

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 straight forward 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, COSHH and risk forms.



Jennifer's Methodology



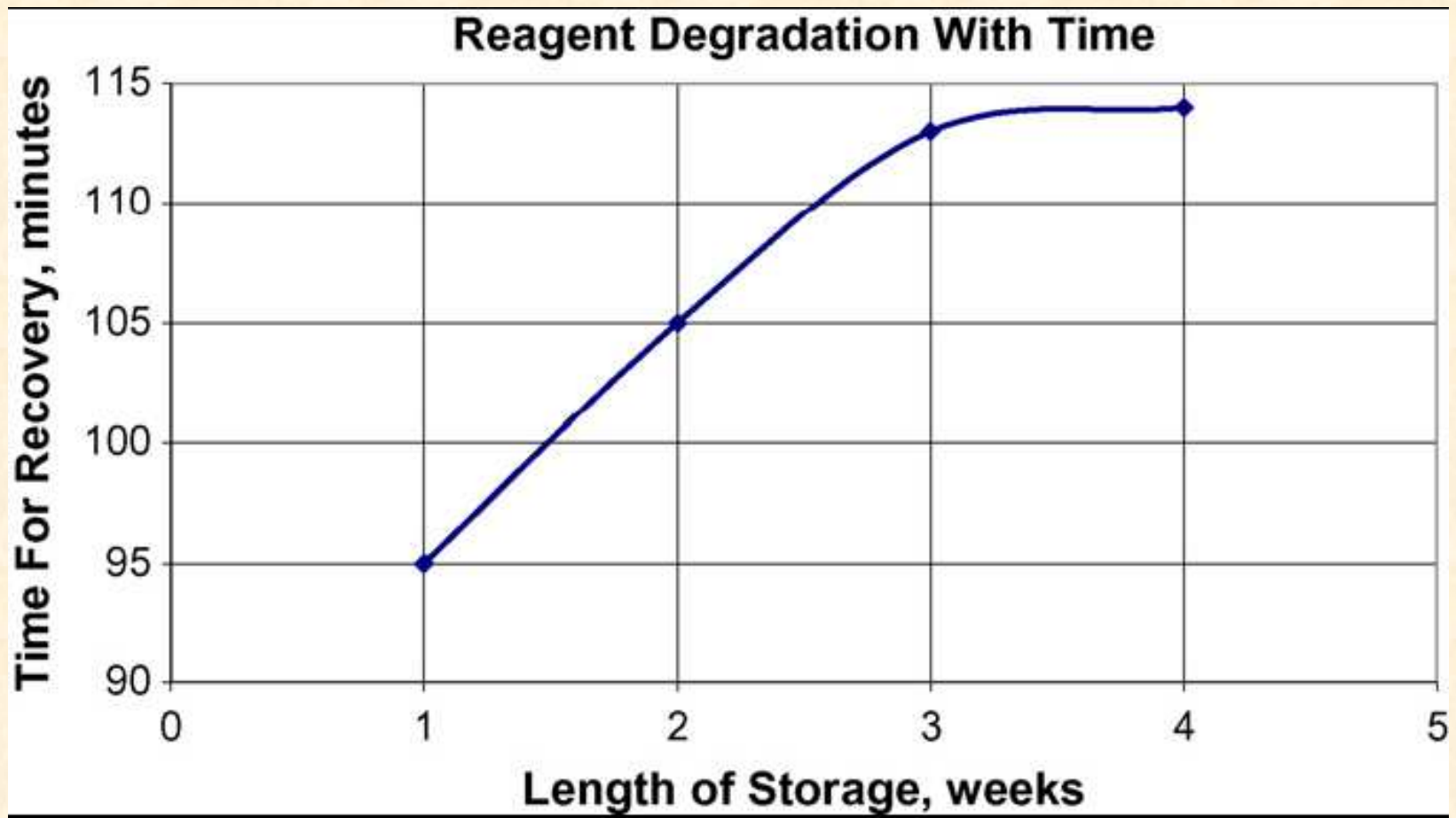
- A press was used with die stamps
- Metal was filed off until no mark was visible
- The disc thickness was measured
- A pre-determined additional amount was filed
- The surface was polished and etched

- Jennifer studied different pressures
- She also studied reagent degradation with time
- Examined the effect of over-stamping



Stamp Letter (4ton)	File Depth (mm)	Result (+ve/-ve)	Photograph Clarity
J	0.75	+ve	Very clear
P	1.0	+ve	Ok clarity
N	1.25	+ve	Very, very faint
F	1.5	-ve	-
-	1.75	-	-







