metaphor + term (partly metaphorical terms)	61,1 %	75,5 %

Next in number in geology, in comparison with geodesy (30,2% vs 8,4% of the total number of metaphors in the English geodetic and geological terminological systems respectively), is a group of terms, where metaphorized core component (the second one) is a commonly used word which determines the meaning of the whole word combination, whereas the first component characterizes or defines the concept and is related to the terminological geological or geodetic vocabulary. For example, geology: *calite skin* “scaly influx of calcite on the walls of the cave”; geodesy: *valley shoulder* “a long, narrow region of low land between ranges of mountains, hills or other high areas, often having a river or stream running along the bottom”.

In other cases, both components of the term are subject to metaphorical rethinking. The term as a whole acquires a new meaning. The terminological terms, in which both words are metaphors, turned out to be not so frequent in the sphere of geology (8,7%) and difficult in terms of interpretation of meaning, as they characterize one concept with metaphorized words of the common language. The second component nominates the geological concept, and the first gives it an evaluative and figurative characteristic. For example, *rooster tail* “feathery shape of the water column”. Whereas in geodesy such terms are more frequently used (16,1%), like *active leg* “is the part of the route from the current location to the next route point”.

The conducted analysis made it possible to classify metaphorical terms under study according to their structural and morphological characteristics. Structural approach is aimed at determining the most effective ways to explicate metaphorical meanings of terms, belonging to geodetic and geological terminologies. From a cognitive point of view, according to Kerimov (2005), the morphological word-formation of metaphorical terms is not very important, because the cognitive function (the main function of the conceptual metaphor) and other functions can perform a metaphor of any part of speech. However, it is always interesting which units of the language predominate in the verbalization of the concept by metaphors (Kerimov, 2005, pp. 51-53). Morphological approach, applied by us, gave an opportunity to investigate the morphological structure of metaphorical terms in detail. The offered classification was based on the classification proposed by Diakov and Kyiak (Diakov & Kyiak, 2000, pp. 13-14) and grounds on the division of terminological units under study into the following structural models: one-stem terms, compound terms and terminological word combinations (see Figure 1).



