

Respirable Air Pollution Particulates and Cancer: The Magnetite Connection

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ABSTRACT

Background: The main purpose of this manuscript is to bring awareness to *in vitro* experiments demonstrating respirable air pollution magnetite as a factor in cell deformation and the increase in intensity (range) surrounding the foreign material observed at the end of the human blood coagulation cascade. Also to introduce a possible mechanism as a factor in cancer genesis. Magnetite is a rock mineral and one in the oxides of iron and is the most magnetic or all naturally occurring minerals on Earth; its origins could be Biogenic (produced or brought about by living organisms) or Anthropogenic (chiefly of environmental pollution and pollutants originating in human activity). These nano-sized particles penetrate the nasal mucosa and invade the lung tissue, subsequently migrating via the circulating blood throughout our bodies. At present, the mechanism involved in cancer genesis is unknown of importance is that there is a strong correlation in cancer incidence and air pollution respirable particulates.

Materials and methods: Images and video recordings from recent unpublished and previous *in vitro* experiments by this author are presented.

Results and conclusion: In this manuscript, only qualitative visual results are shown. The images show that when magnetite fragments are imbedded in fresh blood smears, cells deformations (red blood cells) occur. When metal iron filings are in contact with fresh blood, blood coagulation or cell deformations also occur. It is concluded that based on the visual images herein presented, magnetite magnetic field reaches consistently causes cell deformation and a greater range in blood coagulation; whereas the iron particles have a dual effect on blood tissue namely, cell deformations as well as a lesser coagulation effect. An additional observation is that whenever the metal iron filings are within magnetite magnetic reach; there is also an increase in the coagulation area. Cell deformations are identified as a possible factor in cancer genesis.

Keywords: Magnetite, Metal iron filings, Cells deformation, Human blood coagulation

INTRODUCTION

Epidemiological studies have correlated cancer with the breathing of nano-sized air pollution particulates a.k.a. particulate matter (PM) [1,2]; and matched to their size, for example, a particle measuring 10 nm is labeled PM10. Another characteristic is the molecular composition of the PM; they are described as magnetite like biospheres with a biogenic origin (produced or brought about by living organisms) or anthropogenic (chiefly of environmental pollution and pollutants originating in human activity) [3]. "They arise as combustion-derived, iron-rich particles, often associated with other transition metal particles, which condense and/or oxidize upon airborne release. Those magnetite pollutant particles which are ≤ 200 nm in diameter can enter the brain (or other organs) directly via the olfactory bulb" [4,5]. "The occurrence of magnetite in cell tissues therefore represents an intriguing dichotomy: on the one hand, the mineral can play a key role in magneto-reception and navigation, and thus survival, of various types of organisms and on the other hand, it can impart deleterious

effects in humans, especially when they are exposed to high PM concentrations in polluted urban environments" [6]. At present, the deleterious effect mechanism is unknown.

THE *IN VITRO* EXPERIMENTS

An optical microscopy method temporarily preserving human blood tissue properties on a glass slide smear was developed and introduced. This technique is referred by the acronym (TIBS) for Temporary *In Vivo* Blood Smear [7-9]. Amongst the utility of this method was allowing for the

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detection of energy changes attributed to molecular changes occurring during the human blood coagulation cascade. A literature search showed that when foreign particles are in contact with fresh blood tissue, adhesion occurs, thus initiating a blood coagulation cascade (Figures 1-3) [10-13] and video links. In my initial experiments with metal iron filings particles, energy emissions in the form of light were observed during the coagulation cascade. At the time, the light emissions were hypothesized to be either from a fibrin burst or a piezoelectric effect caused by the sudden mechanical compression of blood tissue at the end of coagulation (Supplementary Figure 4) [14].

