Open Access Library Journal
2025, Volume 12, e14457
ISSN Online: 2333-9721
ISSN Print: 2333-9705

Strategies for Accurate Translation of Geological Science and Technology Terminology from the Perspective of Functional Equivalence Theory

Yiru Chen, Pengpeng Gao

School of Foreign Languages, Xi'an Shiyou University, Xi'an, China
Email: 2532434823@qq.com

How to cite this paper: Chen, Y.R. and Gao, P.P. (2025) Strategies for Accurate Translation of Geological Science and Technology Terminology from the Perspective of Functional Equivalence Theory. *Open Access Library Journal*, **12**: e14457.
https://doi.org/10.4236/oalib.1114457

Received: October 14, 2025
Accepted: November 3, 2025
Published: November 6, 2025

Copyright © 2025 by author(s) and Open Access Library Inc.
This work is licensed under the Creative Commons Attribution International License (CC BY 4.0).
http://creativecommons.org/licenses/by/4.0/

Open Access

Abstract

Geological data is significant to mineral exploration in the "Data Mineral Age." Guided by Eugene Nina's functional equivalence theory, the translation adopts the case analysis method to summarize the problems in the translation process and propose solutions from three levels: lexicon, syntax, and discourse. The results are: at the lexical level, there are many terminologies and abbreviations in energy science and technology texts, and the target language should be selected according to the specific context in translation. At the syntactic level, there are many passive sentences and complex sentences in English. When translating passive sentences, adjustment and conversion can be used. For complex sentences, the method of division can be used to make the hierarchy clearer. At the discourse level, cohesive words can be added through amplification to achieve discourse coherence. Hopefully, this study can provide some reference for the accuracy of technical terminology translation.

Subject Areas

Literature

Keywords

Functional Equivalence Theory, Geological Science and Technology Text, Translation

1. Introduction

The "14th Five-Year Plan" clearly points out that international geological survey

and scientific and technological cooperation should be deepened, and the ability and level of serving international mining cooperation should be improved. Against the background of the carbon peaking and carbon neutrality goals, China's high-quality economic development and ecological civilization construction continue to deepen, and the high-quality development of the geological exploration industry is an important part of it [1]. The strength of translation service ability is directly related to the depth and breadth of overseas promotion of China's geological industry.

Geological data for mineral exploration is important for finding, evaluating, and developing mineral resources. Using geospatial tools and other technologies, geologists can detect the location and distribution of mineral exploration more accurately and efficiently, and provide technical support for developing and utilizing mineral exploration. Zhou (2016) is guided by Eugene Nida's functional equivalence theory, which is based on analyzing the differences between English and Chinese passive sentences. He puts forward the Chinese translation method of passive sentences [2]. Song (2020) points out that geological texts are characterized by strong professionalism, objective expression, strict structure, and rigorous logic. Therefore, using the functional equivalence theory as to guide, to achieve the accuracy of information transmission and normalization of expression [3]. Zhu (2020) analyzes the important and difficult points of geological text translation from lexical, syntactic, and cultural aspects under the guidance of functional equivalence theory [4].

This project can bring value to the geological industry and similar texts and provide professional language services for popularizing important technical exchanges in the energy science and technology field.

2. Introduction to Functional Equivalence Theory

In 1969, the American linguist Eugene Nida proposed the concept of functional equivalence. At first, he proposed dynamic equivalence, which emphasized that the equivalence between source and target language should be higher than the formal and stylistic equivalence, and this view was easily misunderstood, resulting in the meaning of the translated text deviating from the style [5]. In 1986, Eugene Nida proposed to replace it with functional equivalence, which emphasized the communicative role of translation in language communication. According to Eugene Nida, translation is a linguistic transformation and a kind of communication. If the information does not convey the purpose of communication and is not understood by the target readers, then the translated text is substandard [6]. Dynamic equivalence focuses more on the target reader's subjective experience and perception of the translation, emphasizing that the translation should evoke effects or reactions in the audience comparable to those elicited by the original text among its source-language readers. Functional equivalence, on the other hand, emphasizes the actual function and role of the translation within the target culture and context, stressing that the translation should achieve functional equivalence

with the source text.