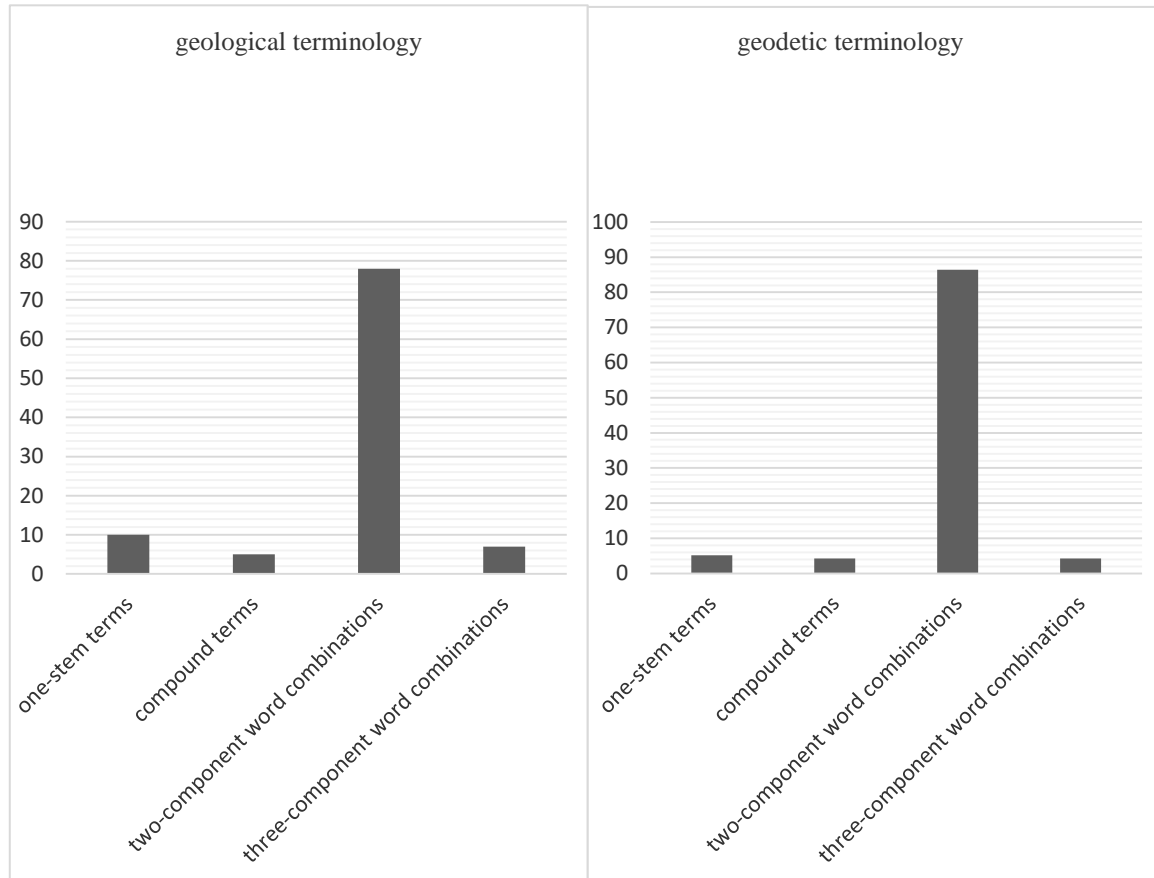


Figure 1. The percentage representation of metaphorical terms in geological and geodetic subject-specific terminologies (with the focus on their structural characteristics)

Among the metaphorized geological and geodetic one-stem terms (10% vs 5,2% of the total number of metaphorical terms in geology and geodesy respectively) are used mainly nouns, adjectives and occasionally verbs (see Table 4).

Table 4. The percentage representation of structural models of one-stem metaphorical terms in geological and geodetic subject-specific terminologies (with the focus on parts of speech they belong to)

Structural models of one-stem metaphorical terms	Geological terminology	Geodetic terminology
Nouns	87,6%	86,7%
Adjectives	7,4%	-
Verbs	5%	13,3%

The main function of the noun is to name the objective reality, so the noun metaphor is the most common structural type of one-stem metaphors in the studied terminologies (87,6% vs 86,7% from the number of metaphorical one-stem terms in geology and geodesy respectively). For example, geological term *bacon* defines “fibrous variety of calcite” and geodetic term *strength* means “power of the geodetic network to resist force”.

A study of geological and geodetic one-stem metaphorical terms showed that in addition to nouns, these languages are characterized by a small number of terminological units expressed by an adjective and verb. An adjective expresses a passive, qualitative feature of an object or phenomenon, for example geological metaphorical term *blind* stands for “a vein that does not continue to the surface”. The verb expresses the active feature of the subject. The metaphorical potential of a verb is very large and is important for metaphor in general, because any verb conveys information about the dynamics of the phenomenon, about proceduralism and variability, about activities that can transform reality in a similar way to other processes (Datsyshyn, 2001). In the English language of geology and geodesy verb metaphors, like *to kick* “disrupt the normal circulation of fluid in the oil well”, are not common, in comparison with the one-stem terminological units in geodetic terminology, for example: *to judge* (an angle) “to define (an angle)”.

Compounding, as a way of forming metaphorical terms in geological and geodetic terminologies, is characterized by relative productivity. Nevertheless “complex words are needed not only to meet the need for new words but also to express two ideas in one word” (Doroshenko, 2004, p. 46). The results of quantitative analysis (see Figure 1) show that metaphorical compounds are not very productive and account for only 5% and 4,2% of the total sample in terminologies of geology and geodesy. Dominant in the structure of such units have proved to be nouns (see Table 5).