RELEVANT IMAGES AND VIDEO RECORDINGS SUPPORTING ABOVE NARRATIVE

The dual effect of metal iron filings on fresh blood - Compressed blood tissue identified as blood clots (Figure 1)

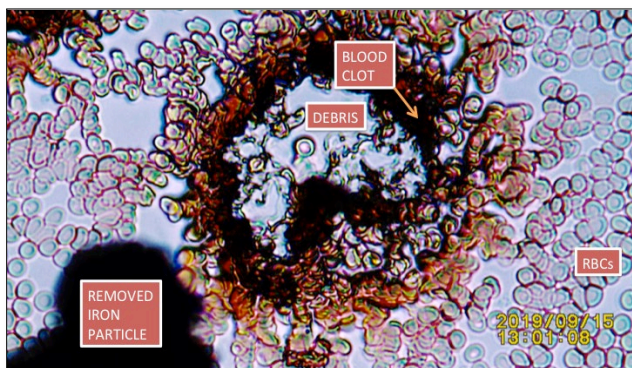


Figure 1. Showing post removal of iron particle observed coagulated blood and debris resulting from the iron particle interacting with fresh blood.

The dual effect of metal iron filings on fresh blood - The demonstration of cells deformation by iron particles in fresh blood (Figure 2)

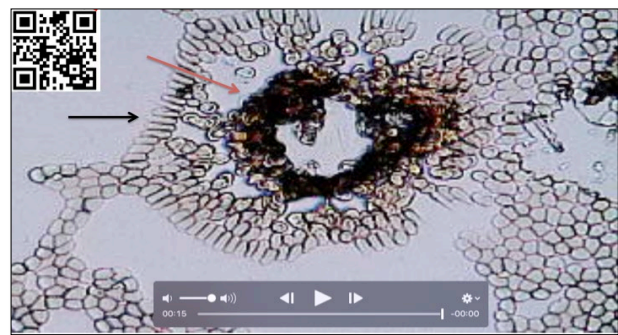


Figure 2. Selected video frame showing post iron particle removal via tooth pick. Black Arrow=Deformed RBCs; Red Arrow=Blood clot For additional details link to <https://youtu.be/ZGHWDY8O9sQ> or scan QR code in left upper corner of image

The dual effect of iron particles - The dual effect of iron particles a side by side comparison in same slide (Figures 3 and 4)

Compare both iron filings below and observe two different effects. Coagulated blood surrounding the iron to the left, and deformed RBCs surrounding the iron to the right. The dual mechanisms for these different findings remains unexplained at present

For additional details please link to: <https://youtu.be/OAGZYMqIYps> or scan QR code in right upper corner of image.

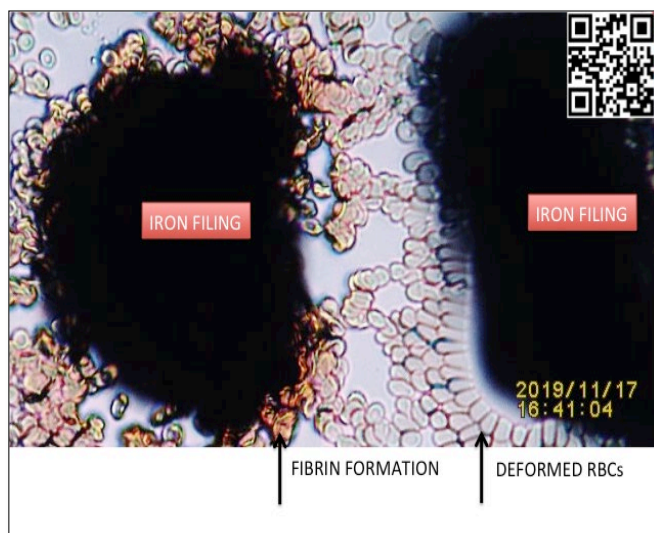


Figure 3. Microphotograph of video frame showing two different effects of metal iron filings on a fresh blood smear. The images observed side by side in same blood smear preparation. Fibrin formation and deformed RBCs denoted by black arrows

