How to sample artefacts for luminescence rock surface dating

Luminescence rock surface dating (RSD) can be used to determine when a lithic artefact was last exposed to sunlight and then buried. This guide will describe how to sample buried lithic artefacts for luminescence RSD.

Rock type

Not all rock types yield a luminescence signal. Some lithologies work better than others.

Optimal rock types:

- Quartzite
- Sandstone

Promising rock types:

- Silcrete
- Granite/granodiorite/metamorphic

Potential rock types:

- Chert
- Andesite/basalt/rhyolite

Rock types unlikely to work:

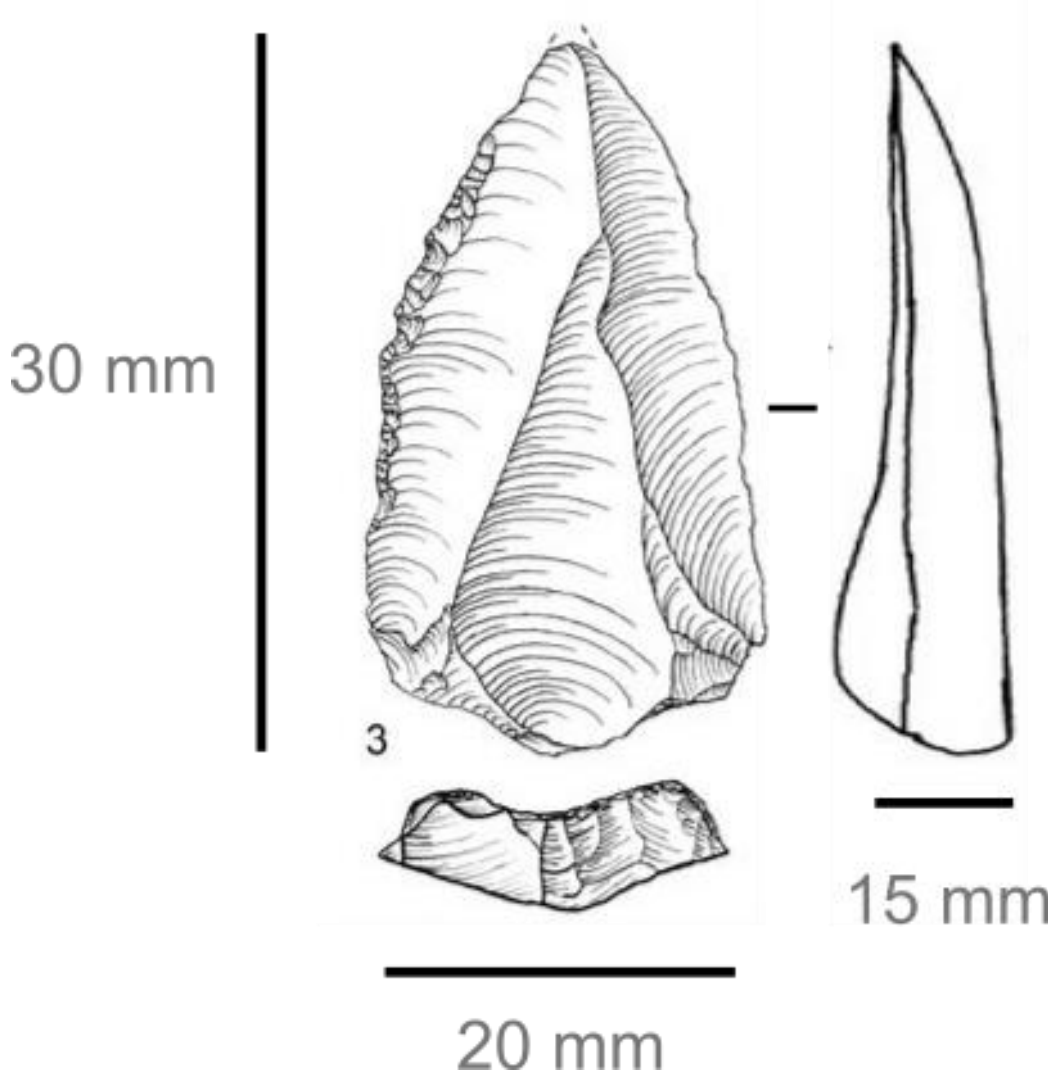
- Limestone
- Hydrothermal quartz

Artefact/clast size

Artefacts need to be large enough for preparation and dating to be possible. In general, larger artefacts are better. The smallest that an artefact can be and still allow sample preparation are at least:

- 30 mm long,
- 20 mm wide, and
- 15 mm thick.

