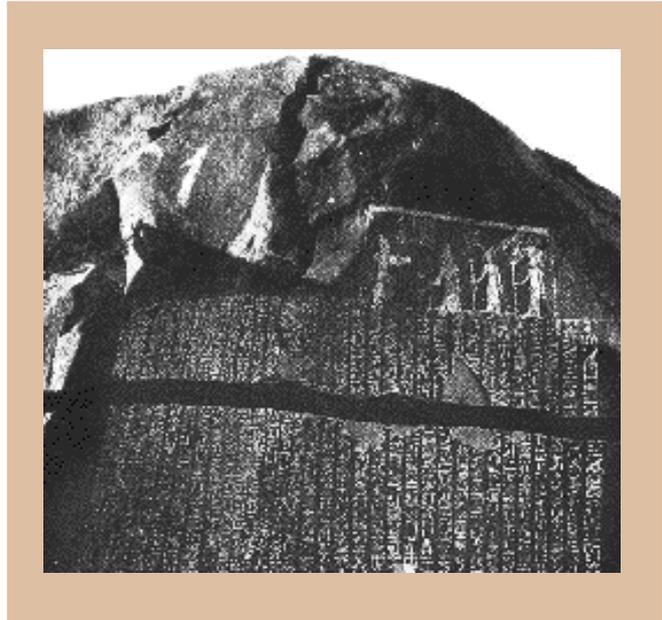


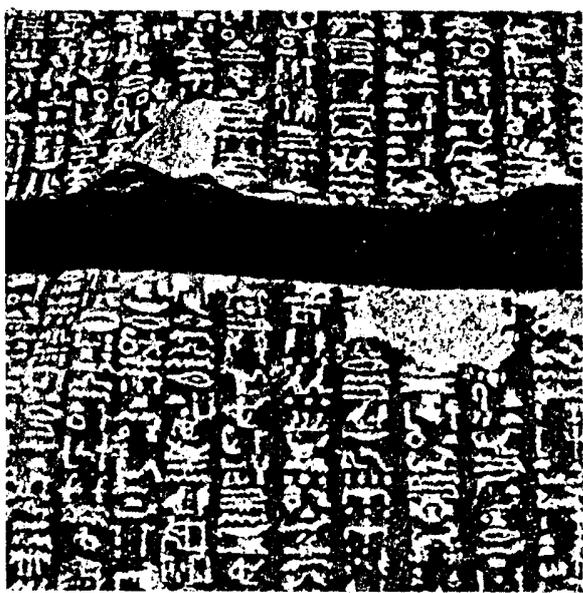
**THE FAMINE STELE PROVIDES THE HIEROGLYPHIC
NAMES OF CHEMICALS AND MINERALS INVOLVED IN THE
CONSTRUCTION OF PYRAMIDS.**

by J. Davidovits

**Presented at the Vth International Congress of Egyptology, Cairo,
Egypt, Oct. 1988.**



The **Famine Stele**, island of Sehel,
Elephantine, Egypt.
32 columns of hieroglyphic text
(read from right to left).



Upper portion of columns 12 to 21
(read from right to left)

PYRAMID MAN-MADE STONE, MYTH OR FACTS, III).

THE FAMINE STELA PROVIDES THE HIEROGLYPHIC NAMES OF CHEMICALS AND MINERALS INVOLVED IN THE CONSTRUCTION.

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ABSTRACT

Egyptologists have long claimed that no records exist which describe how the Pyramids were built. A stone stela is engraved on a rock at the **island Sehel**, near Elephantine, north of Aswan. It was discovered in 1889 by C.E. Wilbour and was deciphered by Brugsch (1891), Pleyte (1891), Morgan (1894), Sethe (1901) and Barguet (1953). The hieroglyphic text, called the **Famine Stele**, has been examined and the previous translations compared with each other. One third of the stela deal with the building of monuments, involving three of the most renowned characters of the Egyptian civilization: Pharaoh Zoser, Scribe Imhotep and God Khnum.

