The detection of phosphorus in the tissue of bomb victims in Gaza

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Abstract

One of the authors went on a fact finding mission to Gaza immediately after the termination of the Israeli invasion. One of the allegations towards the invading Israeli army was the use of phosphorus bombs. The author was able to take samples of tissue from burn victims. Attempts were made to demonstrate the presence of phosphorus in the burn wounds. Using histology and Raman spectroscopy it was found with a high degree of probability that phosphorus was present, although it was not proven with absolute certainty.

Key words: phosphorus, burns, Gaza, Raman spectroscopy, human rights

An independent fact-finding mission into violations of human rights in the Gaza Strip was undertaken from December 27, 2008 until January 18, 2009.[1]

Together, with the local pathology staff in Shifa Hospital, Gaza City, the team examined microscopic slides stained with Haematoxylin-Eosin from burn victims. The slides showed non-specific necrosis and inflammation and a few carbon particles indicating the effect of burns.

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Inorganic phosphorus has the ability to penetrate deep into the tissue in the presence of oxygen. In some of the bomb craters brownish material was found that would smoke and catch fire when exposed to oxygen. The author, JLT, witnessed such a lump bursting into flames as soon as it was taken out of a can where it had been covered in milk powder.

JLT was handed 14 mounted, unstained slides with the information that the biopsies had been taken from burn wounds with a suspicion of phosphorus content. As it would be impossible to take the material out through the Northern Crossing at Erez, it was given to an acquaintance who took it out via the Rafah crossing in the south to London, from where it was sent to JLT.

As we had no knowledge of any method that may be used for the histology detection of phosphorus in tissue, we left some of the samples unstained and applied Raman Spectroscopy to the tissue. Raman spectroscopy has been used as a tool to examine diseases affecting both soft and mineralized tissue.[2,3] Raman spectroscopy is applicable in the study of tissue samples both with and without biologically occurring phosphates. The study of inorganic phosphate minerals and their structure is also possible using Raman spectroscopy e.g. the study of turquoise by Frost et al.[4] To the best of the authors'

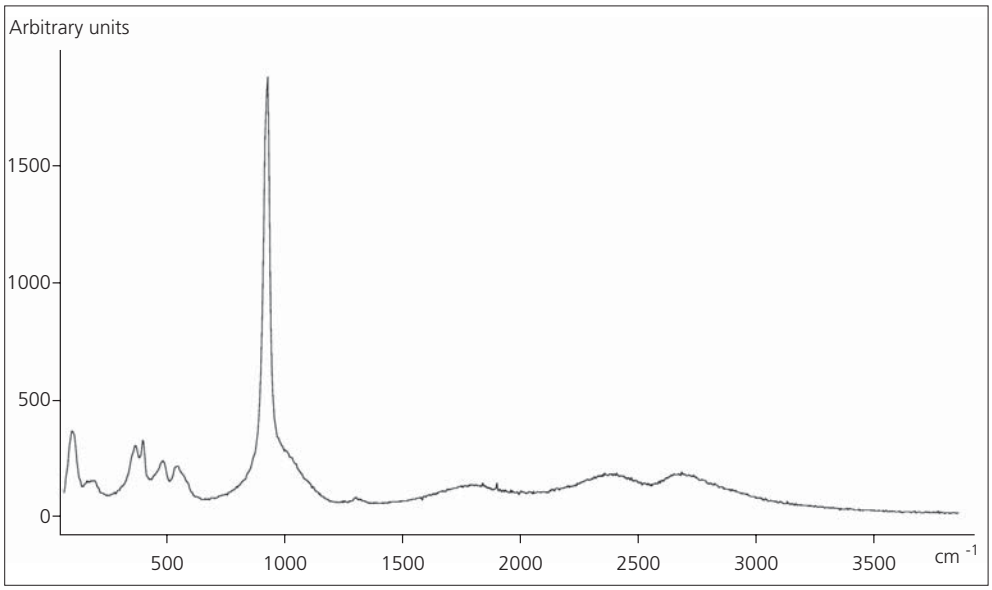

Figure 1.

knowledge, this is the first time Raman spectroscopy has been used to examine tissue for exogenous, inorganic phosphate.

Figure 1 shows the spectrum for a control particle of potassium phosphate. At the time we had no indication of the site of any phosphorus particles and applied the spectroscopy around the carbon particles. As expected the spectroscopy showed the presence of carbon.