Table 5. The percentage representation of structural models of compound metaphorical terms in geological and geodetic subject-specific terminologies (with the focus on parts of speech they belong to)

Structural models of compound metaphorical terms	Geological terminology	Geodetic terminology
Noun + Noun (NN)	87,1%	83,4%
Noun-Noun (N-N)	9,7%	8,3%
Noun-and-Noun (N-and-N)	3,2%	8,3%

The analyzed terminologies are characterized by metaphorical compound terms, formed on the basis of compiling independent components without the participation of interfixes (the number of which prevail in both terminologies, see Table 5), for example: geology: *cuphole* “deepening, which was formed near the shore as a result of water waves”; geodesy: *footplate* “a flat oval base of a rod”, with interfix: geology: *rabbit-eye* “limestone”, etc. as well as with interfix and connecting conjunction, for example: geology: *salt-and-pepper* “diorite is an intrusive rock intermediate in composition between gabbro and granite”, etc.

As it was mentioned before the researched material includes one-stem, compound and terminological word combinations of metaphorical character. Based on the results of the quantitative analysis of vocabulary, it is possible to claim that in the analyzed terminologies the vast majority of metaphorical terms are word-combinations: two-component (78% in geology and 86,4% in geodesy) and three-component (7% in geology and 4,2% in geodesy from a total sample of 1463 metaphorical terms). This is because in “such names, which have a nominative direction and retain the meaning of words – their components, capture the essential features of the depicted, so that such a name of reality is included in the system of concepts of a particular field of knowledge” (Doroshenko, 2004, p. 31).

Two-component terminological units of metaphorical character include the main component, which names the basic concept, and the dependent component, which indicates its more specific features and they are represented by different structural models, singled out according to parts of speech they belong to (see Table 6).

Table 6. The percentage representation of structural models of two-component metaphorical word combinations in geological and geodetic subject-specific terminologies

Structural models of two-component metaphorical word combinations	Geological terminology	Geodetic terminology
Noun model	80,2%	51,9%
Adjectival model	19,5%	44,9%
Verbal model	0,2%	2,8%
Numeral model	0,1%	0,4%

The most productive structural model of two-component terminological word combinations of metaphorical character is the noun model, represented by different variations (in the models below and further on N stands for the noun, Adj. – for the adjective, V – for the verb):

- N+N: geology: *pencil cleavage* “a cleavage in rock such that long, slender, pencil-shaped fragments of rock are created by fracturing during the weathering of a sedimentary rock”; geodesy: *skeleton map* “a map showing only basic details of a land, place”.

- N+of+N: geology: *elbow of capture* “an abrupt turn in the course of a river attributable to stream piracy”; geodesy: *face of map* “the side on which the printed image of the map or chart appears”.

- N+for/to/under+N: geodesy: *key to grids* “a scheme for moving from one coordinate grid to another”.

- N's+N: geodesy: *Devil's slide* “a steep, rocky coastal promontory located about midway between Montara and the Linda Mar District of Pacifica”, etc.

Adjective metaphor is a metaphor-characteristic, it combines the functions of nomination and description with an emphasis on the descriptiveness of the metaphorical expression (Datsyshyn, 2001). This type of metaphor is inferior to the noun metaphor in the English language of geology (19,5% of the two-component terminological word combinations of metaphorical character) and is more frequently used in the sphere of geodesy 44,9% of the two-component terminological word combinations of metaphorical character). The passive feature of an object or phenomenon is expressed with the help of such metaphor. Typical adjective models of metaphorical terminological word combinations (two-component ones) in the studied terminologies are:

- Adj+N: geology: sedimentary trap “any topographic depression where sediments substantially accumulate over time”; geodesy: fresh grid “grid of the new coordinate system”.
- Ving+N: geology: roaring sand “a sounding sand, found on a desert dune, that sets up a low roaring sound that sometimes can be heard for a distance of 1200 feet”; geodesy: running survey “a rough survey made by a vessel while coasting”.
- V3+N: geology: knitted texture “typical structure of serpentine in rocks where it replaces monoclinic pyroxene”; geodesy: depressed area “area with excessive over-pressure”.
- Adj+Ving: geodesy: dead reckoning “the process of calculating current position by using previously determined references position and advancing that position based upon known or estimated speeds over elapsed time and course”.

Very rare is the metaphorical usage of verbs and numerals in the analyzed terminologies. For example, V+N: geology: swallow hole “a natural well-formed in limestone regions either by the dissolution or the collapse of karstic cavity roofs”; Num+N: geology: three sisters “the cluster of glaciated stratovolcanoes”.