Yet, the most controversial aspect of this text resides in the fact that to build temples, pyramids and other sacred buildings, Khnum's instructions and Imhotep's revelations do not mention any constructional stone, such as limestone or sandstone or granite blocks. These materials are not found in the list.

In Zoser's dream (col. 19) Khnum is giving minerals and «since former times nobody ever worked with them to build the temples of the gods..». This clearly relates to the invention described above.

To build monuments, Zoser was given a list of minerals and ores whose hieroglyphic names have not been translated so far. This is the reason why we started an in-depth study of each hieroglyphic word, in order to determine the technical key-words, those which are obviously difficult to translate.

The new interpretation of the Famine Stele has been shown to explain how Pharaoh Zoser, who built the first pyramid (2750 BC), was instructed to make man-made stone (*ARI-KAT*) (concrete).

INTRODUCTION

The author has suggested that the stones of the Egyptian pyramids are manmade numulitic limestone blocks cast into place like concrete, (geopolymer concrete) (Davidovits, 1978, 1979, 1982, 1983). If so, the pyramids were built with far fewer workers than previously believed.

According to the old scenario of Egyptology, tens of thousands of labourers arduously cut with primitive tools millions of three- to twenty-ton numulitic limestone slabs from quarries and hauled them up ramps into position. A comparison has been made between the casting or agglomeration of man-made numulitic limestone for pyramid construction and the traditional carving of natural limestone as claimed by Egyptology.

Our preliminary scientific investigations carried out on stones provided by egyptologists and geologists, included quarry studies, geological, mineralogical, petrographical and chemical analysis (Davidovits and co-workers, 1984) (Davidovits, 1987). Oldest proof of the ancient geopolymer man-made stone technique is found as early as 7,000 BC (Davidovits and Courtois, 1981).

In the mean time, we are concentrating our research on archaeological material, such as texts, available in the principal specialised libraries. New interpretations of technical key-words demonstrate that ancient literature offers an abundant amount of evidence to support the knowledge of geopolymeric

man-made stone in Antiquity (Davidovits, 1986).

We are convinced that, if the agglomeration of stone was used, hieroglyphic texts must exist which might give some clues. However, these texts could have been mistranslated, and for this reason remain unknown.

We are introducing the first study of a text which could be a good step forward in the discovery of other texts.

THE FAMINE STELA

A stone stela is engraved on a rock at the **island Sehel**, near Elephantine, Egypt, north of Aswan. It was discovered in 1889 by C.E. Wilbour and was deciphered by various egyptologists: Brugsch (1891), Pleyte (1891), Morgan (1894), Sethe (1901), Barguet (1953) and Lichtheim (1973).

This stela features three of the most renowned characters of the Egyptian civilization:

- **Pharaoh Zoser**, around 2,750 BC, built the first pyramid, the Step Pyramid at Saqqara. This monument is claimed to illustrate the invention of building with stone.

- **Imhotep**, scribe and architect of Zoser's pyramid, who has been honored and deified for having invented the building with stone.

- **God Khnum**, the potter who, as in the Bible, is fashioning the bodies of humans and gods with the Nile silt, with clay, in other words processing minerals.

Called «**The Famine Stele**», it was engraved during a recent epoch, under the Ptolemes (200 BC), but certain reliable clues have led egyptologists to believe that, in an amplified form it had already become an authentic document by the beginning of the Old Kingdom (2,750 BC).

Unable to provide a successful remedy to a famine which occurred, priests of this Ptolomeic epoch turned to the ancient texts of the great scribe Imhotep, in the library at Hermopolis, in order to find a similar event in the past and to learn the remedy used to bring the famine to an end. They did indeed find a similar event dating from King Zoser (2,500 years earlier), the remedy being represented by the god Khnum.

