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GEOTECHNIC VS. GEOTECHNOLOGY

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Abstract:

Many world languages contain two technical terms which are equally used in the modern scientific and industrial lexicons and, at a first glimpse,sound pretty similar: "geotechnology" ("geotechnological") and "geotechnic" ("geotechnical"). Due to that apparent similarity and the lack of a clear definition of "geotechnology", they are often misused, creating significant muddle and confusion. This article is an attempt to clarify the situation.

Keywords **—Geotechnology, geotechnological, geotechnic, geotechnical, remote operated mining**

I. INTRODUCTION

So, what do these two terms mean and what is the deference?

Since mid-20th century, the word "geotechnical" is used mostly in conjunction with the words "investigation" and "engineering".

Geotechnical Engineering is *the science that studies (investigates) mechanics of soil and rock and includes analysis, design and construction of foundations, slopes, retaining structures, roadways, tunnels and other systems that are made of or are supported by soil or rock* [1]. Essentially, it is all about the construction business.

In turn, the term "Geotechnology" is about as old as "Geotechnic" but belongs to a completely different industry [2].

Geotechnology (GT) is *a set of engineering sciences and mining techniques concerned with extraction of Earth natural resources based on their in-situ conversion into a liquid or gaseous form* [3]. Almost exclusively, GT deals with extraction (mining) of Earth's natural resources.

While it is widely spread and popular in the rest of the world, the term Geotechnology remains seldom and often wrongly used across the western hemisphere, and deserves a closer look.

II. GEOTECHNOLOGY

The following are examples of GT mining methods:

- Solution mining applied for recovery of soluble minerals, such as salt. It requires either a single or multiple boreholes and consists of pumping of fresh water into the salt dome and pumping back of saturated brine. Perhaps, among all the GT methods, SM is the oldest one [4].
- In-situ leach(ing) used for extraction of metals and requires drilling of injection and extraction holes. A reagent then is pumped into the formation. On its way thru the ore to the extraction holes, it dissolves metal and a pregnant solution is pumped to the surface.
- Sulfur melting mining (Frasch process) includes pumping a super-hot water or steam into the sulfur layer(s), melting it down and pumping it up back to the surface in the molted form.
- Underground coal gasification consists of pumping of oxygen (air) into the coal layer(s) followed by its ignition and controlled burning. Extracted heat is used for house heating, agricultural and similar purposes.
- Borehole mining applied for extraction of friable, unconsolidated ores (phosphate, iron,

coal, gold, uranium, rare earths, other). It is based on in-situ water jetting of ores. Produced slurry is simultaneously pumped to the surface.

- Heavy oil stimulation similarly to Frasch, it is based on injection of hot steam into the oil formation thru boreholes, heating up the surrounding strata and extraction of "liquefied" oil thru the same or adjacent holes.
- Geothermal energy includes pumping of cold water thru an injection well into the hot portion of the Earth crust forcing it to migrate towards an extraction well. Heated up water pumped back to the surface and used for electricity generation, greenhouse and similar purposes.

All of the above GT methods are remotely operated thru boreholes terminating the necessity of personnel presence in the mine. In fact, GT eliminates mines altogether which makes it a mineless technology. Operation and control over the mining process is computerized and often conducted from great distances. It is mining without miners.

Comparing the diameter of a GT borehole (usually lesser than 20") with the size of a conventional mine (fig 1), some researchers suggest a term "non-intrusive", which is a synonym to "mineless".

Fig 1. A gold mining GT-rig deployed on the edge of the open pit. Courtesy of Borehole Mining International, Inc. 2019

Mineless Geotechnology is also used for O&G stimulation, underground construction of storage in salt domes, walls, curtains, groundwater collectors, and several more. Yes, GT is used for construction, but it is based on the mineless remote operated mining which makes it radically different, stand-alone science and business.

There are a few more methods which also are qualified as Geotechnological such as heap leaching, SX-EW, old tailings reprocessing [5]and a few more, but to get the ore for leaching, a conventional mining (surface or underground) is required. Thus, these GT methods fail to be called mineless.

Since no earth moving required, mineless GT methods are the most rapid, safe, cost effective and environmentally friendly technologies proving extraction of resources previously deemed uneconomic. It finally allows operations in hazardous (i.e. radiation), dangerous (i.e. unstable strata) conditions and broadens mining to remote areas including offshore, desert and polar zones.

In many cases, to apply the most effective GT mining parameters, *geotechnical investigations* are required. It include rock and ore sampling, lab tests, hydro-geological and rock mechanics studies, computer simulations, etc. Thus, despite some apparent similarity, "geotechnical" and "geotechnological" are two different terms bearing different meanings. In short, geotechnical engineering serves to achieve the best possible geotechnological operating parameters and final results.

Although it sounds very attractive, geotechnology is not a panacea and does not replace the conventional mining. More than that, there are situations when conventional mining methods are preferable. At the same time, there are cases, such as below-the-ocean-floor mining, when there are a few or not at all alternatives to geotechnology. Together with the conventional methods, geotechnology forms the modern mining technological arsenal making it more flexible and versatile.

ACKNOWLEDGEMENT

Extending for over decades and centuries, many generations of scientists, researchers and engineers from around the world contributed their talent, knowledge and experience into development of geotechnology as a modern scientific discipline and industrial branch. The author acknowledges their tremendous input. Without this diligent and hard

work, geotechnology would never reach its today's commercial success.

III. CONCLUSION

Geotechnology has no lack or shortage of scientific publications, engineering reports, case studies, white pages, patents, internet blogs,etc. Since mid- late-20th Century, Geotechnology Departments established in many institutes and universities worldwide, including Canada, Estonia, Japan, Indonesia, Norway, Russia, Slovakia, Vietnam, US and more [6]. Their primary goals are students education and conduction of R&D in the area of modern mining technologies.

To avoid awkward disarray, it is imperative to become familiar with existing and prevailed terminology before using it for different purposes. Eventually, it will help everyone, but especially those newer generations of researchers to step on the same page and move the modern world forward.

REFERENCES

[1] *Geotechnical Engineering*, www.whatisgeotech.org

[2] *Geotechnology*, Marriam-Webster Dictionary

[3] G. Abramov "*Mining Terminology Disarray*" Mining Engineering, Web Exclusive 08/2019

[4] *Gavin M. Mudd*"Acid In-situ Leach Uranium Mining".Tailings & Mine Waste. Fort Collins, CO, USA – January 23-26, 2000

[5] VelizarStanković "*Reprocessing of Old Flotation Tailings Deposited on RTB Bor Tailings Pond - A Case Study". ResearchGate.net*

[6] Wikipedia.