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

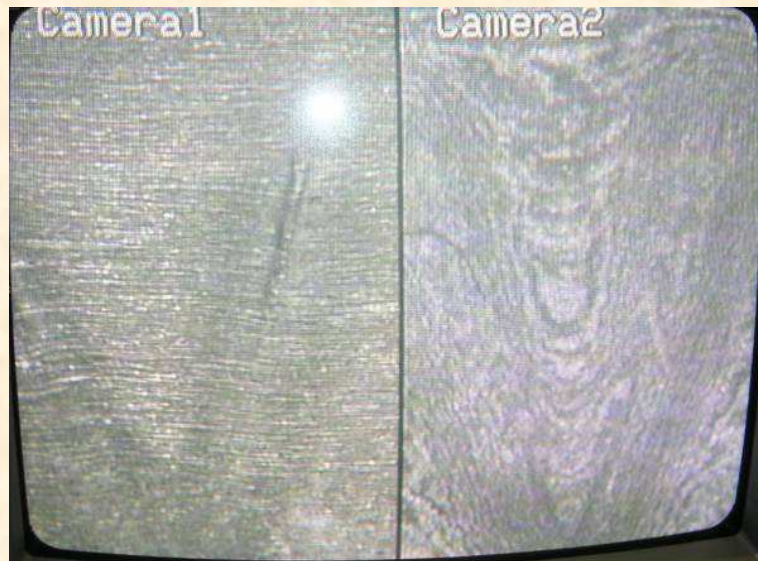


Post Project

- 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



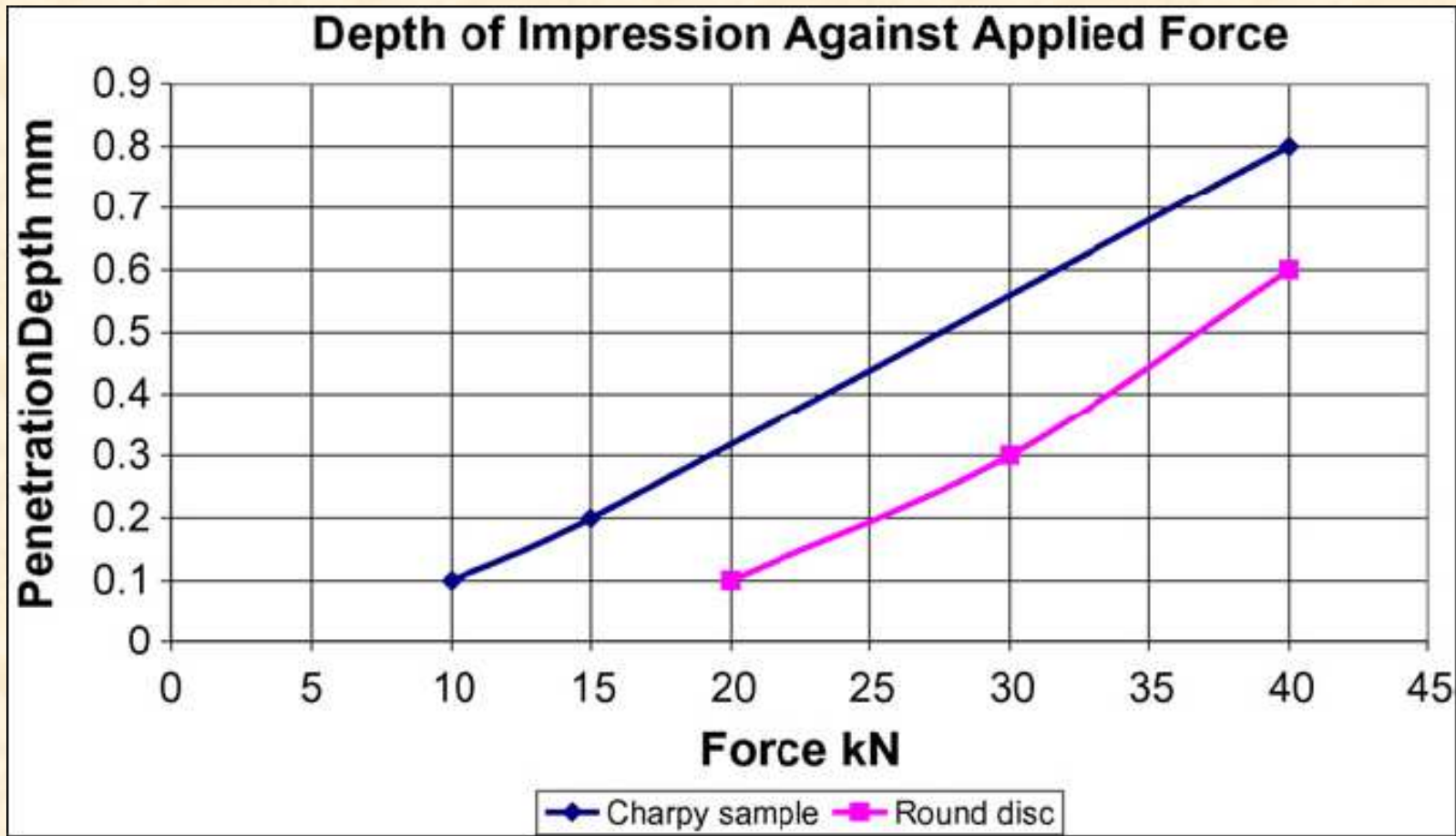


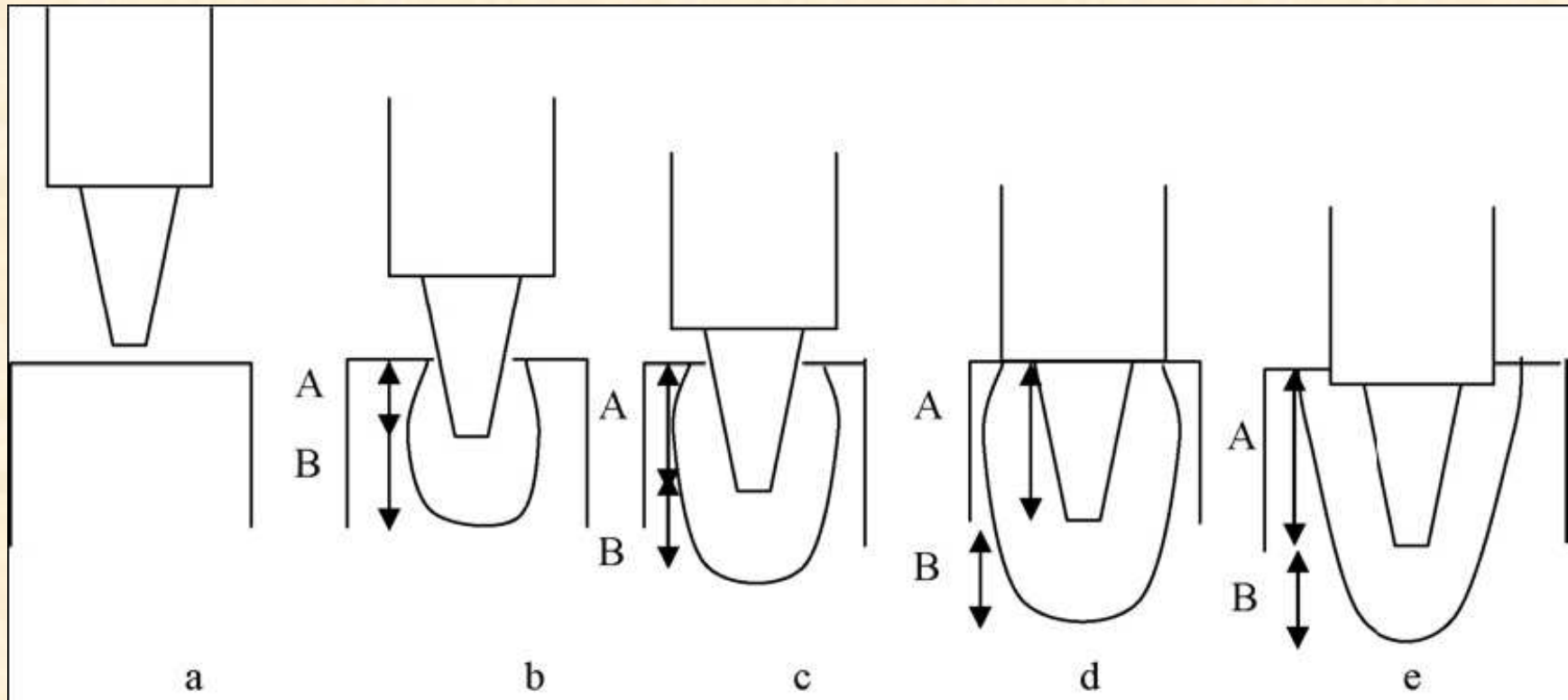


Postulation

- 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

$$Depth \propto \sqrt{\frac{Force}{Yield.stress}}$$



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

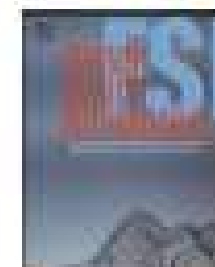




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Development of an etching paste

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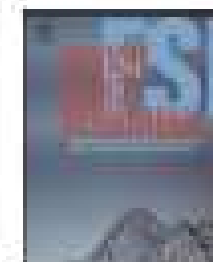
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Restoration of stamp marks on steel components

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