The Famine Stele consists of 32 columns of hieroglyphs written from the right to the left (Plate 1). The text comprises five chapters:

- The description of the Famine, col. 1 to 4;
- The visit to the library at Hermopolis, col. 4 to 6;
- The revelations of Imhotep, col. 6 to 18;
- The dream of Zoser, col. 18 to 22;
- The royal decree, col. 22 to 32.

In columns 6 to 18 Imhotep describes to Zoser the site, the minerals and stones of Elephantine, and in columns 18 to 20, Zoser, in his dream, is learning from Khnum how to build with stone the temples of the gods.

The translations of these passages reveal the exceptional value of this hieroglyphic text which dates from a time contemporaneous with the famous Rosetta Stone. Names of minerals and stones, for which no obvious translation can be made, are given with their original hieroglyphic spelling. Barguet's and Lichtheim's translations reflect the most up to date knowledge of Egyptology. Except for one work by Aufrere (1984) on the possible translation of one single precious stone, no study has been published on this topic recently.

Ten out of thirty two hieroglyphic columns (one third of the stele) deal essentially with **minerals, ores and stones**. This disclosure occurs in columns 10 to 20. We are focussing on this passage. The following is the English version of Lichtheim:

The revelations of Imhotep

(Col. 11) There is a mountain massif in its eastern region, with precious stones and quarry stones of all kinds, all

(Col. 12) the things sought for building temples in Egypt, South and North, and stalls for sacred animals, and palaces for kings, all statues too that stand in temples and in shrines. Their gathered products are set before the face of Khnum and around him.

(Col.13)... there is in the midst of the river a place of relaxation for every man who works the stone on its two sides.

(Col. 15) Learn the names of the stones that are there lying in the borderland: ... *b h n , mt3y, mhtbtb, r'gs, wtsy, prdn, tsy.*

(Col. 16) Learn the names of the precious stones of the quarries that are in the upper region: ... gold, copper, iron, lapis lazuli, turquoise, *thnt*, red jasper, *k'*, *mnw*, emerald, *tm-ikr*, *nsmt*, *t3-mhy*, *hm3gt*,

(Col. 17) *ibht, bks-'nh*, green eye-paint, black eye-paint, carnelian, *shrt, mm*, and ochre,...

The dream of Zoser

(Col. 18) I found the god standing before me... he said «I am Khnum, your maker! My arms are around you, to steady your body,

(Col. 19) to safeguard your limbs. I bestow on you stones upon stones (that were not found before) of which no work was made for building temples, rebuilding ruins, onlaying statues' eyes. For I am the master who makes, I am he who made himself exalted Nun, who first came forth, Happy who

(Col. 20) hurries at will; fashioner of everybody, guide of each man.

Four translations of Col. 11 and 12 are compared :

Brugsch (1891):

... Massen von Gebirgen mit Steinen sassen sie ein nach einer östlichen Richtung hin. Es kommen die Bauleute mit allen Sachen wenn es ihr Zweck ist irgend ein Gotteshaus ... Wohnstätte ... **Pyramide** ... Bildsäule auszuführen.

Sethe (1901):

... Es seien Massen von Bergen in seiner Nachbarschaft auf dem Ostufer mit allerlei festen un über alles kostbaren Mineralien die man suche für alle Tempelbauten ... **Grabbau des Königs** ... Statuen ...

Barguet (1953):

... Il y a un groupe de montagnes dans son emplacement oriental, avec toutes sortes de matières précieuses et de pierres dures des carrières, et tout ce que l'on recherche pour construire tout temple ... les étables ... **les tombes royales** ... les statues ...

Lichtheim (1973):

... There is a mountain massif in its eastern region, with precious stones and quarry stones of all kinds, all the things sought for building temples ... stalls ... **palaces for kings** ... statues ...

