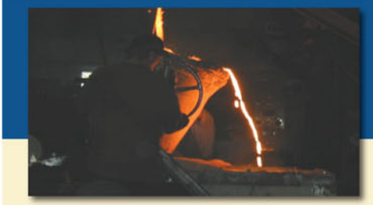


Foundry Sand Murder

William M. Schneck, WSP Crime Laboratory

ABSRACT

At autopsy several blunt force injuries to the skull of a female were observed. A section of skull containing the defects were removed for examination. Upon inquiry it was discovered the husband worked at a ferrous metal foundry in which one of two tools having a triangular pointed shape was missing. A bloodstain on a rug near the victim showed an impression similar to the remaining tool at the foundry. A microscopical examination of the tool and the skull fragment revealed similar particles of pumice and iron. Additionally, sand having an elemental signature similar to foundry sand from the foundry the suspect worked at was recovered from the skull. Although the murder weapon was never recovered, the presence and similarity of foundry sand on the skull and secondary tool that closely matched the sand from the foundry was convincing evidence that the missing tool was the murder weapon. The suspect plead to first degree murder weeks prior to trial.

THE CRIME

- A disheveled man stumbles into a police department 250 miles from his home and states, " You may want to check on my wife she's been ill".....
- Police find the wife in the basement with head trauma consisting of several jagged open wounds.
- Also noted at the scene was a bloody rug with an unusual contact impression.
- The husband becomes a " Person of Interest. "
- The Person of Interest works at a ferrous metal foundry where he was known to use a medieval looking tool to ventilate drums containing foundry sand.
- One of two hand-made tools is shockingly missing!

THE AUTOPSY

Several depressed skull fractures were located in the back of the skull

SKULL SECTION REMOVED AT AUTOPSY AND SUBMITTED FOR EXAMINATION

A small section of skull was cut from the submitted piece and mounted on an SEM sub using a double adhesive carbon tab. A Leica SEM equipped with a Oxford Isis energy dispersive spectrometer was used to examine particles imbedded in the bone.

ONE TOOL IDENTICAL TO THIS ONE IS MISSING……..

The tools were used to ventilate barrels containing foundry sand and scrap iron.

The remaining fabricated tool from the foundry was submitted for examination and comparison to the victim's skull.

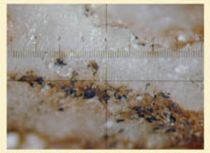
IMPRESSION EVIDENCE

Corner of a rug found near the victim with bloodstains showing a contact impression

Exemplar impression of foundry tool compared to bloodstain impression on rug: General shape and size including round void shared many similarities to bloodstain pattern on carpet.

IMPRESSION IN BLOOD NEAR VICTIM WAS COMPARED TO THE REMAINING TOOL

PARTICLE ANALYSIS



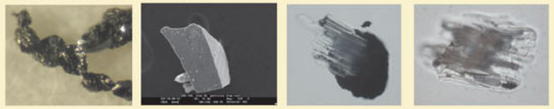
The weapon contact edges on the bone exhibited black particles. SEM-EDS analysis revealed Ca, S, Zn and one particle with Mg, Al, Si, Ca, Ti, Fe, and Mn.

Sonication and filtration

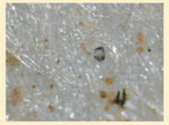
Due to interfering contamination when the bone was analyzed directly using SEM-EDS, a small section of bone was sonicated in alcohol and the debris filtered and re-examined by PLM and SEM-EDS.

Stereomicroscopy 100X

PARTICLES RECOVERED FROM FOUNDRY TOOL

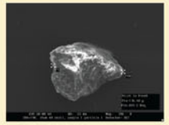


SKULL PARTICLES

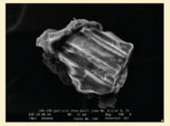


Particle on Filter Paper

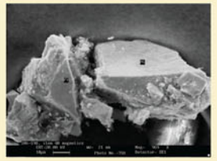
Opaque angular partices were similar to opaque iron particles from the tool.



