MEDICAL GEOCHEMISTRY OF THE MINERAL DUST AND RELATED LUNG DISEASES AT EL-GEDIDA MINE, BAHARIYA OASIS, EGYPT.

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ABSTRACT

Medical geology is a new interdisciplinary science studying the relationships between the geological factors and related human health problems. One of the most common occupational health hazards is the inhalation of the mineral dust. El-Gedida iron mine which located in the bahariya oasis is considered a good case study to apply the medical geochemistry methods by studying the characteristics and the geogenic of the mineral dust. The key project task of this research is to determine the geological sources of the mineral dust and form an overview of the potentially lung diseases due to dust exposure. Different geochemical methods were used to show how the geochemical characteristics affects the potentially lung diseases including XRF, XRD, SEM and EDX. The results show that the most potential lung disease is sidero-silicosis which is attributed to the high concentrations of crystalline silica and hematite in dust samples. Sidero-silicosis results in shortness of breath cough and fever. When the disease becomes progressive, extreme shortness of breath, great chest pains and sometimes total respiratory failure occur with an increased risk of lung cancer has been reported in people with silicosis. We suggest some procedures which should be taken to prevent the development of lung diseases between workers including emphasizing adequate ventilation, limiting exposure hours, continuous medical surveillance, using efficient dust masks and form a multidisciplinary platform between different related sciences towards a better applying of medical geology methods.

Keywords: *Medical Geology, Mineral Dust, Silicosis, Bahariya Oasis, occupational health.*

1. MEDICAL GEOLOGY

The living organisms are composed of major, minor and trace elements which given by environment and geology is the major critical component affecting the environment, so from this criteria the medical geology science is rapidly growing. Medical Geology is defined as the science dealing with the relationship between the geological factors and health problems in humans, animals and plants (Selinus, 2002). The field of medical geology, a relatively new interdisciplinary science, deals with the complex relationships between environmental factors relating to the presence of geogenic contaminates in different geological settings, their mobility, geographical distribution and their effects on human and animal health (Bunnell, 2004).

So medical geology is a multidisciplinary scientific field shared by specialists of different scientific domains, such as earth sciences, environmental sciences, medicine, public health, biology, biochemistry, chemistry, pharmacy, nutrition, and others. The direct link between geology and health can be made by ingestion and inhalation of geogenic chemical elements by eating, drinking

and breathing air. These geogenic contaminations, which can be of adverse health outcomes and sometimes lead to death, can produced by natural processes like volcanic eruptions, mud flows and natural storms or by anthropogenic processes like mining, hydrocarbon exploration and urbanization.

On the other hand, the interaction between geogenic factors and human health may be positive like the addition of trace amounts of essential metals to groundwater which in these special cases affects the human health positively.

2. Silicosis & Siderosis

The term 'pneumoconiosis' is an abbreviation which derives from *pneumon* (lung) and *konis* (dust) and therefore translates as dusty lung. The British Industrial Injuries Advisory Council defined pneumoconiosis as 'permanent alteration of lung structure due to the inhalation of mineral dust and the tissue reactions of the lung to its presence. Silicosis is an interstitial fibrotic lung disease that is caused by pulmonary response to the inhalation of respirable crystalline silica dust. The disease is prevalent among workers in miners, foundries, blasting operations and glass manufacturing.

The mineral must be in a crystalline form to cause Silicosis. Crystalline silica exist as quartz, cristobalite, tridymite, and four other rare forms (keatite, coesite, stisbovite and moganite). Quartz is the most common form of crystalline silica. The particles must also be small enough to be resipirable (0.2–10 mm) aerodynamic diameter in order to reach the distal airspaces of the lung. Crystalline silica has very low solubility in human body fluids and can be deposited and accumulated in the lungs. Mechanism of toxicity to crystalline silica, the primary cause is described ingested into a cell, free radical oxygen species can be generated from the surface of the particle leading to lipid peroxidation as membrane damage occurring to cells that ingest these tiny particles resulting in membrane damage and cell death. The rate of disease progression depends on the rate of silica deposition in the lung, and the total amount of crystalline silica which is actually retained in the lung. Siderosis is another type of pneumoconiosis, which is caused by the inhalation of iron dust accumulating within the lung parachyma.

