BIO414 (CRYPTOGAMIC BOTANY II)

WEEK 3

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LICHENOMETRY

In archaeology, palaeontology, and geomorphology, lichenometry is a geomorphic method of geochronologic dating that uses lichen growth to determine the age of exposed rock, based on a presumed specific rate of increase in radial size over time.

Measuring the diameter of the largest lichen of a species on a rock surface can therefore be used to determine the length of time the rock has been exposed.

Lichen can be preserved on old rock faces for up to[citation needed] 10,000 years, providing the maximum age limit of the technique, though it is most accurate (within 10% error) when applied to surfaces that have been exposed for less than 1,000 years.

Lichenometry is especially useful for dating surfaces less than 500 years old, as radiocarbon dating techniques are less accurate over this period.

The lichens most commonly used for lichenometry are those of the genera Rhizocarpon (e.g. the species Rhizocarpon geographicum) and Xanthoria.

The measured growth rates of R. geographicum tends to fall within the range of 0.9 - 0.3 millimeter per year, depending on several factors, including the size of the lichen patch.

Lichenometry can provide dates for glacial deposits in tundra environments, lake level changes, glacial moraines, trim lines, palaeofloods, rockfalls, seismic events associated with the rockfalls, talus (scree) stabilization and former extent of permafrost or very persistent snow cover.

It has also been explored as a tool in assessing the speed of glacier retreat due to climate change.

Among the potential problems of the technique are the difficulty of correctly identifying the species, delay between exposure and colonization, varying growth rates from region to region as well as the fact that growth rates are not always constant over time, dependence of the rate of growth upon substrate texture and composition, climate, and determining which lichen is the largest.

Several methods exist for dating surfaces with help of lichenometry; the most simple relies on a single largest lichen while other methods use more.

There are also differences in the way the lichen is measured; while some suggest that the largest diameter should be measured, other scientists prefer the diameter of the largest inscribed circle.

A problem in dating lichens is the fact that several thalli can fuse together, making several minor lichens appears as a larger one of older age. Lichenometrist Tom Bradwell has listed the following five method families as the principal ones into which most other methods can be classified;

Largest lichen (LL)

Largest five lichens (5LL)

Fixed-area largest lichen (FALL)

Size-frequency approach (SF)

Lichen cover approach (LC)

Largest lichen (LL)

When the single largest lichen of a species is used it means that the lichen that is oldest or grows in most favorable conditions is used to date the minimum age of the exposed surface.

This was the original lichenometric from which others then developed or used as reference.

Despite relying upon a single lichen this technique is praised for its simplicity and allows obtaining an image of the age of rock exposure while still in the field.

Largest five lichens (5LL)

This method is a development of the LL and was developed in the 1970s to avoid reliance on one single potentially anomalous lichen. It has been proved that neither accuracy nor precision improves significantly by having more than five lichens.

Fixed-area largest lichen (FALL)

This technique was initially specially designed for dating rockfalls and talus cones with no uniform age of deposition.

The largest thallus in a unit area is measured. The sample areas are usually boulders with surfaces of about 1 m^2.

Size-frequency approach (SF)

The analysis of size and frequency of lichens was initially done in order to study lichen populations and preexisting thalli growing on surfaces, but has since been used as an effective absolute and relative dating method.

Lichen cover approach (LC)

This method works with the premise of that the area covered by a single species will increase over time, and by measuring the total area percentage covered by a certain lichen species the age of exposure can be inferred.

AIR POLLUTION AND LICHENS

Use as Bio-indicators

Lichens are widely used as environmental indicators or bio-indicators.

If air is very badly polluted with sulphur dioxide there may be no lichens present, just green algae may be found.

If the air is clean, shrubby, hairy and leafy lichens become abundant.

A few lichen species can tolerate quite high levels of pollution and are commonly found on pavements, walls and tree bark in urban areas.

The most sensitive lichens are shrubby and leafy while the most tolerant lichens are all crusty in appearance.

Impacts of Acid Rain

Acid rain became a recognised international problem during the 1980s resulting from the dispersion of air pollutants via tall chimney stacks.

Air pollution and acid deposition has led to problems for lichens on bark, particularly because the tree bark has often become more acidic. In some areas, although gaseous sulphur dioxide levels have fallen, the bark of older trees is too acidic for recolonisation, and new growth develops on twigs and younger trees.

Some species of lichens have become more widely distributed than they were a century ago as they are more tolerant of acid conditions, such as some species of Bryoria, Parmeliopsis,

REFERENCES

Url 1.: http://www.biologydiscussion.com/lichens

Url2. https://en.wikipedia.org.

Url3. http://www.air-quality.org.uk/19.php