Compound terms often become an integral part of two-component terminological word combinations of metaphorical character, for example:

- (N-N)+N: geology: hourglass valley “a valley that resembles an hourglass in plan”; geodesy: eyepiece mark “mark done with the help of the eyepiece of a microscope or telescope, that is the piece of glass at one end, where you put your eye in order to look through the instrument”.
- (N-and-N)+N: geology: ball-and-pillow structure “a sedimentary structure occurring on the base of some sandstones which are interbedded with mudstones, and characterized by globular protrusions and isolated pillows of sandstone found in the underlying mudstone”; geodesy: half-and-half method “approximate method in geodetic investigations”.
- (N-N)+N: geology: elephant-hide pahoehoe “a type of pahoehoe on whose surface are innumerable tumuli, broad swells, and pressure ridges which impart the appearance of elephant hide”; geodesy: bulls-eye level is “a round domed level that reads 360° at once”.
- (Adj-N)+N: geodesy: loose-leaf map “a map having or designed to have leaves that can easily be removed or replaced”.

Two-component terminological word combinations (of metaphorical character) often become the basis for the creation of three-component terminological word combinations, in which the generic name, expressed by a two-component terminological word combination, becomes a species (Doroshenko, 2004, p. 160). For example, geology: chestnut soil “any of an agriculturally important group of zonal soils typically having a dark-brown surface horizon that grades downward into a lighter zone and then into a horizon of lime accumulation and being characteristic of certain cool semiarid grasslands and steppes” → reddish chestnut soil “any of a group of zonal soils developed under mixed grass with some shrubs in a warm-temperate semiarid climate that have dark brown surface soils tinted pinkish or reddish and up to 2 feet thick underlain by heavier reddish brown soil on grayish or pinkish lime accumulations”.

A productive model of the three-component metaphorical word combinations in both terminologies under study is noun word-combinations formed by the following models:

- N+N+N: geology (53,1%): palm tree structure “an uplifted, commonly antiformal area, the convex upward form of the upward-diverging faults”, coon tail ore “banded ore consisting mainly of fluorite and sphalerite in alternate light-and dark-colored layers”; geodesy (50,2%): elevation mask angle “the minimum acceptable elevation above the horizon that a GPS satellite has to be at to avoid blockage of line-of-sight”.
- (N-N)+N+N: geology (2,4%): piggyback thrust sequence “a thrust sequence formed by the progressive development of thrusts by collapse of the footwall”; geodesy (8,3%): eyepiece micro correction “a slight correction with the help of an eyepiece of a microscope or telescope (that is the piece of glass at one end, where you put your eye to look through the instrument)”.
- N+and+N+N: geology (2,4%): pillar and stall method “method of mining in which large chambers are excavated, leaving pillars of ore, rock, or coal to support the roof”; geodesy (8,3%): eye and ear method “method based on observations with the help of eyes and ears”.

Analysis of the researched material indicates that verbal and mixed models of three-component metaphorical word combinations were not frequent in both terminologies. Among the three-component metaphorical word combinations,

a small group of adjectival metaphorical terminological units stands out. This observation leads to the conclusion that adding a definition to a two-component metaphorical word combination turns it into a three-component one. For example, geology: *capillary moisture zone* “the lower part of the aeration zone, which is located above the groundwater mirrors”; geodesy: *gnomic azimuthal projection* “an azimuthal projection that uses the center of the earth as its perspective point. It projects great circles as straight lines, regardless of the aspect. This is a useful projection for navigation because great circles highlight routes with the shortest distance”.

## 5. Discussion

The current study investigated terminological units of metaphorical character in the structure of geologic and geodetic subject-specific terminologies with the focus on both semantic and structural features of the terms. The results indicate that metaphorical processes, which are peculiar for the above mentioned terminological systems, are grounded on associative resemblances of appearance, shape, colour, function, structure. It has been found out that anthropological metaphors are dominative due to their direct relation to human beings, their appearance, body, actions, etc. The conducted analysis was also set out to determine the nature of the term metaphorization and the obtained results indicate that fully metaphorical terminological units dominate over partly metaphorical terms in both geodetic and geologic terminologies.