If miners workers exposed to amounts of both silica and iron oxides, that's resulting in disease having the histological features of both silicosis and siderosis and called sidero-silicosis. Sidero-silicosis results in shortness of breath, cough, fever and a bluish skin at ear lobes or lips. When the disease becomes progressive, extreme shortness of breath, great chest pains and sometimes total respiratory failure occur. An increased risk of lung cancer has been consistently reported in cohorts of people with silicosis.

3. Mineral dust and minerals bio-uptake

Some hazards are introduced through complex mining activities and processes. If these hazards are not managed properly, they can result in serious injuries, death or occupational illness for the workers (Jordan & Abdaal, 2013; Castilhos *et al.*, 2015). One of the most common hazards is the respirable dust which is a prominent occupational health hazard (IARC, 1997; OSHA, 2010).

By the exposure to mineral dust which is the mineralogical fraction of airborne particulates that can be deposited anywhere in the lung gas-exchange region (WHO, 1999). Airborne mineral dust severely impacts human health (Bu-Olayan & Thomas, 2011) as the smaller particles may be more harmful to health than larger particles (Mischler *et al.*, 2016) and advances in mining equipment

have certainly resulted in more powerful cutting, which can yield smaller particles (Sapko *et al.*, 2007; Colinet *et al.*, 2010). Bioavailability is the portion of a constituent available for assimilation by life forms; the nature and degree of bio-uptake varies from organism to organism. Humans require the intake and assimilation of trace-to-major amounts of a broad spectrum of constituents in order to maintain viability (Berry, 1991).

All substances are poisons; there is none which is not a poison. The right dosage differentiates a poison and a remedy (Dissanayake, 2005). That's shown with the dose/functional response curve for a specific element (Fig. 1). So the availability and accessibility of naturally occurring GCs are mainly dependent on bio-hydro-geo-chemical processes, concentration in the source, particle size, and the physical and chemical properties.

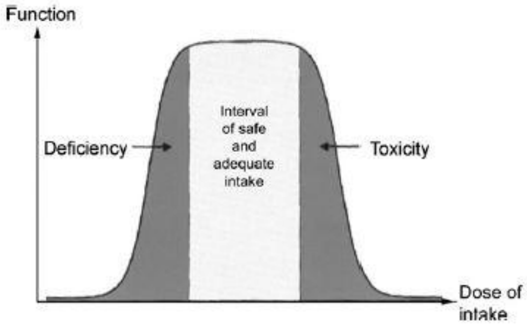

Fig (1): Dose versus functional response (Lindh, 2005).

4. GEOLOGIC SETTING

The bahariya oasis is a large depression in the western desert of Egypt which is located about 270 km SW of Cairo with special economic interest due to the presence of great iron ore deposits about 270 million metric tons (Said,1990). El-Gedida mine is located in the bahariya oasis northern plateau and is divided topographically into two main parts: a high plateau in the center and two wadis surrounding it. The average relief between the plateau and the wadis is about 30m. Fig. (2) Shows the geological map of the Bahariya Oasis, Western Desert, Egypt with the location of the studied iron ores (Catuneanu *et al.*, 2006).

According to the target of this study, we focused on the western wadis mine area which consists of three main formations from base to top: middle micocene Naqb-Qazzun sequence, Late Eocene Hamra formation and Oligocene Qatrani formation. There are some outcrops of the cenominain El-baharyia formation underlying the mentioned formations and also recent surface deposits exist on the top. Fig(3) shows the stratigraphic columnar section of the iron ores in the Wadi areas of El-Gedida mine area (El Aref *et al.*, 1999).