This is a minimum size. Larger clasts are preferred.



How to collect artefacts for RSD in the field?

Mechanical excavation

Where mechanical excavation is undertaken and each bucket scoop is sieved, lithic artefact samples should be collected at the sieves.

1.

Before excavator scrapes the excavation unit (spit), archaeologists at the sieve should have all equipment necessary for artefact collection including:

- Aluminium foil
- Black, opaque sample bags
- Clear sample bags
- Labels for each bag to identify which excavation unit (spit) the artefact is from

Mechanical excavation

2.

Excavator scrapes the excavation unit (spit) of predetermined depth. Excavator drops bucket load onto sieve.

Mechanical excavation

4.

Archaeologists at the sieve sift through sediment as it falls through the sieve.

5.

When a potential artefact of the appropriate size (30 x 20 x 15 mm minimum) is seen, the archaeologist should immediately:

- pick it up,
- identify it, and
- wrap it in a light safe material such as aluminium foil and an opaque black bag. Label sample with excavation unit (spit) ID and depth below surface.

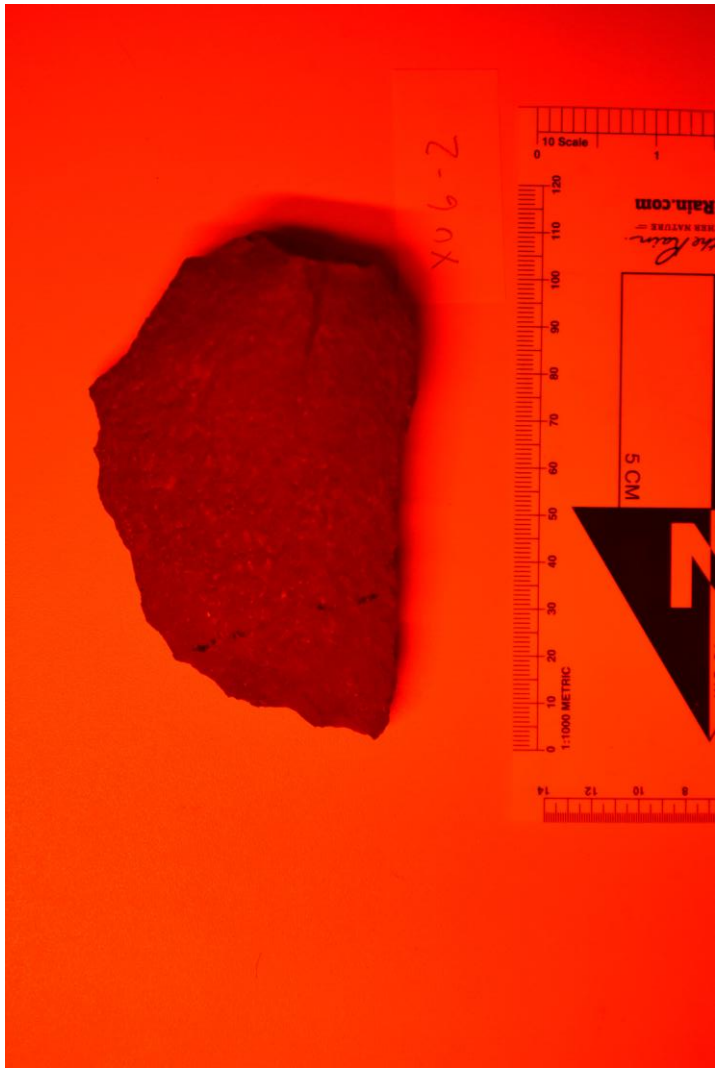
The artefact should be in a light-safe wrapping within 30 seconds of identifying the artefact.