The difference between the translation «Pyramide» by **Brugsch** and «palaces for kings» by **Lichtheim** must be noticed. Both translations relate to the hieroglyphic word 'aa' and the determinative for pyramid



DISCUSSION

According to Egyptology, the use of stone was certainly not general under the kings who preceded Zoser. But at Saqqara we are, in the pyramid of Zoser, manifestly in the presence of a great innovation, seen not only in the construction of the pyramid itself in stone, but also in a vast surrounding enclosure with temples, reproducing in stone the architectural forms of the sun-dried clay bricks which had previously been used. According to the restorers of the site, Drioton and Lauer (1939) and Lauer (1939), in substituting stone for mud brick, Inihotep introduced a remarkable innovation. The monuments of Zoser do constitute a veritable petrification of previous architecture.

In Zoser's dream (col. 19) Khnum is giving minerals and according to **Barguet**: 'auparavant, on n'en a fait aucun travail, pour bâtir des temples' (since former times nobody ever worked with them to build the temples of the gods). This clearly relates to the invention described above.

Yet, the most controversial aspect of this text resides in the fact that to build temples, pyramids (not

palaces as stated by [Lichtheim](#)) and other sacred buildings, Khnum's instructions and Imhotep's revelations do not mention any constructional stone, such as limestone or sandstone or granite blocks. These materials are not found in the list (see Fig.8).

To build monuments, Zoser was given a list of minerals and ores (Col. 15 and 16) whose hieroglyphic names have not been translated so far. This is the reason why we started an in-depth study of each hieroglyphic word, in order to determine the technical key-words, those which are obviously difficult to translate.

Key-word: **ARI-KAT**



This verb occurs three times (Fig. 3). In col. 13 and 19, associated with minerals, it has been translated by: «to work with»; in col. 20, the god Khnum «fashions» or «creates» humanity (with clay). The first part of the verb, ARI, means to make, to create, to form, to fashion, to beget; the second part, KAT and the ideograph «man», means the work done by man. The adjective, ARI, designates an artificial material, for example synthetic lapis-lazuli. The best meaning for the verb, **ARI-KAT**, could be: to process, to synthesize, to manufacture.

Key-word: ideograph **RWD**



Found in col. 11, this ideograph is part of a sentence which qualifies the materials employed for building temples and pyramids (col. 11 and 12).

Translated by [Barguet](#) as hard stone, RWD has been thoroughly discussed by [Harris](#) (1961) who states (p.23) that «...in all events, there can be little doubt that RWD is a term for hard stone in general, though which stone would come into the category it is difficult to say, especially in view of the reference to alabaster as RWD».

Yet, generally, the element RWD refers to Egyptian sandstone, more precisely the stone material found in the quarries of Southern Egypt, and used to build the temples of the New Kingdom and Late Periods at Karnak, Luxor, Edfu, Esne, Denderah, Abu-Simbel. This material, Egyptian sandstone is a soft material, which, in some cases can be easily scratched by the fingernail ([Rozière](#), 1801). It is the contrary of a hard stone. It is two times softer than Giza limestone, four times softer than Carrara Marmor or eight times softer than Aswan granite. It becomes obvious that the element RWD does not mean hard stone.

On the other hand, the ideograph RWD also means: germinate, grow, and the causative verb, S-RWD, to make solid or to tie strongly. Gravel and pebble contain also the ideograph RWD.

Finally, sandstone, quartzite, in some cases granite, and other stones qualified with RWD, are the natural solid stones resulting from the geological solidification of aggregates, such as sand or quartz particles.

Key-word: **AAT**



Col. 16 gives the different names of AAT. According to [Harris](#) (p.21) AAT is to be regarded as a word for minerals, and refers to ores. In col. 19, these ores are processed for the first time, yielding the invention of building with stone materials.

Key-word: **TESH**



The composite word **AAT NEB RWD UTESHAU**, at the end of col. 11, is of particular interest. [Barguet](#) translates: 'matières précieuses et pierres dures des carrières', but states in a note that his reading may be doubtful due to the strange writing of this word, in hieroglyph. Instead of TESH, [Barguet](#) reads SHETI.