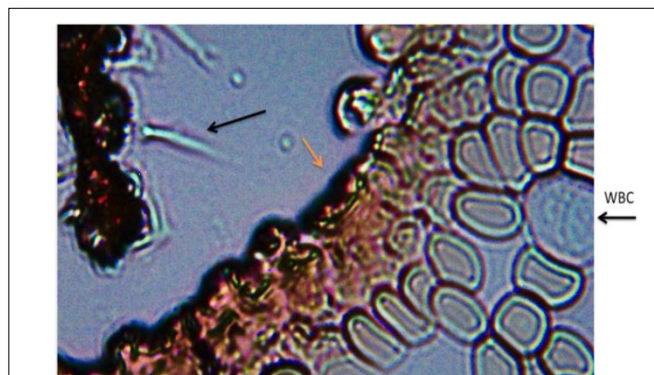


Figure 4. Compressed RBCs. Amplified inner core after removing iron particle: Black arrow=Teardrop deformed RBC; Orange arrow: Compressed RBCs

The effect of magnetite fragment on fresh blood: Red blood cells deformation

Subsequent experiments with magnetized magnetite rocks fragments showed not only color changes displays throughout the coagulation stage; but ultimately an increase in coagulated blood surrounding the magnetized fragments and **Figures 5-7** and video links.

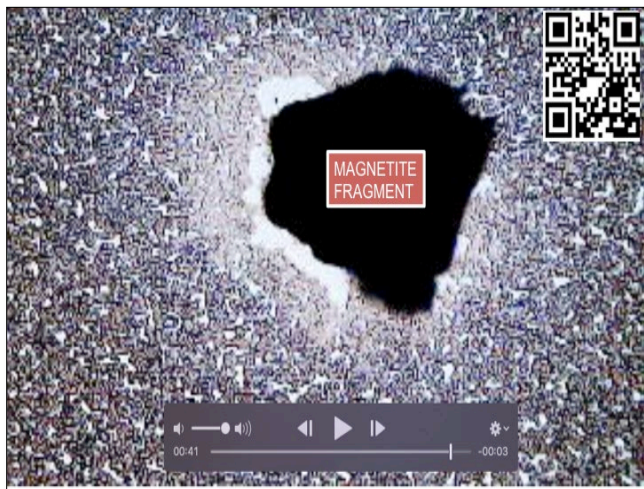


Figure 5. Magnetite fragment placed on fresh blood smear. Image at end of water evaporation. Compared with iron filing on fresh blood smear, there is an absence of RBC motion
For additional details link to <https://youtu.be/54BaJzNhuJc> or scan QR code in right upper side of image

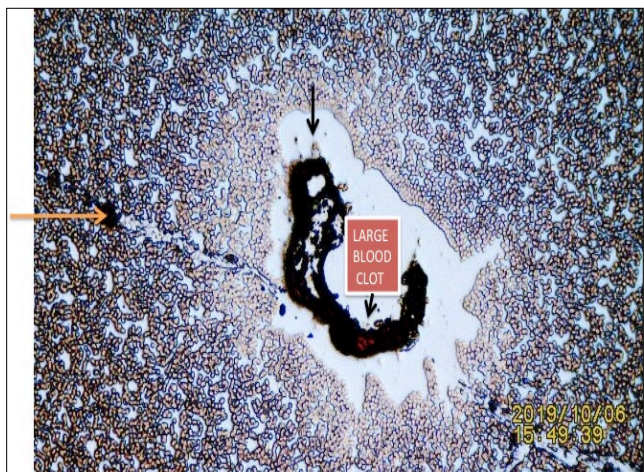


Figure 6. Small magnetite fragment removed showing hidden material adhered to slide.
Large red arrow=Magnetite fragment removal trail by wooden toothpick; Top black arrow=Compressed deformed RBCs image; Bottom black arrow=Large blood clot