Functional equivalence theory includes lexical, syntactic, discourse, and stylistic equivalence. Lexical equivalence refers to when dealing with vocabulary-related problems, translators need to dig deep into vocabulary connotation and analyze and judge the meaning of words according to different cultural backgrounds in combination with specific sentence meaning and context, to avoid readers misunderstanding the meaning of words. Syntactic equivalence refers to translators clarifying the source text's stylistic style, language expression characteristics, and language habits. Moreover, it is necessary to consider the target language's expression and the reader's reading habits, so that the syntactic cohesion can be smoothly transformed. Discourse equivalence describes the translator paying attention to the overall structure of the source text and the target text when translating.

Functional equivalence theory stresses that translation is effective and that the target language is fluent and understandable [7]. This meets the requirements of energy science and technology text translation, ensures the accuracy of the translation, and, at the same time, makes the target language fluent, which is beneficial to the understanding of the target readers. Considering its consistency, functional equivalence theory is suitable for guiding translation practice.

3. Features of the Text

With the in-depth development of economic globalization, countries are increasingly connected. In order to achieve better and faster development, countries have cooperated one after another. China is a truly resource-rich country with vast territory and abundant resources. The total cultivated land area accounts for less than 10% of the world's cultivated land area but feeds nearly 22% of the world's population. Its mineral resources have become the primary source of disposable energy, industrial raw materials, and agricultural means of production in all countries [8]. The emergence of terms in geological science and technology texts is closely related.

The features of geological science and technology text are professionalism and accuracy, conciseness and abbreviation, objectivity, and passivity, which require translators not only to ensure the accuracy of the information conveyed but also to consider the needs of the target readers [9]. In this text, in aspects of vocabulary, its word-building methods are flexible and diverse, and the translator needs to master geological English vocabulary skillfully. In terms of syntax, passive sentences, nominalization structure, parallel structure, and multiple complex sentences are used. In some aspects of discourse, the translator should mainly focus on logic. This text has prominent features of scientific and technical texts, which makes it challenging to translate.

4. Case Study

The geological science and technology text focuses on geology. It aims to convey

information in professional and concise language to enable the target reader to understand the meaning of the source text more clearly. Functional equivalence theory emphasizes choosing the most suitable way to express semantics. It emphasizes the relationship between readers and translated texts so that readers can understand the meaning of the source text clearly. Given this, this chapter chooses Eugene Nina's theory as the guiding theory to analyze the source text from lexical, syntactic, and discourse aspects.

4.1. At Lexical Level

The geological science and technology text has the unique language characteristics of geology. Moreover, in the English vocabulary of geology, there are few words with pure geological meanings, and the meanings of most words are not uniform, which influences translators' translations. In this part, case studies will be conducted from the perspectives of geological terms and abbreviations to deal with the text and improve translation accuracy.

4.1.1. Translation of Terms

The geological science and technology text has prominent lexical features and abundant terms. The text mainly describes the geological industry's energy, minerals, topography, and geomorphology [10]. It has a single and precise meaning, less ambiguity, strong irreplaceability, more uncommon words, and less use in daily life. In the translation process, dictionaries and other tools must be used to assist translation.

Example 1

ST: These families include the gabbro, norite, gabbro norite, troctolite, anorthosite, dolerite, and basalt.

TT: 该矿类包括辉长岩、苏长岩、辉长苏长岩、橄长岩、斜长岩、粗玄岩及玄武岩。

Analysis: Many kinds of rock names are mentioned in this sentence, and some rocks have many translation methods, so it is necessary to further determine and choose the appropriate translation methods. "Anorthosite" is translated as "钙长石" or "斜长岩". "钙长石" consists of calcium-aluminosilicate hydrochloride, and the color is white or gray. "斜长岩" includes anorthose and deep color. "Dolerite" is translated as "辉绿岩" or "粗玄岩". "辉绿岩" is a plutonic rock. "粗玄岩" is coarse-grained. Through the term online, make sure that translates as "斜长岩" and "粗玄岩".