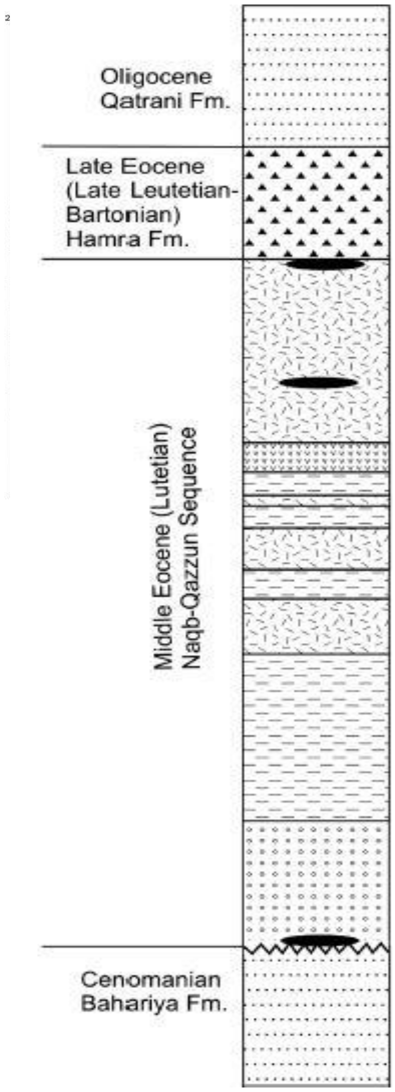

Fig (2): **Shows the geological map of the Bahariya Oasis, Western Desert, Egypt with the location of the studied iron ores (Catuneanu *et al.*, 2006).**

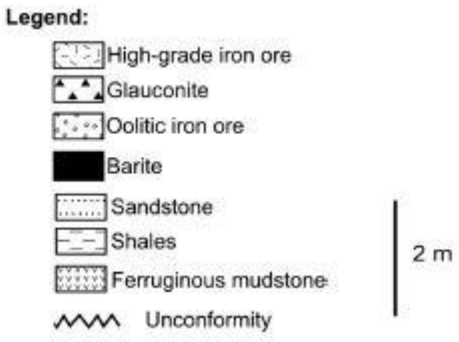

Fig (3): **Stratigraphic columnar section of the iron ores in the western wadi of El-Gedida mine area (El Aref *et al.*, 1999)**

MATERIALS & METHODS

Geochemical analyses are an essential component of medical geology methods, so we depend on it in our study to show how the geochemical characteristics affects the potentially lung diseases. To achieve this target, a total twelve samples were collected, seven bulk samples and five dust samples, Samples locations were selected to represent the most critical locations. A list of sample locations with a brief description are given in table (1), and some field photographs are shown in Fig (4) a, b.

Ten samples were selected and analyzed by the X-ray diffraction (XRD) method. This analysis was carried out at the Egyptian geological survey (Central laboratories), using the automated powder diffractometer system of Philips PW 1710; with Ni – filter Cu radiation (ë = 1.542 A) at 40 KV, 30 mA and scanning speed 20 /min in order to determine the mineralogical composition relationship between bulk and dust samples and the crystallographic system of the mineral dust compositions.

Eleven samples were analyzed by the X-ray fluorescence (XRF) method, the non-destructive, semi-quantitative method which gives the elemental composition of major cations. This analysis was

carried out at the national research center (lab of preparation and chemical analysis by X-ray fluorescence).

Dust mixture sample was evaluated by scanning electron microscopy with energy dispersive X-ray (EDX) analysis to make sure from the crystallintiy and the morphology of mineral dust particles.This analysis was carried out at the SEM unit at the national research center.

Sample Symbols	Type of sample	Description	Analysis
A1	Bulk	Lower (Naqb-Qazzun)fm.	XRD,XRF
A2	Bulk	Mid. (Naqb-Qazzun)fm.	XRD,XRF
A3	Bulk	Recent surface deposits	XRD,XRF
A4	Bulk	Upper (Naqb-Qazzun)fm	XRD,XRF
A5	Bulk	Hamra fm.	XRD,XRF
A6	Bulk	Qatrani fm.	XRD,XRF
A7	Bulk	Bahariya fm.	XRF
D1	Dust	Mine internal paths	XRD,XRF,EDX
D2	Dust	Inside diver's cabin	XRD,XRF,EDX
D3	Dust	Place of ore fracturing	XRD,XRF,EDX
D4	Dust	Place of ore loading	XRD,,EDX
D5	Dust	Stuck on the truck	XRF,SEM

Table (1) Samples description

Fig(4): Field photos showing the accumulation of mineral dusts : outside the geologists car (A) and inside the hauling trucks(B).

3. RESULTS AND DISCUSSION

X-ray diffraction analysis of dust samples demonstrated the existence of hematite and quartz with high concentrations; hematite reaches its highest value in the dust sample of the mine interior paths (D1) and at the place of ore fracturing (D3) while the quartz reaches its highest value in the dust collected inside the truck (D2). Bulk samples are differentiated as the iron ore beds (A1-A2-A4) indicate very high concentrations of hematite and low silica contentions. On the other hand, (A3 - A5 – A6) indicates higher silica contents. Complete results are shown on the table (2).