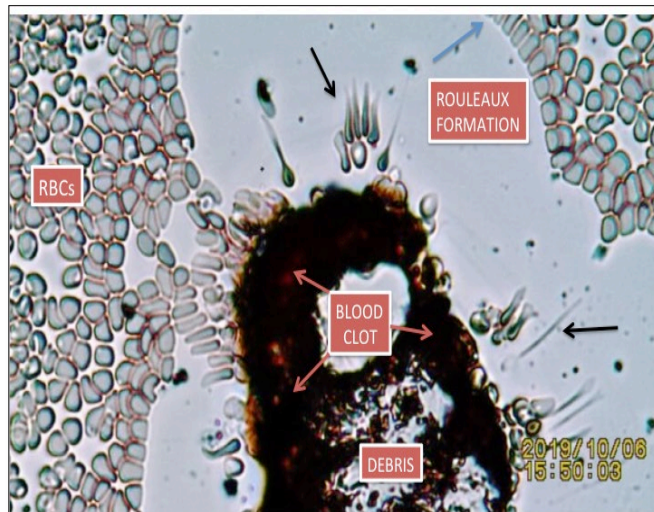


Figure 7. Enlarged area from **Figure 5.**
Showing Black arrows=Deformed RBCs; Red arrows=Blood clot; Purple arrow=Rouleaux formation

Magnetite Magnetic Reach Effect on Iron Filings in Fresh Blood - Increase in blood coagulation (Figures 8-10)

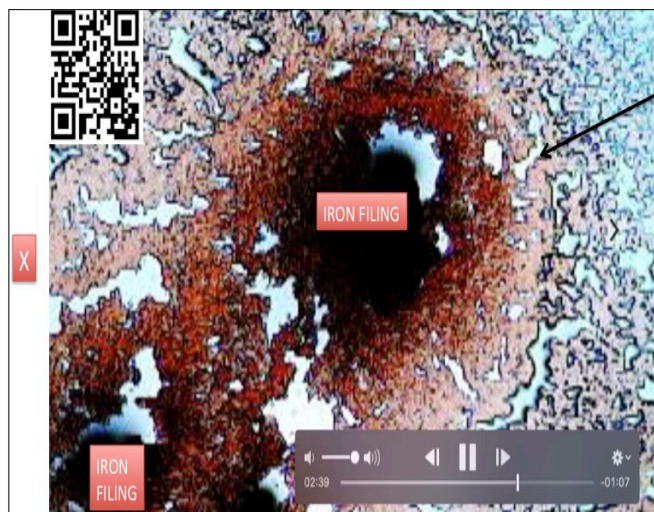


Figure 8. Paramagnetic iron filings under magnetite magnetic field reach.
X=Magnetite rock on slide (out of viewing field); Black arrow=Pointing at increased in blood coagulation by magnetite
For additional details please link to: <https://youtu.be/qLWyLj3YI3Q> or scan QR code in left upper corner of image. Suggested to move video cursor at faster speed to appreciate the magnetite magnetic reach effect