The study suggests that according to morphological approach terminological metaphors can be classified into one-stem terms, compound terms and terminological word combinations. From the obtained data it is evident that noun models prevail in both terminologies. The results of the quantitative analysis indicate that word combinations are the most productive in terminological systems under study; among them two-component word combinations have proved to be dominant. The growing role of metaphorical word combinations in the process of enriching terminological vocabulary is explained by their great term formation potential and ability to clarify scientific concepts, nominating complex objects and phenomena. The presented research conducted in the line of structural and semantic approach of the language investigation contributes to the existed studies of specialized terminologies with the focus on metaphorical vocabulary within geologic and geodetic terminological systems.

## 6. Conclusions

The presented paper discussed key aspects of metaphorisation and peculiarities of metaphorical terms in the English geodetic and geologic subject-specific terminologies. The conducted research has demonstrated that metaphorisation is one of the most important cognition mechanisms, which plays an essential role in forming the vocabulary of professional fields. We have concluded that terminological units of metaphorical character are created as a result of mental activity when there is some kind of similarity between concepts of a source domain (often commonly used language) and a target domain (that is a particular terminology they function in).

Metaphorical transfer of meaning is widely applied in subject-specific terminologies, including geodetic and geologic ones, studied by us, which is to some extent because the usage of metaphorical terms facilitates understanding of new concepts and contributes to professional communication since metaphors express unfamiliar concepts by familiar ones. They are productive means of new concepts nomination and enrichment of specialized terminologies. Terminological units of metaphorical character are on the one hand accurate, brief, easy to remember, but on the other one, difficult to grasp for non-professionals.

The results of the research have shown that the key part of geodetic and geological metaphorical terms are anthropological, related to human being, our mode of life and objects of reality, which surround us (geodetic terminology – 54,2 %, geological terminology – 27,8 %). Detailed semantic and definitional analysis of the researched material has revealed that specialised concepts are nominated applying common language words with the help of metaphorical transfer of meaning. The most productive form of such mechanism (within the above mentioned terminologies) is function and form similarity between commonly used and terminological meaning of a lexical unit.

The article also addressed the problem related to the nature of metaphorisation of terminological units. As a result, metaphorical terms have been classified into fully and partly metaphorical ones. The latter proved to be dominant in the structure of both terminologies (geodetic and geological), that indicates the important role metaphors play in subject-specific terminologies.

Morphological and structural analysis of English geological and geodetic metaphorical terms have shown that terminological units under study are characterized by the same structural models as commonly used words. The analyzed scope of data has been classified into: one-stem and compound terms as well as terminological word combinations of metaphorical origin. Quantitative analysis of the extracted vocabulary has demonstrated that terminological word-combinations of metaphorical character prevail among geologic (85%) and geodetic (90,6%)

metaphorical terms. The most frequent have proved to be two-component metaphorical word-combinations (78% – geologic and 86,4% – geodetic ones). Terminological word combinations are dominant in subject-specific terminologies, namely geologic and geodetic ones, as far as their application gives an opportunity to increase the number of components in the structure of a language unit and to differentiate various objects, specifying their meaning and application that is very important for terminological vocabulary.

The presented classification of metaphors according to their structural models makes it possible to understand how the choice of one or another part of speech for their metaphorical reinterpretation affects the process of naming geological and geodetic objects and processes. The noun creates a new nomination, while the adjective shows their essential features, and the verb indicates procedure and action, crossing geological and geodetic objects and processes with nominations of realities of human life or the world of nature, thus bringing the field of geology and geodesy closer to the recipients. We have observed that nouns proved to be dominant among one-stem terms, compounds and word combinations of metaphorical character, due to the fact that they play a very important role in the process of nomination and conveyance of specialized knowledge.

The study provides the analysis of geologic and geodetic metaphorical terms selected from dictionaries and related reference sources from the point of view of their semantic and structural peculiarities. The prospects for further research in the field are the textual and critical discourse analysis of metaphorical processes in specialized terminologies with the focus on cognitive aspect of metaphorical terms formation.

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