INTRODUCTION
Radionuclide dating of residues on lithic tools using Accelerator Mass Spectrometry (AMS) has demonstrated the potential of the technique on samples containing just microgams of carbon. The accuracy of such dating is to a great deal dependent on avoiding the transferal of contamination into the sample. With such small samples extra care is required to avoid age offsets. Based on results from previous studies (Yates et al., 2014; Yates et al., under review), we propose strategies for artefact handling during field work, handling and storage to optimize accurate AMS dating of stone tools residues.

What causes residue radiocarbon dates that are too old?

<table>
<thead>
<tr>
<th>Contamination type</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton worn on tool</td>
<td>Long et al., 1992</td>
</tr>
<tr>
<td>Carbonate from soldering</td>
<td>Neufeld et al., 2013</td>
</tr>
<tr>
<td>Indicator of chemical processing</td>
<td>Neufeld et al., 2013</td>
</tr>
<tr>
<td>Carbons from blue stains</td>
<td>Long, 2008 (under review)</td>
</tr>
<tr>
<td>Carbonate &lt; 150°C</td>
<td>Neufeld et al., 2013</td>
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<tr>
<td>Adhesive on the sample</td>
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CONCLUSION
If the aim is to radiocarbon date minimal amounts of residues, it is crucial to avoid contact between organic material and the artefact. Obviously not all excavations require a complete change in field technique, handling and storage. A lot depends on the expected residue preservation, aim and possibilities of the excavation or retrieval.

Both, residue identifications and contaminant prevention protocols are keystones to achieve accurate dating. Several studies point to sample contamination from fungus, microbe or bacterial activity and starch – often linked to too warm storage, insufficient sample protection and laboratory set up. Along with this consideration, several other important steps in the sampling protocol sequence can influence the results and need to be carefully assessed. A constant improvement of our proposed sampling strategies to avoid contaminants compromising AMS dates is essential.

ACKNOWLEDGEMENT
We thank Maxee Daws who took all SEM images on LED 440 Stereoscan SEM, School of Environment, Science & Engineering, Southern Cross University.

Thank to U. Baumert and Dr. Dietemann, Doerner Institute, Munich, Germany for providing GC Chromatograms and reports on GC/MS analyses on birch tar from Fiesack.

REFERENCES

A preliminary sampling protocol for residue radiocarbon dating
A.B. Yates1, A.M. Smith2, F. Bertuch3, A. Scheffers3, R. Joannes-Boyau1

1 Southern Cross University, Southern Cross GeoScience, PO Box 157, Lismore, NSW, 2483, Australia
2 Australian Nuclear Science and Technology Organisation, Locked Bag 2001, Kirrawee DC 2232, Australia
3 University of Bern Department of Anthropology, Bern, Switzerland

What causes residue radiocarbon dates that are too young?

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<tr>
<th>Action</th>
<th>Risk of carbon transfer - X</th>
<th>Carbon transfer avoidance - √</th>
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<tr>
<td>Excavating</td>
<td>Metal instruments</td>
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<tr>
<td>Restoring artefact</td>
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<td>Hosing</td>
<td>Water supply to water supply</td>
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