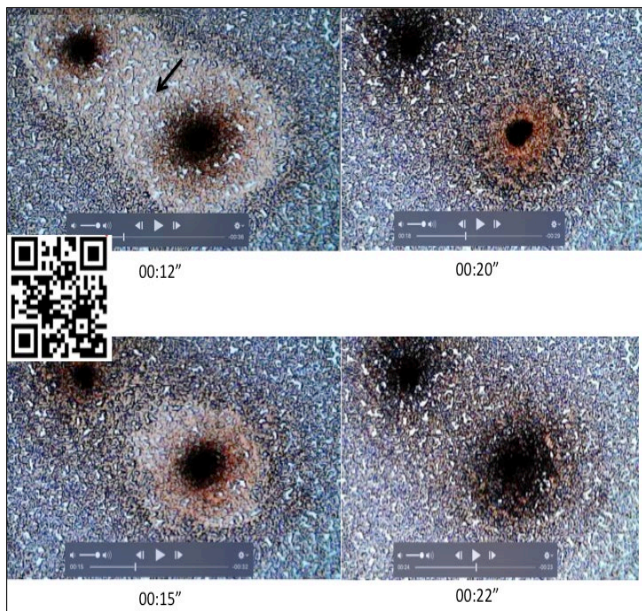


Figure 9. Magnetite flakes sandwiched between two 25 × 75 × 1 mm glass slides; the magnetic field penetrating the 1 mm glass. Selected frames of video-recording demonstrating light radiation surrounding iron filings in TIBS. Notice the light display phenomena. Blood undergoing evaporation exhibiting changes in light emission surrounding iron filing. Notice the apparent increase in blood coagulation around the now magnetically charged paramagnetic iron particles. For additional details link to: <https://youtu.be/PGjbv-v9K5c> or scan QR Code in left center of image. Light emission during blood coagulation cascade

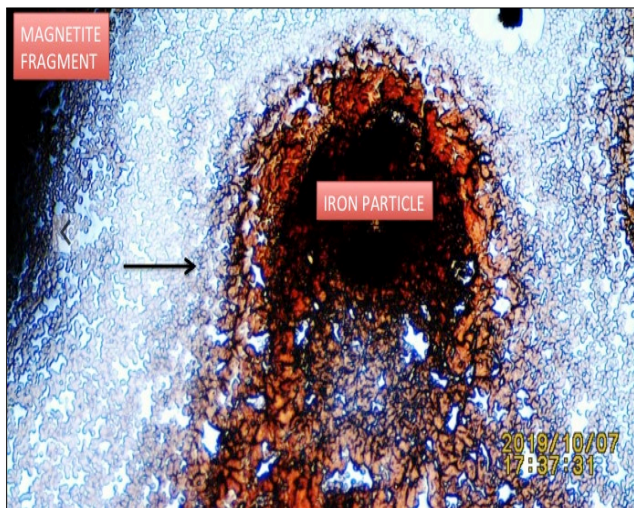


Figure 10. Iron particle in TIBS post coagulation. Black arrow=Showing increased blood coagulation range. This is theorized to occur due to the magnetic field reach of magnetite

SUMMARY AND CONCLUSION

The TIBS methodology has allowed for documentation of the effects of fragments of both, metal iron filings and magnetite rocks fragments placed on fresh human blood smears. There are two types of effects: the first are persistent cells deformations by magnetite and a dual effect of metal iron filings. Additionally, there is an increase in blood coagulation surrounding the magnetized magnetite fragment and iron particles when within the magnetite magnetic reach (Figures 7-9).

MEDICAL IMPLICATIONS IN CANCER TREATMENT

There has been numerous papers describing the various properties of Magnetite, they range from remainence in multidomain materials magnetization of multidomain particles of magnetite [15], Magnetite as a semiconductor [16], identifying magnetite as an efficient catalyst for the degradation of organic materials [17], amongst others. The published literature, also lists papers describing the interaction of blood components and blood cells with foreign surfaces, by stating that “Within seconds body foreign surfaces will be covered by blood products to varying extent depending on physicochemical characteristics of the biomaterial surface...Is important to note that negatively charged biomaterial surfaces exhibit a strong tendency to activate the contact activation of blood plasma coagulation” [12,18]. An extensive literature search failed to show magnetite as a factor in cell deformation. There is a solo paper found where magnetite is used as a tool for speeding the blood coagulation cascade [19].

In conclusion, the data presented is in support of magnetite magnetic reach and metal iron particles as factors in cells deformation. Those findings paired with an increase in the observed blood coagulation cascade and range behooves additional research in the cancer war.

The question arises

Could Biogenic or Anthropogenic Magnetite nanoparticles induce cellular changes in other than prokaryotic cells?

Answer

Yes, but further research needed to duplicate the findings in this manuscript, why? Because, again, the published literature seems to support a positive answer to the question as follows: “It has also been reported that treatment with trace amounts of ferrous ions in the cell culture medium and exposure to a static magnetic field increases DNA damage, which is detected using the comet assay...In addition, many studies have found a strong magnetic field can induce orientation phenomena in cell culture” [20].

In this manuscript **Figures 4-6** show that when iron is present in a magnetite fragment, cells deformation occurs.

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