Mechanical excavation

5 (cont.)

Samples collected in the field do not need to be recorded in the field, as they will be photographed and recorded in the light-safe environment of the Vicus laboratory prior to any impacts on the artefact. This allows ample opportunity for the community to assess whether they still support dating the artefact.

While sampling in the field, **the priority is to identify lithic artefacts and get them into a light-safe state quickly (under 30 seconds)** - if this means that non-cultural rocks are mistaken for lithic artefacts that is ok, as all finds will be assessed in the light-safe environment in the laboratory.



Mechanical excavation

6.

Collect approximately 100-200 grams of sediment from the sieve in a clear plastic bag (this sample is not light sensitive). This bag should be labelled with the excavation unit (spit) and be put in the same bag as the artefacts.

This sample is essential for measuring the sediment component of the artefact’s dose rate.

Mechanical excavation

7.

It is strongly encouraged to collect a series of sediment OSL samples from the wall of the trench to understand the sedimentary environment of the landscape.

These data will help understand the age of the artefacts and the age, post-depositional processes, and palaeoenvironment that they may have experienced during burial.

Mechanical excavation

8.

Please complete a sample submittal sheet for each artefact luminescence sample and sediment luminescence sample.

For each artefact sample, make sure to note:

- Sample code
- Trench, excavation unit (spit), and depth below surface
- Approximately how long artefact was exposed to light

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SAMPLE SUBMITTAL SHEET FOR LUMINESCENCE DATING OF ARTEFACTS

1. A completed sample sheet must accompany each sample, Fill out with as much detail as possible in the field.

Date:	Name:
Company:	Project and Location:
Latitude/Longitude:	Elevation (in metres above sea level): Use a GPS or topographic map
Sample Code: Provide a unique sample code for each luminescence sample collected.	
Excavation methodology – please describe method of excavation (mechanical vs hand excavation, excavation unit size, etc)	
Approximately how long was the artefact exposed to light?	If only part of artefact was exposed, was the light exposed portion of artefact outlined and labelled? How?
Artefact lithology:	Artefact description:
Type of Sedimentary Deposit:	☐ Wind-lain ☐ Water-lain ☐ Beach ☐ Lake ☐ Hill slope ☐ Other:
Dose Rate Sample – Collected from the material immediately surrounding the artefact. This can easily be done once the artefact is collected.	Sample code: Context: ☐ Similar material within 20 cm of sample ☐ Different material within 20 cm of sample ☐ Additional DR sample/s taken
Water Content – Please provide some information about the conditions at the time of sampling.	Is the sample representative of long-term water content since deposition? E.g. Has it rained recently? Extended dry period? Mark an X on the line Drier _____ Similar _____ Wetter
Burial depth (cm) - This is the sample depth from the current ground surface. Include notes on any buried soils and any evidence of recent deposition/erosion or disturbance that may have influenced the burial-depth history.	
Estimated Age - Is there independent age control from your site? Geomorphic context? Features of assemblage? Etc.	
Sedimentary/Stratigraphic Description (take detailed photos, use drawings/sketches on back of page if possible) - include information on grain size, sorting, any sedimentary structures visible, how homogenous the material is, evidence of bioturbation (animal disturbance)/roots or disturbance etc.	

Sampling Procedure Checklist

- ☐ Artefact packed in aluminium foil and light safe bag after <30-60 s of light exposure?
- ☐ Light exposed portion of artefact marked with marker or in photo?
- ☐ Sampled representative sediment for dose rate within a 5-7 cm radius around artefact?
- ☐ Site/samples documented with photos/sketches and descriptions?

Hand excavation

Where hand excavation is undertaken, there are two opportunities for sample collection: in situ by the excavating archaeologist and in the sieves.

Collection of artefacts in situ relies on the archaeologist to identify and collect samples in the excavation square. This is the best situation for sample collection, as the sample's provenance is securely known and the sample's light exposure can be kept to a minimum.

1.

While excavating, the archaeologist should have all equipment necessary for artefact collection including:

- Aluminium foil
- Black, opaque sample bags
- Clear sample bags
- Labels for each bag to identify the excavation unit (spit) and depth below surface of artefact

Hand excavation

2.