The root **TESH** has the general meaning of: crush, separate, split, and the verb **BETESH** indicates the action of dissolving, disaggregation. A stone which is crushed, or disaggregated, or split, is called an **aggregate**.

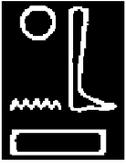
This leads us to conclude that the word **RWD UTESHAU** indicates any natural aggregate, or naturally split material, such as weathered and naturally disaggregated material. **RWD** could be extrapolated as being the ideograph describing agglomeration, here at the beginning of the word, or of **agglomerated stone** (geologically or man-



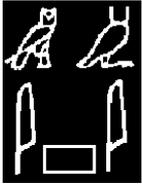
made) when put at the end.

If our assumption is right, the stony materials listed in col.15 should be in a loose form, or easy to disaggregate. Two names contain the root TESH, four names do not.

The **BEKHEN** stone has been found in inscriptions located in the Wadi-el Hammamat, in the desert South-East of Aswan, and is referred to as being either black basalt, or diorite, or sandy skist, or porphyry, or greywacke, or psammite gneiss (Lucas and Rowe, 1938; Morgan, 1894). Yet, according to the Hammamat Inscriptions (Couyat-Montet), quarrying of bekhen at the Wadi-Hammamat was carried out in a very primitive way. The chosen blocks were generally thrown down to the bottom of the mountain where they arrived split into numerous lumps.



The **MTHAY** stone is more interesting to discuss. This name seems to contain the root of the word MAT which means granite. Harris (p.72) agrees with Barguet when he notes that it is strange that granite is not otherwise mentioned in the text. Since it was the most typical stone of this region, it is therefore the more likely that this remarkable form of writing conceals MAT, i.e. granite. However, except for the peculiar hieroglyphic orthography which occurs in the Famine Stela, the referenced writings for granite always contain the same hieroglyph, the sickle MA, with different adjectives.



In col. 15, the letter ME is not the sickle, but a denuded bird, without wings and feathers. This way of writing the letter ME is to be found in the word MUT, to kill himself. The word METH also means to die. On the other hand, the granite MAT is often written with the ideogram heart, life, suggesting the idea of living granite. Assuming that the writer of the Famine Stele wanted to stress, in a condense form, that the granite is a **weathered, loose, disaggregated material** found in some geological outcrops, he could have tried to emphasize the idea of dead granite.

Key-word: AIN



Col. 15 begins with: Learn the names of AIN (stone) (Fig. 8). The hieroglyphic word for solid stone, constructional stone and block, is AINR. The majority of solid rocks is called AINR, with an adjective. Harris makes no distinction between AIN and AINR, the coptic word for stone, ONE, being very similar to AIN. However AINR is essentially applied to stone used in building. AIN should be recognized as a **generic word for stone**, as a substance, i.e. a stony material, in opposition to other materials like wood or metal.

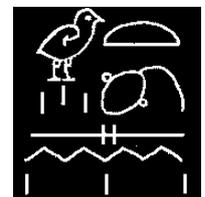
Key-word : ideograph



The phonetic value of this ideograph is not known; from the dictionary, it is a determinative for smell and odor, but is not associated with perfumes. It essentially relates to substances which give out smells, effluxes or emanations. Yet, these odors are not necessarily bad, and it does not mean to stink. Sometimes this ideograph has been associated with the notion of pleasure.

Found in Col. 12, it is for Brugsch a word for unguent (in German «salbe»). Barguet and Lichtheim do not translate it using the general term: products in connection with those cited in col. 11, '*aat nb rwd uts3u*' the minerals and stones.

The ideograph could represent a bladder or a vase containing a liquid, which gives out an odor, but is not a perfume. **In other words it could be the determinative for chemical product.** The majority of chemicals have a characteristic smell, and chemists have learned how to detect, recognize and associate any peculiar odor.



According to col. 11 and 12, those products which smell are the ores and stone materials which are essential for the building of temples and pyramids.