Mg, Al, Si, S, Ca, Cr, Fe

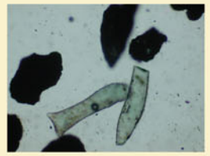


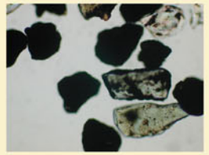
Pumice: Al, Si, Ca, Fe, K, Na



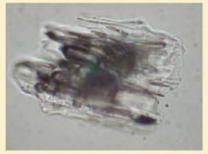
Casting Sand at the Foundry
'Olivine sand' : clear, green, amber glassy exotic shapes. Stereomicroscopy

Casting Sand used at the Foundry

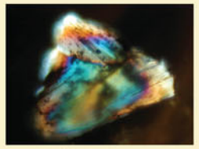




'Olivine sand' : clear, green, amber glassy exotic shapes. PLM

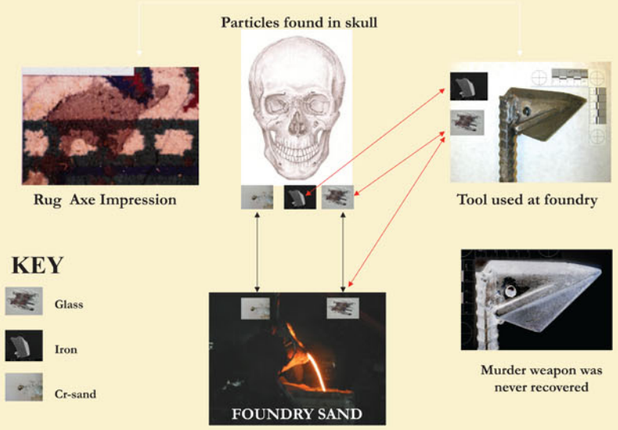


Pumice: Al, Si, Ca, Fe, K, Na,



Mg, Al, Si, S, Ca, Cr, Fe

LOCARD PRINCIPLE IN FORENSIC GEOLOGY



QEMSCAN

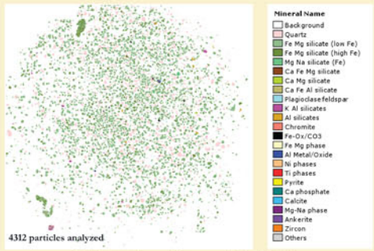
A sample of the known foundry sand was embedded in epoxy and all 4312 particles analyzed.

QEMSCAN is an integrated automated system which provides quantitative analysis of minerals, rocks and man-made materials.

QEMSCAN is an abbreviation standing for Quantitative Evaluation of Minerals by SCANning electron microscopy and a registered trademark owned by FEI Company.

QEMSCAN identifies mineral phases using backscattered electron and secondary electron signals, in combination with electron-induced secondary X-ray emission. In addition to chemical assays and modal mineral proportions, most QEMSCAN measurement modes provide textural information.

QEMSCAN analysis of the known foundry sand



Field scan image 30 mm polished block

SUMMARY

Although the murder weapon was never recovered, a tool reportedly fabricated and used at the foundry was submitted for testing. Foundry sand particles on this tool were similar to those found embedded in the victim's skull. The suspect plead guilty to first degree murder several weeks prior to trial.
The tool on display was made by the same employee that fabricated the two original tools.

CONCLUSIONS

A tool with a pointed triangular shape exhibiting a one centimeter hole could have made the blood transfer impression on the rug. The tool head from the remaining tool at the foundry has similarities in shape to this impression. A tool with a similar shape could have made the bloody impression on the rug.

Opaque angular iron grains and glassy pumice particles found on the skull fragments are similar in morphology and composition to those found on the foundry tool.

Magnetic foundry sand grains with black coatings containing magnesium, aluminum, silicon, sulfur, calcium, chromium, and iron found on the skull fragment are similar in morphology and composition to sand used at the foundry and probably originated from the foundry.