After staining all the slides we discovered birefringent particles in some of the tissue. Figure 2 shows crystals of potassium phosphate and Figure 3 shows some of the birefringent particles in the tissue. There is an obvious similarity. However, when Raman spectroscopy was applied (Argon-ion-laser, blue line at 457.9 nm) we were unable to differentiate the birefringent particles from the background signals, so phosphorus could not be detected (Figure 4).

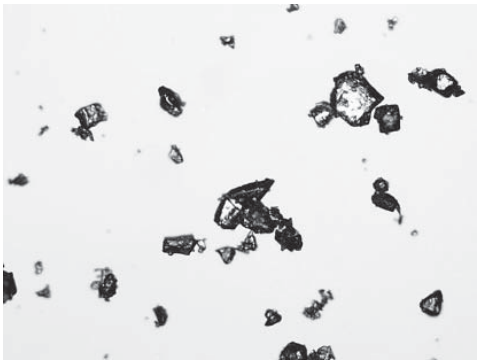

Figure 2.

Conclusion

We believe that the inconclusive results of Raman Spectroscopy in the detection of phosphorus were due to the processing and subsequent staining and mounting of the tissue, which might interfere with the

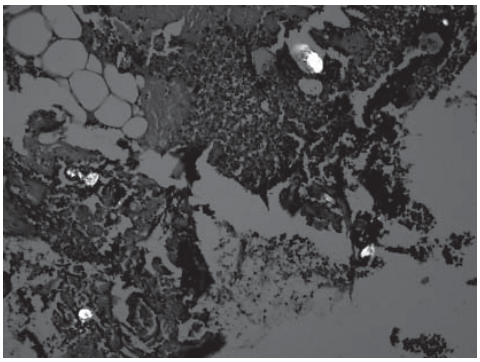

Figure 3.

measurement. The birefringent material is likely to be a phosphorus compound, supported by the clinical observation of very deep and very slowly healing burn wounds. White phosphorus may be used in war as a smoke screen. Its use against individuals is prohibited.

References

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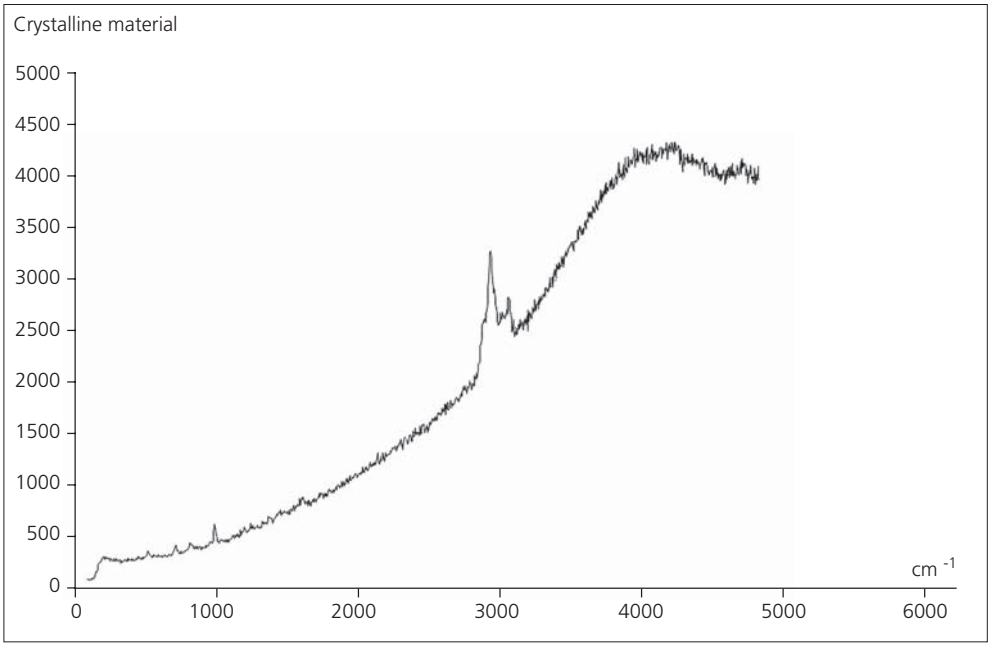

Figure 4.