Lexicographers studying ancient minerals make the assumption that their names should derive from their color. They rely on the fact that, in ancient Greek, various gem names are closely associated with a color, for example the semi-precious stones containing the root chryso, yellow.

The minerals, ores and stone materials, featured in Barguet's, Harris' and Lichtheim's translations

of the Famine Stela, demonstrate that this type of lexicographical research is not successful. The majority of hieroglyphic names has not found any contemporary equivalence.

We think that, by introducing the concept of odor, and perhaps later that of taste, we are simply following the ancient and classical methods of characterization of chemicals, namely the determination of their color, odor and taste.

Products having an odor are to be found in a text related to the Great Pyramids. In his Book II, Euterpe, the Greek historian **Herodotus** relates what priests at Memphis told him on the pyramid of Cheops: «Engraved on the pyramid in Egyptian characters is the amount spent on the workers in horse-**radish, onions and garlic**; and the person who interpreted these inscriptions for me told me, as I remember well, that this expense came to sixteen hundred talents of silver. (more than 100 Million US\$ of 1980)». Popular imagery is found in this description and the slave workers are described as stinking of garlic and onions.

We have claimed (Davidovits, 1978, 1982) that this description relates to the cost of the expeditions undertaken for collecting minerals of the arsenate types, located in the turquoise and copper mines of the Sinai. A simple method in petrography for the identification of natural minerals and ores is to heat them with a small blow lamp. If they immediately release a smell of garlic, they belong to the arsenate family (arsenate of copper or of iron).

We looked at the hieroglyphic names of minerals and ores which could contain the meaning of onion, garlic, radish. We found a representative for each of these 3 odors:

the onion-stone:



in col. 15 the «**uteshi** stone» ends with an ideograph which has been the subject of discussion. Brugsch reads HEDSH, and gives the meaning white, whilst Barguet reads differently, and does not translate, whereas Harris states from the photograph that the reading must remain in doubt. Our reading from the photograph is **HEDSH**, but our translation is **onion**. The uteshi stone could be the stone which smells like onion.

the garlic stone:



Garlic has been suggested for HUTEM and TAAM, i.e. the root word TEM. In col. 16, the ore **TEM-IKR** could represent the garlic stone, the prefix KR meaning weak, i.e. the stone which has a weak smell of garlic.

the radish stone:



Radish corresponds to KAU and KA-T. In col. 16, the ore **KA-Y** could mean 'ore with a smell of radish'.

Column 11

	un they are
	khat numerous
	tutu mountains
	m gergfa in the side
	tut East
	ger to found
	aat ores
	neb all
	rwdt uteshui crushed stones (weathered aggregates
	khet products

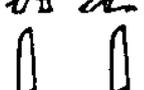
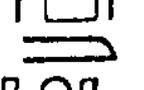
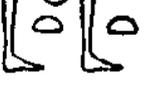
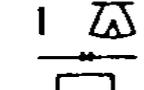
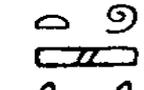
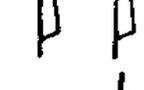
Column 12

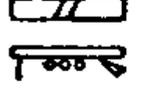
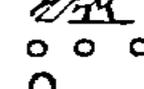
	neb hehi sen all are seeking
	khus to build
	neterhet temples god
	neb all n sunut from South
	hanut North
	nti for aam animals
	neter sacred
	her and aa pyramid
	nti for sutin king
	hena with

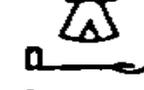
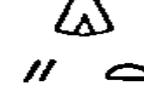
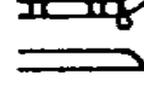
	khente statues
	neb aha all erected
	sen they het neterhet in temples
	her and tat sanctuaries
	ra more ger over
	tu products (chemicals) sen they
	ab are found
	er kheft in front
	n Khnum of Khnum
	n teb fa-teb and around him