Table (2) **X-ray diffraction results**

Mineral Species (Semi. Quant %)	A 1	A 2	A 3	A 4	A 5	A 6	D 1	D 2	D 3	D 4
Hematite	83	50		32			55	42	54	30
Quartz		10	10	20	50	89	5	21	1	2
Geothite	3	40*		13			10	37	45**	20**
Gypsum			45	25	10		30			40
Anhydrite			40	10						8
Geoschwitz , Mica					40					
Graphite						11				
Molysite			5							
Sylvite	10									
Natroalunite	4									

****Geothite,Aluminain,syn** ***Geothite,cadmian,syn**

We used the XRD Stick patterns for determination the Crystallographic system of different samples containing minerals especially for make sure whether the silica is crystalline or not.

Examples of the resulted stick patterns are shown in the figure (5) A, B. Table (3) concludes the classification of samples minerals according to their crystallographic systems.

Table (3) **Determination of Crystallographic system from XRD Stick patterns**

Mineral Species (Semi. Quant %)	Chemical Formula	Crystallographic System
Hematite	Fe_2O_3	Rhombohedral
Quartz	SiO_2	Hexagonal
Geothite	$Fe_2O_3.H_2O$	Unknown
Gypsum	$CaSO_4 . 2H_2O$	Monoclinic
Anhydrite	$CaSO_4$	Orthorhombic
Graphite	C	Hexagonal
Molysite	$FeCl_3 . 6H_2O$	Unknown
Sylvite	KCl	Cubic
Natroalunite	$NaAl_3 SO_4 (OH)_2$	Rhombohedral

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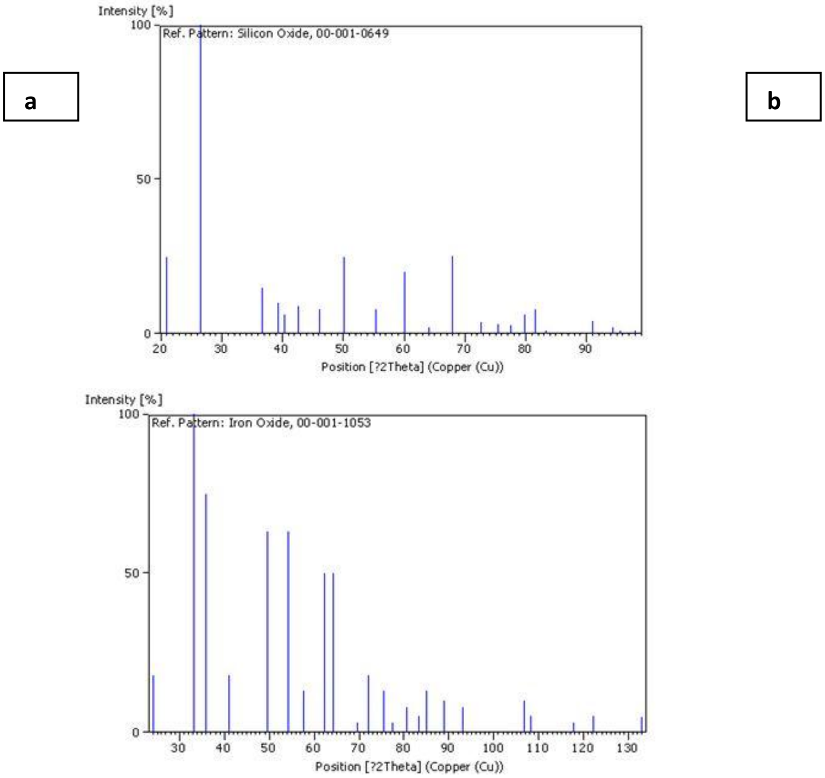

Fig. (5) examples of the Crystallographic system determination from XRD Stick patterns (a) Quartz (b) Hematite

Elemental analysis by wavelength dispersive X-ray fluorescence spectrometry indicates related high sio2 at the dust stuck on the truck (D5) and the dust inside the drivers cabin (D2) While iron oxides are highly-concentrated in all dust samples. On the bulk samples, results of the XRF are integrated with XRD results to determine the dust geological sources. A full data are summarized on Table (4).

Table (4) X-ray Fluorescence results for main constituents of bulk and dust samples.