Example 2

ST: The **core** is generally nearly colorless to greenish-brown or yellowish-brown.

TT: **岩芯**的颜色一般是无色到绿棕色或黄褐色。

Analysis: In the sentence that mentions "core" As a noun, it is usually translated

as "果心 guǒ xīn or 要点 yào diǎn" which refers to the core of apples or questions. However, it can not be directly used here. Because this word belongs to the specialization of general vocabulary, it should be translated into geological English as "岩芯 yán xīn" or "地核 dì hé" according to the context. In this way, the original meaning can be expressed more accurately, which aligns with geological English.

4.1.2. Translation of Abbreviations

Abbreviations are concise in form and frequently appear in geoscience literature. The use of acronyms can improve the efficiency of expression and reading and make the article more concise, which accords with putting readers first in functional equivalence theory and fully considers the purpose of readers' understanding [4]. However, there is a lack of unified norms, and using abbreviations is confusing. Misunderstanding abbreviations will cause ambiguity and even affect the understanding of the whole article. Therefore, for the translation of abbreviations, it is necessary to clarify their specific meanings according to the characteristics of the geological science and technology text, the translation experience, and the content of the text.

Example 1

ST: **X-ray diffraction (XRD)** is a conventional technique to pinpoint minerals in a laboratory environment. It is an adaptable and nondestructive analytical technique to obtain detailed structural and phase information of materials quickly. **XRD** is a significant device in mineralogy for identifying, quantifying, and characterizing minerals in complex mineral assemblages.

TT: **X 射线衍射(XRD)技术**，在实验室中精准定位矿物位置，一种适应性强的无破坏性的分析技术。此技术能快速提供矿物的详细结构和相位信息。**XRD** 是矿物学研究中用于识别、量化和描述复杂矿物组合的关键设备。

Analysis: In translation, abbreviations are sometimes omitted and used directly. When abbreviations first appear, they should be translated into Chinese and marked with abbreviations. When acronyms reappear, they can be used directly to avoid translation repetition. By searching, the translator confirms in Baidu and Bing dictionaries that XRD translates as "X射线衍射 shè xiàn yǎn shè (XRD) 技术 jì shù."

Example 2

ST: Iron stones and **BIFs** are the two forms of deposits that can be found (BIFs).

TT: 铁矿和**条带状铁建造(Banded Iron Formations**: 一种主要产出于前寒武纪(>5.4 亿年)的富铁化学沉积岩)是能够被发现的两种沉积物。

Analysis: BIFs is an acronym for Banded Iron Formations, which refers to 条带状铁建造 tiáo dài zhuàng tiě jiàn zào and means an iron-rich chemical sedimentary rock produced mainly in the Precambrian (>540 million years). Because the word is professional and challenging to understand, they must mark the full title of "Banded Iron Formations" when the translator translates it. It is necessary to use parenthetical notes to facilitate the understanding of the target readers.

4.2. At Syntactic Level

The geological science and technology text requires accurate and standardized language expression, clear and strict logical structure, and objective and fair content statements. To meet these requirements, geological English syntactically uses passive sentences, nominalized structures, parallel structures, and multiple complex sentences. Translators must deal with passive, long and complex sentences in this kind of translation practice. The translator combs out the grammatical structure of these sentences, clarifies the logical relations in the context, and uses functional equivalence as a translation guide according to readers' needs. Therefore, this section will conduct case studies on passive structure and complex sentences to deal with the text and determine the specific translation method.

4.2.1. Passive Structure

English sentence patterns usually use "subject + predicate verb". The predicate verb is usually changed into a passive voice when the subject is an object. In most cases, geological English focuses on describing things and states and expressing facts, processes, and results, so passive structures are often used [10]. Translators should adopt flexible ways to change passive structures into impersonal or active sentences according to the differences between English and Chinese sentence patterns.

Example 1

ST: Chromite ores **are** usually **assigned to** one of the following two classes based on the mode of occurrences, petrologic character, and tectonic setting of their host rocks.

