From Honours Project to Published Paper: the Development of an Etching Paste.

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Two Themes

• How we relate research and teaching
  – Developing graduate attributes through honours projects
  – Input from research into our teaching
• The science of recovery of erased marks
  – A model for material deformation
  – An etching paste
Context

• There is a move to reflect on the attributes a graduate should have
  – Not simply the knowledge they should have
• Attributes are developed over time
• Projects are an important opportunity to put them into practice
• Undergraduates need to be aware of current technical developments
  – How to achieve that?
The Idea

• In our third year students do a practical that includes etching and recovery.
• Etching is relatively straightforward in the laboratory with flat specimens
• Would a paste or gel be possible? E.g. using alumina or silica, or PVA or PEG
• Title was offered to students
• Chosen by Jennifer (a student with consistent 2.1 grades)
• Preliminary discussion
• Agreed that part of the project would give some assured results and part would be more speculative
• Development of Etches for Erased Identification Marks. Jennifer Matthew

• This project expands upon the practical in FS0901 semester 1.
• The second phase is experimental. Choose one or two situations and look at developing a method to reinstate the marks. Possible ideas include:
  • How much surface preparation is needed to successfully carry out etching?
  • How much damage does a criminal have to do to prevent recovery?
  • Can the etch be developed into a paste or paper to make it easier to apply?
  • Can light effects or image enhancement improve recovery?
• You will need to prepare an ethical statement, a project plan, equipment and chemical list, COSSH and risk forms.
Jennifer’s Methodology

• A press was used with die stamps
• Metal was filed off until no mark was visible
• The disc thickness was measured
• A pre-determined additional amount was filed
• The surface was polished and etched
• Jennifer studied different pressures
• She also studied reagent degradation with time
• Examined the effect of over-stamping
<table>
<thead>
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<th>Stamp Letter (4ton)</th>
<th>File Depth (mm)</th>
<th>Result (+ve/-ve)</th>
<th>Photograph Clarity</th>
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<tr>
<td>J</td>
<td>0.75</td>
<td>+ve</td>
<td>Very clear</td>
</tr>
<tr>
<td>P</td>
<td>1.0</td>
<td>+ve</td>
<td>Ok clarity</td>
</tr>
<tr>
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<td>Very, very faint</td>
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<tr>
<td>F</td>
<td>1.5</td>
<td>-ve</td>
<td>-</td>
</tr>
<tr>
<td>-</td>
<td>1.75</td>
<td>-</td>
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Paste Trials

• Initial trial used alumina
• Very successful
• Paste is thixotropic and stays in position
• Etching was often clearer or faster
Comparison of Liquid and Paste

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Post Project

• Jennifer got a good grade for her project
• Normally this is where an honours project ends
• However, we can often add additional interpretation to the student’s results
  – Was the paste marketable?
  – Why is the paste better?
  – Why does pressure affect depth of recovery?
• Re-examination of the data and a few extra tests
Comparison Of Etches
Postulation

• From the observations, liquid is clearly better when erasure is by infilling
  – Better penetration of reagent
• A chromatographic separation is occurring
• A mechanism is suggested based on the limited diffusion in the paste and hence different relative concentrations
• Again, a model is proposed based on elastic/plastic transition

\[ \text{Depth} \alpha \sqrt{\frac{\text{Force}}{\text{Yield.stress}}} \]
Beyond the Project

• The paste is unlikely to be marketable
• The technique could have wider application
• Two papers were written and published in Forensic Science International
• We have modified our third year practical to incorporate the study and use it to encourage students to think about their own project
Development of an etching paste
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Restoration of stamp marks on steel components
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