Oxides (wt%)	A1	A2	A3	A4	A5	A6	A7	D1	D2	D3	D5
SiO_2	4.09	1.97	13.1	4.07	43.95	62.67	59.45	6.38	13.13	7.62	9.78
TiO_2	0.10	0.04	0.27	0.03	0.73	0.80	1.50	0.07	0.18	0.22	0.11
Al_2O_3	8.20	0.46	5.32	0.91	6.74	9.11	26.74	5.28	4.17	5.52	2.38
$Fe_2O_3^{tot.}$	56.20	86.73	4.80	75.23	28.70	6.53	2.83	68.25	55.03	73.56	62.30
MnO	8.11	0.76	0.21	5.06	Bd*	0.23	0.36	5.08	1.49	2.11	4.59
MgO	0.32	0.12	1.08	0.35	2.93	2.09	0.45	0.43	2.46	0.34	0.98
CaO	1.36	0.05	23.13	1.41	0.46	2.31	0.05	0.23	2.81	0.26	1.60
Na_2O	0.94	0.17	1.76	0.64	0.83	1.74	0.25	0.52	0.74	0.40	1.10
K_2O	0.77	0.02	0.54	0.14	6.74	1.96	1.35	0.27	0.67	0.25	0.65
P_2O_5	0.62	0.25	0.19	0.26	0.09	0.08	0.08	0.23	0.79	0.54	0.37
SO_3	6.55	0.66	40.03	2.23	0.13	4.28	0.09	2.29	3.03	1.44	3.01
Cl	0.60	0.17	2.13	0.62	1.29	3.76	0.15	0.42	0.61	0.42	1.07
LOI	11.73	8.11	7.29	7.81	7.99	4.22	6.45	10.15	14.48	9.84	11.53

Below detection*

EDX analysis showed the atomic % and the weight % of both hematite and quartz, and results are integrated with the SEM which is Dominated with hematite crystals with lower amount of quartz crystals Fig.(6)a,b and Table(5).

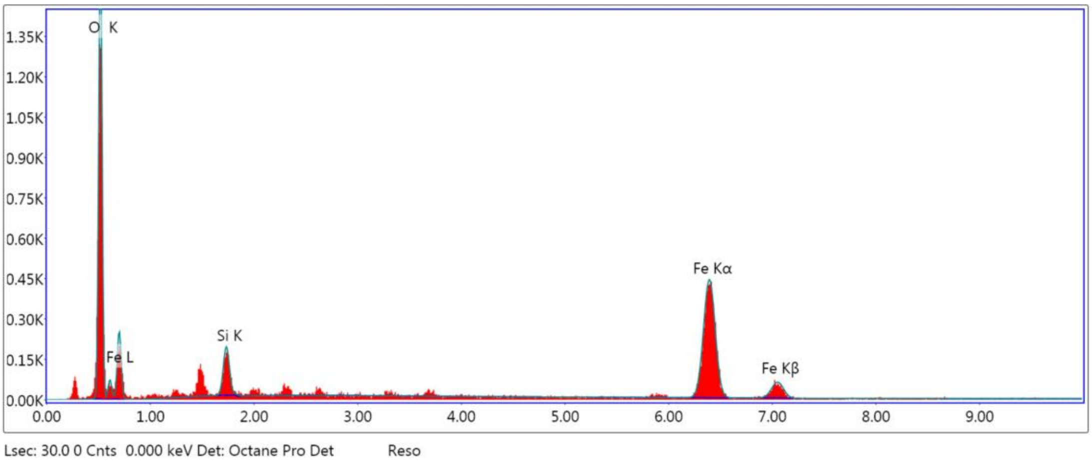

Fig (6.a) Dust mixture sample analysis by energy dispersive x-ray (EDX)

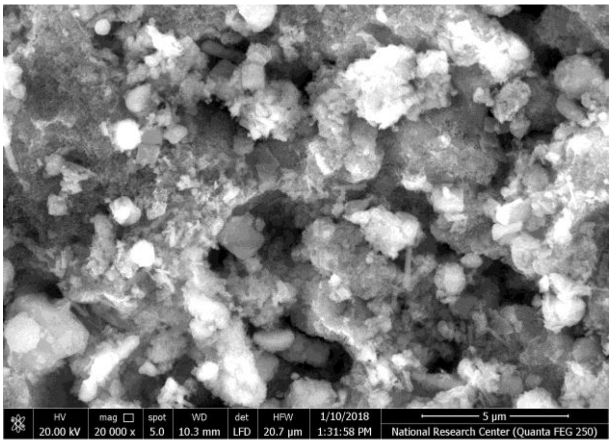

Fig (6, b) Dominated hematite crystals with lower amount of quartz crystals are be shown by SEM.