While excavating, the archaeologist should already be attentive to identifying appropriately sized artefacts (30 x 20 x 15 mm, minimum)

Hand excavation

3.

When the archaeologist begins to reveal a potential lithic artefact during excavation they should stop excavation.

- The portion of the potential artefact that has been exposed to ambient light should be recorded (photographically or marked directly on the potential artefact with marker or pencil).
- The location of the in situ artefact should be recorded (with a total station or the X, Y, and Z coordinates)
- The (still mostly buried) artefact should be photographed in situ.

Hand excavation

4.

When ready, the potential artefact should be:

- Removed and visually inspected for as little time as possible (under 10 seconds),
- Wrapped in aluminium foil, and
- Placed into an opaque black bag as quickly as possible.
- The bag should be labeled with the appropriate:
    - Site,
    - Square,
    - Excavation unit (spit), and
    - Depth below surface.

Hand excavation

4 (cont.)

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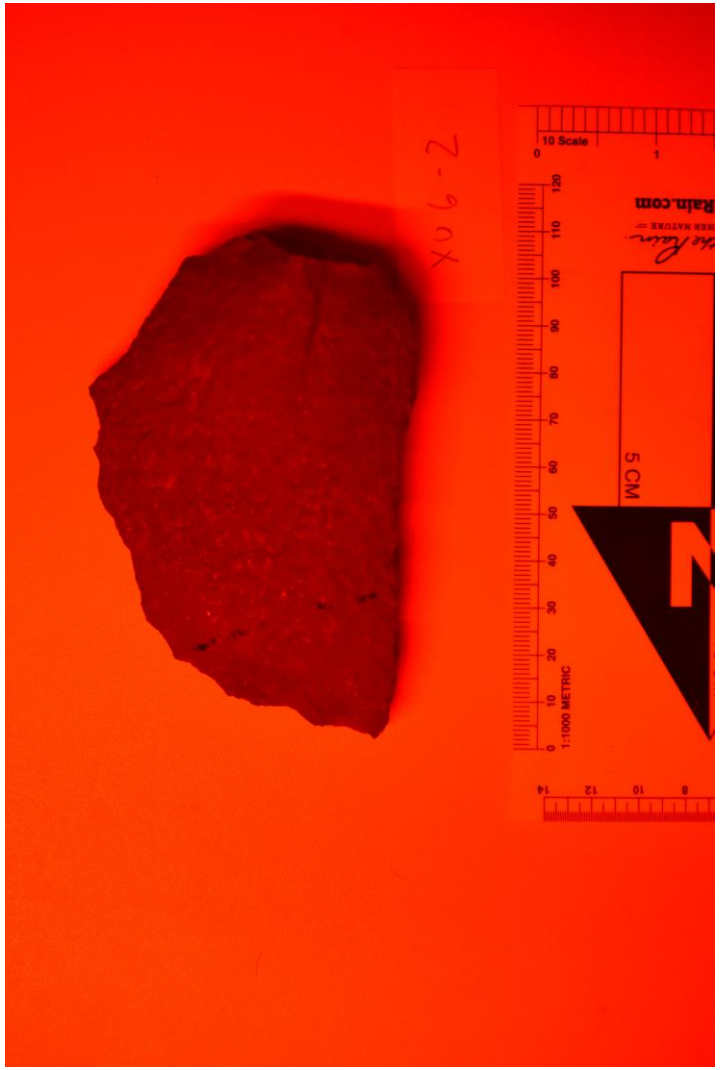

Hand excavation

5.

A bulk sediment sample from a 5 cm radius directly beneath the artefact should be collected (100- 200 grams).

This sample is for measurement of the dose rate and is not light sensitive. It can be collected in a clear, plastic sample bag.

Artefact wrapped in aluminium foil and stored in black bag.

Bulk sediment from beneath artefact for dosimetry – collected in clear sample bag

Hand excavation

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It is strongly encouraged to collect a series of sediment OSL samples from the wall of the trench to understand the sedimentary environment of the landscape.

These data will help understand the age of the artefacts and the age, post-depositional processes, and palaeoenvironment that they may have experienced during burial.

Hand excavation

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