TT: 根据母岩的岩相特征和构造背景，铬铁矿**通常分为**以下两类。

Analysis: This is a passive sentence. The translator uses conversion. Because Chinese and English use passive sentences differently, English often uses passive sentences, so it needs to be adjusted in Chinese translation. The translator thinks this sentence's active tense is more appropriate and concise. The translator translates "铬铁矿 通 常 被分为" (gè tiě kuàngtōngcháng bèi fēn wéi) into "铬铁矿 通 常 分为" (gè tiě kuàngtōngcháng fēn wéi) and puts the subject in the second sentence finally.

Example 2

ST: Grade of ore: Regarding the ore idea, it is important to remember that the ore (or mineralization) has a grade, which **is defined as** the average concentration of a valuable substance (e.g., gold or tin) in a sample or a mineral deposit.

TT: 矿石品级：就矿石(或矿化)概念而言，品级很重要，其**定义为**样品或矿床中有价值物质(如金或锡)的平均浓度。

Analysis: The translator uses adjustment. First, the passive form in the sentence is "is defined". The "is defined" translates into "定义" (dìng yì). The passive sentence of this sentence exists in the non-restrictive attributive clause and is guided by "which" for further explanation. To make the sentence's meaning express more smoothly, which makes it easier for readers to understand directly, the translator removes the subject of "which is defined as the average...".

4.2.2. Complex Sentences

Complex sentences are the key and difficult points in geological English. There are many modifiers in complex sentences [11], so translators should pay attention to the comprehensive application of various translation skills in translation. However, the translator should first thoroughly understand the source text and then combine translation skills to translate the text based on their understanding of the source text.

Example 1

ST: Hence, the term shear zone can be simply defined as a tabular zone **where** strain is remarkably greater than in the surrounding rock.

TT: 因此，剪切带可简单定义为应变明显大于周围岩石的曲面状区域。

Analysis: First, this sentence should be translated not only as a complex sentence but also to pay attention to the terminology. "Where strain is..." is an attributive clause, and "where" modifies "a tabular zone" to indicate the characteristics of the shear zone. The translator adjusts the order to achieve functional equivalence by translating "a tabular zone" at the end of the sentence.

Example 2

ST: Igneous, sedimentary, and metamorphic rocks are the three types of rocks **that** express the basic processes **that** occur in the crust.

TT: 火成岩、沉积岩和变质岩是地壳运动下形成的三种岩石。

Analysis: The sentence contains two attributive clauses guided by "that". First, the translator uses division to find out that the backbone of the sentence is "Igneous, sedimentary, and metamorphic rocks are the three types of rocks". This sentence has an SVP structure, and then the translator analyzes the clause further by grasping the backbone. The first "that" modifies "the three types of rocks". The meaning of "express" is "表达"(biǎo dá), in this sentence, it means to illustrate the basic processes occurring in the Earth's crust by showing different morphologies and characteristics, so translating express to "是". The second modifies "the basic processes". When translating, the translator adjusts the word order of sentences according to the differences between Chinese and English language habits.

4.3. At Discourse Level

The geological science and technology text features careful conception, concise wording, clear levels, and outstanding emphasis in discourse. Therefore, while realizing semantic equivalence in translation, the translator should not neglect the whole text. Text is the final foothold of translation and an important link in judging the quality of translation.

Example 1

ST: Because they help in the separation of components from solution, boiling and solubility are significant in the deposition of ores from hydrothermal fluids.

TT: **因为**水热运动有助于从溶液中分离矿物成分，**所以**沸腾和溶解在热液成矿中具有重要意义。

Analysis: The sentence tells the effect of hydrothermal movement. The source language only explains the reason but not the result. In this sentence, there is a causal relationship. Therefore, when translating the sentence, the translator adopts amplification and translates it as "因为(yīn wéi).....所以(suǒ yǐ)....." to indicate the causal relationship.

Example 2

ST: The assumption of this concept is that mineral deposits will only form and remain preserved where critical earth processes (geodynamic setting, lithosphere architecture, fluid, ligand, and ore component reservoir(s), fluid flow drivers, and pathways, depositional mechanisms, and post depositional processes) have occurred in a spatial and temporal coincidence and that the occurrence of these critical processes can be recognized from mappable geological features expected to reappear.