Table (5) Atomic and weight % determination of dust mixture sample using (EDX)

Compound	Weight %	Atomic %	Net Int.	Error %
Si O2	23.31	44.68	42.3	11.53
Fe 2O3	76.69	55.32	200.03	2.58

CONCLUSIONS

According to the elemental and mineralogical analyses of dust samples, we indicate that there is a very high potentiality for El-Gedida mine workers to suffer from adverse lung diseases especially sideosilicosis as a result of the exposure to significant amounts of crystalline silica and iron oxides in dust samples. From the combination between methods and the correlation between the results of dust and bulk samples, we can determine the potential sources of dust as the crystalline silica yields from Hamra, Bahariya and Qatrani formations, while the sources of hematite and goethite are mainly from the Naqb-Qazzon sequence (Iron ore layers). So we suggest some procedures which should be taken to prevent the development of lung diseases between workers as the follow:

1. **Emphasizing adequate ventilation on job sites and increase air exchanges on trucks.**
2. **Limiting the amount of work time spent in potentially exposing areas.**
3. **Both air quality monitoring and medical surveillance should be performed continuously**
4. **Workers should use tight-filling efficient dust masks.**
5. **Spray water on the tool-dust contact points and on mine internal paths.**
6. **Workers should be engaged to be better informed and converted to a more objective view about environmental issues and their suitable responses to potential risks.**
7. **Mass media should perform strategies to raise the public awareness and make environmental sciences more responsive to public concerns.**

And about our vision to achieve a development in medical geology applications in our Arabian countries, we provide these recommendations:

A – **Research centers should develop a plan to improve the primary database which is necessary in medical geology fields. For example, doing geochemical mapping projects, which can help in identifying regions where soil, rocks, and water have elemental concentrations at harmful levels.**

B- We need to form a scientific multidisciplinary platform between different related specializations to work in collaboration together; As Geologists should work with medical and public health researchers.

C- Interdisciplinary information should be exchanged between different research centers and universities to facilitate the complex methodology of medical geology.

D- Medically, the assessment of both positive and negative effects of minerals requires further research by in vivo and in vitro experiments and also epidemiological studies.

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REFERENCES

Afify, A. M., Sanz-Montero, M. E., Calvo, J. P., & Wanas, H. A. (2015). Diagenetic origin of ironstone crusts in the lower cenomanian bahariya formation, bahariya depression, western desert, Egypt. *Journal of African Earth Sciences*, *101*, 333-349.

Baioumy, H. M. (2015). Rare earth elements, S and Sr isotopes and origin of barite from Bahariya Oasis, Egypt: implication for the origin of host iron ores. *Journal of African Earth Sciences*, *106*, 99-107.

Baioumy, H. M., Ahmed, A. H., & Khedr, M. Z. (2014). A mixed hydrogenous and hydrothermal origin of the Bahariya iron ores, Egypt: Evidences from the trace and rare earth element geochemistry. *Journal of Geochemical Exploration*, *146*, 149-162.

Becklake, M. R., & Cowie, R. L. (1994). Pneumoconioses. *Textbook of respiratory medicine*, *2*, 1811-51.

Berry, M. J., Banu, L., Chen, Y., Mandel, S. J., Kieffer, J. D., Harney, J. W., & Larsen, P. R. (1991). Recognition of UGA as a selenocysteine codon in type I deiodinase requires sequences in the 3′ untranslated region. *Nature*, *353*(6341), 273.

Bundschuh, J., Maity, J. P., Mushtaq, S., Vithanage, M., Seneweera, S., Schneider, J., ... & Reardon-Smith, K. (2017). Medical geology in the framework of the sustainable development goals. *Science of the Total Environment*.

Bunnell, J. E. (2004). Medical geology: emerging discipline on the ecosystem–human health interface. *EcoHealth*, *1*(1), 15-18.