Column 15

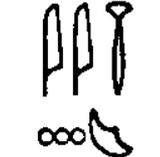
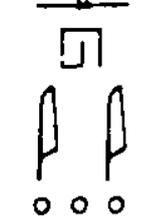
Column 16

	ren names
	ain stony materials
	bkhn ?? (stone)
	mthy ?? (dead granite stone)
	mkhtbtb ?? (stone)
	r'qs ?? (stone)
	utshy (hetsh) ?? (onion stone)
	taab on East
	prdni ?? (stone)
	on West
	tshi (stone)
	on West

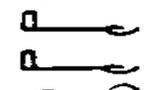
	ren learn names
	aat ores
	shta rare
	ntimat located
	mat up stream
	nub gold
	nub hedsh silver
	kha copper
	baak iron
	khstb lapis- lazuli
	mfkat turquoise
	thnt ?? (ore)
	khnmt jasper

	k' ?? (radish stone)
	menu ?? (stone)
	brkt emerald
	tm-ikr ?? (garlic stone)
	np ?? (ore)
	un-nn more over
	nshmt ?? (stone)
	ta-mhi ?? (stone)
	maki ?? (ore, stone)

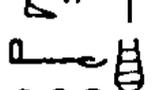
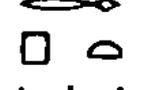
Column 17

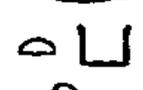
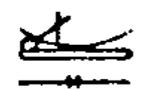
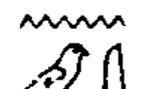
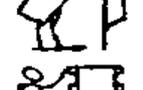
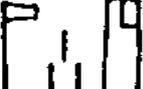
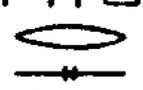
	ibht
	b'ks-ankh
	green make up
	mssdm black eye
	hrd red ochre
	shi from shi
	mimi ??

Column 18

	I am
	Khnum
	your
	creator
	hands
	my
	on you
	to tight
	your body
	to

Column 19

	take care
	your limbs
	I give
	you
	aat
	ores
	after
	aat
	ores

	since
	creation
	nobody
	arikat manufac- tured
	sen them
	au
	to build
	neter temples
	er es-mau to rebuild
	uasam ruined
	eraab in
	beh ater stone temples

CONCLUSION

This new translation introduces the elements discussed above

(Col. 11): There is a mountain massif in its eastern region (of Elephantine) containing all the ores, all the crushed (weathered) stones (aggregates) suitable for agglomeration, all the products

(Col. 12) sought for building the temples of the gods of the North and South, the stalls for sacred animals, the pyramid for the king, all statues that stand in temples and in sanctuaries. Moreover, all these chemical products are set before the face of Khnum and around him.

(Col. 13)...there is in the midst of the river a place of relaxation for every man who processes the ores on its two sides.

(Col. 15) Learn the names of the stony materials which are to be found...*bekhen*, dead (weathered) granite, *mhtbt*, *r'qs*, *uteshi-hedsh* (onion stone),... *prdney*, *teschy*. - .

(Col. 16) Learn the names of the rare ores located upstream...gold, silver, copper, iron, lapis-lazuli, turquoise, *thnt* (chrysocolla), jasper, *Ka-y* (radish stone), *menu*, esmerald, *temikr* (garlic stone), more over, *neshemet*, *ta-mehy*, *hemaget*, *ibehet*, *bekes-ankh*, green make up, black antimony, red ochre...

(Col.18).. I found the god standing.. he spoke to me: «I am Khnum, your creator, My arms are around you, to steady your body, to

(Col. 19) safeguard your limbs. I bestow on you rare ores upon rare ores... since creation nobody ever processed them (to make stone) for building the temples of the gods or rebuilding the ruined temples...»

The **Famine Stele** describes the **invention of building with stone** attributed to Zoser and Imhotep, builders of the first pyramid, the Step Pyramid at Saqqara (2,750 BC). According to the text, this invention of building with stone occurs through processing different minerals and ores which could be chemicals involved in the **fabrication of man-made stone, or a type of concrete**.

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