TT: 此概念假设，**只有**在地球关键运动(地球动力环境、岩石圈结构、流体、配体和矿石成分储层、流体流动驱动因素和路径、沉积机制和沉积后过程)的空间和时间上发生重合的情况下，矿床**才**会形成并保存下来，而且这些关键过程的发生通常与可预测且可映射的地质特征相。

Analysis: In this sentence, there is no apparent cohesion mark in the source text. However, when translating into Chinese, the translator adds conjunctions to make it more logical and coherent. Chinese grammar requires a conjunction "只有(zhǐ yǒu)" (used to explain the conditions) to indicate conditions for forming the mineral deposits. "才(cái)" is also needed to indicate the result of mineral deposits.

5. Conclusions

Guided by the functional equivalence theory, various translation techniques are employed to solve the problems encountered in the translation process at the lexicon, syntax, and discourse levels. On the lexical level, please pay attention to terms and combine them with the specific context to determine the general vocabulary around the context. The translator uses parenthetical notes to solve abbreviations. On the syntactic level, adjustment and conversion can be used in passive sentences. For complex sentences, division can be chosen. On the discourse level, amplification is applied to achieve discourse coherence. In this way, the quality of the translation can be improved, and the translation can extract the original information better and more accurately to convey it to the target readers more rigorously and objectively.

The small sample size limits the scope of this study. In future research, the author will expand the selection range of research samples to enhance the generalizability and reliability of the findings. Additionally, the author will explore integrating more advanced translation theories and technological approaches to conduct deeper analyses of complex issues in translation practice, thereby providing more comprehensive and actionable strategy recommendations for improving translation quality.

Acknowledgements

This research was supported by the 2025 Annual Project of the "14th Five-Year Plan" for Educational Science of Shaanxi Province, entitled "AI-Enabled Construction of Effective Questioning Strategies for English Learners".

Conflicts of Interest

The authors declare no conflicts of interest.

References

[1] Ren, K.X. and Chen, C.H. (2025) Geological Exploration Technology Development Trends under the "Dual Carbon" Target. *Popular Standardization*, No. 1, 43-45.

[2] Zhou, S. (2016) Linguistic Features and Translation Strategies of Geological Texts. Master's Thesis, Chengdu University of Technology.

[3] Song, Y. (2020) English-Chinese Translation of Geographic Information Engineering Scientific Papers under the Guidance of Functional Equivalence Theory. *English Square*, No. 16, 50-53.

[4] Zhu, H.X. and Luo, L. (2020) Research on Geo-Science English Translation from the Perspective of Functional Equivalence Theory. *China Geological Education*, **29**, 75-78.

[5] Hu, L. and Zheng, Y.Y. (2023) Practicality and Theory of English Translation from the Perspective of Functional Equivalence. *Journal of Nanchang Normal University*, **44**, 105-109.

[6] Lyu, Y.L. (2022) Research on Translation Characteristics and Strategies of Scientific and Technological ENGLISH. *Nonferrous Metals Engineering*, **12**, 195-196.

[7] Jia, Y.J. (2022) Research on Functional Equivalence in Scientific and Technological English Translation. *Journal of Heihe University*, **13**, 132-134.

[8] Liu, W.L. and Zhang, C.Z. (2019) Characteristics and Translation of Abbreviations in Mining Geology English—"New Edition of Geological English Course". *Mining and Metallurgical Engineering*, **39**, 158.

[9] Liu, G. (2024) Research on the Application of Functional Equivalence Theory in Scientific and Technological English Translation. *Journal of Harbin Vocational & Technical College*, **1**, 121-123.

[10] Sun, Y.C. and Fu, L.Y. (2022) Characteristics and Translation of Geological English Words and Sentences. *Journal of Southwest Jiaotong University* (*Social Sciences Edition*), **23**, 24-35.

[11] Lu, Y. and Yang, C.M. (2018) English-Chinese Translation Techniques for Geological Professional English. *China Mining Engineering*, **47**, 61-65.