Castilhos, Z., Rodrigues-Filho, S., Cesar, R., Rodrigues, A. P., Villas-Bôas, R., de Jesus, I., ... & Beinhoff, C. (2015). Human exposure and risk assessment associated with mercury contamination in artisanal gold mining areas in the Brazilian Amazon. *Environmental Science and Pollution Research*, *22*(15), 11255-11264.

Catuneanu, O., Khalifa, M. A., & Wanas, H. A. (2006). Sequence stratigraphy of the Lower Cenomanian Bahariya Formation, Bahariya Oasis, Western Desert, Egypt. *Sedimentary Geology*, *190*(1), 121-137.

Colinet, J., Listak, J. M., Organiscak, J. A., Rider, J. P., & Wolfe, A. L. (2010). Best practices for dust control in coal mining.

Corrin, B., & Nicholson, A. G. (2006). Occupational, environmental and iatrogenic lung disease. *Pathology of the Lungs. 2nd ed. Oxford: Churchill Livingstone, Elsevier*.

Di Giulio, G. M., Figueiredo, B. R., Ferreira, L. C., Macnaghten, P., Manay, N., & dos Anjos, J. Â. S. A. (2013). Participative risk communication as an important tool in medical geology studies. *Journal of Geochemical Exploration*, *131*, 37-44.

El Aref, M. M., El Sharkawi, M. A., & Khalil, M. A. (1999). The geology and genesis of stratabound to stratiform Cretaceous–Eocene iron ore deposits of El Bahariya Region, Western Desert, Egypt. In *International Conference on Geol. Araab World (GAW4)* (pp. 450-475).

El-Habaak, G., Askalany, M., Faraghaly, M., & Abdel-Hakeem, M. (2016). The economic potential of El-Gedida glauconite deposits, El-Bahariya Oasis, Western Desert, Egypt. *Journal of African Earth Sciences*, *120*, 186-197..

Engelbrecht, J. P., & Jayanty, R. K. M. (2013). Assessing sources of airborne mineral dust and other aerosols, in Iraq. *Aeolian Research*, *9*, 153-160.

Ernst, W. G. (2012). Overview of naturally occurring Earth materials and human health concerns. *Journal of Asian Earth Sciences, 59,* 108-126.

Field, R. W., & Withers, B. L. (2012). Occupational and environmental causes of lung cancer. *Clinics in chest medicine*, *33*(4), 681-703.

Fubini, B., & Fenoglio, I. (2007). Toxic potential of mineral dusts. *Elements*, *3*(6), 407-414.

Gomes, C. D. S. F., & Silva, J. B. P. (2007). Minerals and clay minerals in medical geology. *Applied Clay Science*, *36*(1), 4-21.

Greenberg, M. I., Waksman, J., & Curtis, J. (2007). Silicosis: a review. *Disease-a-Month*, *53*(8), 394-416.

Haldar, S. K. (2013). *Introduction to mineralogy and petrology*. Elsevier.

IARC Working Group on the Evaluation of Carcinogenic Risks to Humans, International Agency for Research on Cancer, & World Health Organization. (1997). *Silica, some silicates, coal dust and para-aramid fibrils* (No. 68). World Health Organization.

Jean, J. S., Guo, H. R., Dowling, K., & Akhtar, R. (2013). Medical Geology in Asia: Toxic materials in the environment and human diseases. *Journal of Asian Earth Sciences*, *77*, 255-255.

Moreno, T., Querol, X., Castillo, S., Alastuey, A., Cuevas, E., Herrmann, L., ... & Gibbons, W. (2006). Geochemical variations in aeolian mineral particles from the Sahara–Sahel Dust Corridor. *Chemosphere*, *65*(2), 261-270.

Moskowitz, B. M., Reynolds, R. L., Goldstein, H. L., Berquó, T. S., Kokaly, R. F., & Bristow, C. S. (2016). Iron oxide minerals in dust-source sediments from the Bodélé Depression, Chad: Implications for radiative properties and Fe bioavailability of dust plumes from the Sahara. *Aeolian Research*, *22*, 93-106.

Nakhla, F. M. (1961). The iron ore deposits of El-Bahariya oasis, Egypt. *Economic Geology*, *56*(6), 1103-1111.

Pinkerton, K. E., & Southard, R. J. (2005). Silica, Crystalline.

Plumlee, G. S., Morman, S. A., Meeker, G. P., Hoefen, T. M., Hageman, P. L., & Wolf, R. E. (2013). The environmental and medical geochemistry of potentially hazardous materials produced by disasters. *Treatise Geochem*, *11*, 257-304.

Rabeiy, R. E., ElTahlawi, M. R., & Boghdady, G. Y. (2017). Occupational health hazards in the Sukari Gold Mine, Egypt. *Journal of African Earth Sciences*.

Salama, W., El Aref, M., & Gaupp, R. (2012). Mineralogical and geochemical investigations of the middle Eocene ironstones, El bahariya depression, western desert, Egypt. *Gondwana Research*, *22*(2), 717-736.

Schatzel, S. J. (2009). Identifying sources of respirable quartz and silica dust in underground coal mines in southern West Virginia, western Virginia, and eastern Kentucky. *International Journal of Coal Geology*, *78*(2), 110-118.

Selinus, O. (2002). Medical geology: Method, theory and practice. *Geoenvironmental mapping: Methods, Theory and Practice*, 473-496.

Selinus, O., Finkelman, R. B., & Centeno, J. A. (2011). Principles of Medical Geology.

Singh, N., & Davis, G. S. (2002). occupational and environmental lung disease. *Current opinion in pulmonary medicine*, *8*(2), 117-125.

Skinner, H. C. W. (2007). The earth, source of health and hazards: An introduction to medical geology. *Annu. Rev. Earth Planet. Sci.*, *35*, 177-213.

Steenland, K., & Stayner, L. (1997). Silica, asbestos, man-made mineral fibers, and cancer. *Cancer Causes & Control*, *8*(3), 491-503.

Wardrop, N. A., & Le Blond, J. S. (2015). Assessing correlations between geological hazards and health outcomes: addressing complexity in medical geology. *Environment international*, *84*, 90-93.

World Health Organization. (1999). Hazard prevention and control in the work environment: airborne dust.

الجيوكيمياء الطبية لغبار المعادن و أمراض الرئة المرتبطة به بمنجم الجديدة بالواحات البحرية – مصر

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قسم الجيولوجيا – كلية العلوم – جامعة العريش – مصر

الملخص :

يعتبر مجال الجيولوجيا الطبية من فروع الجيولوجيا المستحدثة و التي تتطلب لتضافر جهود العديد من التخصصات معاً لدراسة العلاقة بين العوامل الجيولوجية و المشاكل الصحية المترتبة عليها. و يعد غبار المعادن من اخطر المشاكل الصحية التي يعاني منها العاملين نتيجة لاستنشاقه بكميات كبيرة. و يمثل منجم حديد الجديدة بالواحات البحرية نموذجاً جيداً لتطبيق الطرق الجيوكيميائية للكشف عن الأصل الجيولوجي و عن خصائص غبار المعادن هناك. و تهدف هذه الدراسة إلي تقديم صورة عامة عن الامراض المحتمل ان يتعرض العاملين هناك إلي خطر الأصابة بها و لذلك تم استخدام مجموعة من الطرق الجيوكيميائية تشمل اجراء تحليل فلورية الاشعة السينية و حيود الاشعة السينية و تحاليل باستخدام المجهر الإلكتروني الماسح. و أشارت النتائج إلي أن المرض الأكثر احتمالية في منجم الجديدة هو مرض السحار الحديدي الجديدي و ذلك لاحتواء جميع عينات الغبار علي تركيزات عالية من الكوارتز المتبلور (ثاني اكسيد السيليكون) و الهيماتيت (اكسيد الحديد)، حيث يؤدي هذا المرض إلي ضيق حاد في التنفس و إلي السعال الشديد و الأصابة بالحمي كما أنه من المثبن علمياً ان احتمالية الأصابة بسرطان الرئة تزداد لدي المصابين السحار السليسي. و تم تقديم العديد من التوصيات التي تشمل تقليل عدد ساعات العمل التي يتعرض بها العاملين بالمنجم إلي الغبار و زيادة تبادل الهواء داخل المعدات و ضرورة المتابعة الصحية الدورية و نشر الوعي العام بخطورة هذه النوعية من الأمراض ، كما أوصينا بضرورة العمل المشترك بين التخصصات المختلفة لتفعيل دور الجيولوجيا الطبية.

الكلمات المفتاحية : الجيولوجيا الطبية ، مرض السحار ، الواحات البحرية ، غبار المعادن