

Birds of a feather stick

Archaeological feather residue analysis

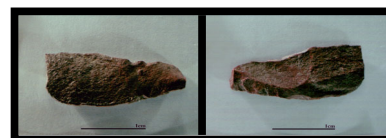
Gail Robertson



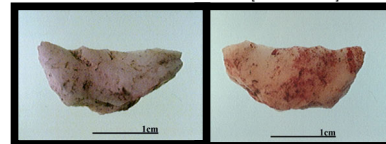
Throwing the Spear (Courtesy of Dr. Val Attenbrow)

Most research into the identification of birds by microscopic analysis of their feathers has been in the areas of taxonomy, forensic science, ecological studies of carnivore feeding habits and aeronautical bird-strike incidents. Because these methods aim to determine the Order of bird to which a feather fragment belongs, it has been the identification of downy barbules which has been the essential focus. In archaeological research, however, the question may be directed to a different level of information, for example, not "what bird is that?" but "is it bird or not?"

This paper examines some of the microscopic features of feathers used in both feather and bird identification and demonstrates the significance of this methodology in archaeological residue analysis.



Miscellaneous backed artefact (DEEP CREEK)

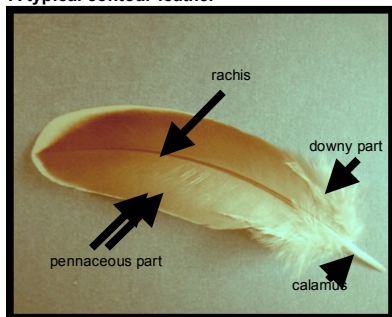


Symmetric backed artefact (DEEP CREEK)

STRUCTURE OF FEATHERS

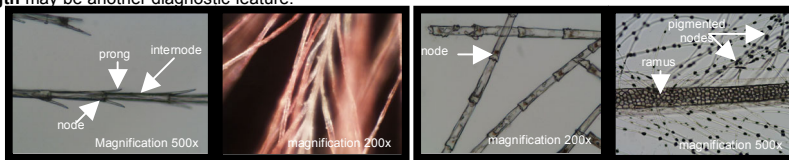
Bird feathers all have the same basic morphology, even though they differ in outward appearance. All feathers have a central shaft (or quill) made up of the **rachis** and **calamus**. On either side of the rachis are attached numerous closely set **barbs** which also have a central shaft, called a **ramus**, to which **barbules** are attached. **Barbules** are the smallest division of the feather and are of two basic types, **downy** and **pennaceous**. They consist of a flattened **base**, where they are attached to the **ramus**, and a distal **pennulum**. Barbules may be clear or coloured, with plumage colour being produced as a result of various combinations of a relatively small number of **pigments** (melanin or lipochromes) and of changes in the **structure** of the **cortical layers** in different feathers (Chandler 1916).

A typical contour feather



DOWNY BARBULES

The most obvious feature of *Downy* barbules are the distinct **nodes** which occur at intervals along an elongated filamentous **pennulum**. Most of the microscopic features used to discriminate between feathers from different groups of birds are associated with the shape of these nodes. (a) The nodes may have an **expanded** shape; (b) they may have **projections** or **prongs** of varying shapes and sizes - which may be present along the entire length of the barbule or just towards the tip or absent altogether; (c) they may be **pigmented**. The **internodal length** may be another diagnostic feature.



Threskiornis aethiopia

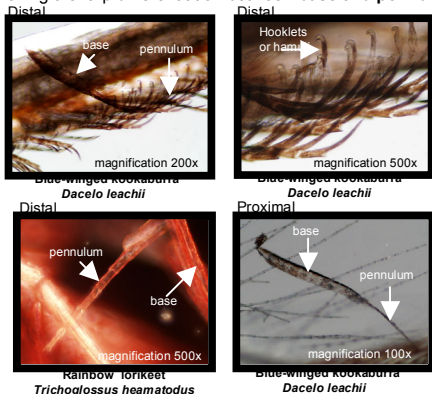
Eolophus roseicapillus

Psephotus chrysopterygius

Sphecotheres viridis

PENNACEOUS BARBULES

Pennaceous barbules are differentiated into **distal** and **proximal** forms which usually interlock with a series of distinctive **hooklets** or **hamuli** which are always present on the **distal** form. They generally have a broad flattened base with a distal **pennulum** of varying length and width. In some cases, the proximal barbules are tapering, rather than having a sharp differentiation between **base** and **pennulum**.



Blue-winged kookaburra
Dacelo leachii

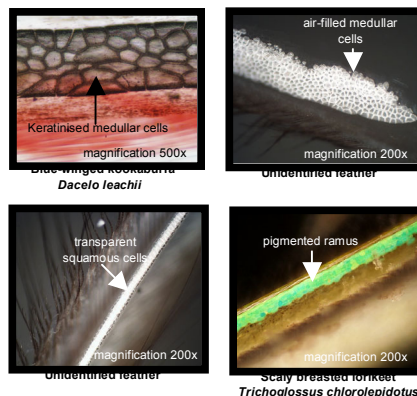
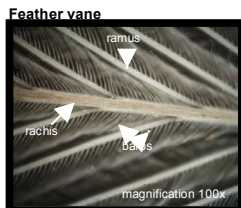
Blue-winged kookaburra
Dacelo leachii

Rainbow lorikeet
Trichoglossus heamotodus

Blue-winged kookaburra
Dacelo leachii

RACHIS AND RAMUS

The cells which make up the rachis and rami of feathers are **keratinised** and are of three types: (a) **Surface** layer - formed by a thin layer of keratinised squamous epithelium which is transparent; (b) **cortical** layer - made up of densely packed flattened cells; (c) **medullary** layer - formed by multi-angular cells of varying size with air-filled cavities (Voitkevich 1966:7).



Blue-winged kookaburra
Dacelo leachii

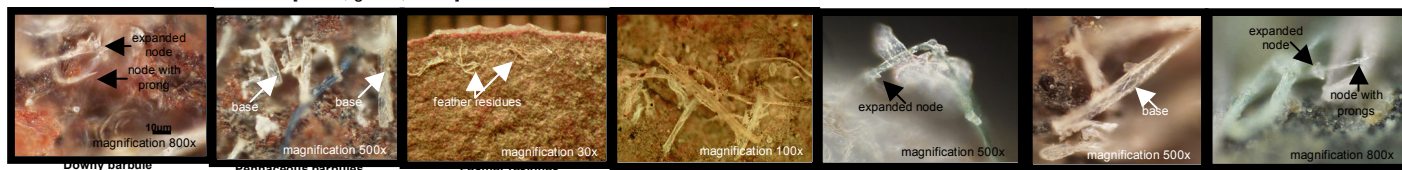
Undetermined feather

Undetermined feather

Stately breasted lorikeet
Trichoglossus chlorolepidotus

ARCHAEOLOGICAL FEATHER RESIDUES

Microscopic residue and usewear analysis of lithic artefacts dated to between 3500BP and 1000BP demonstrated that a number of these artefacts were associated with feather use and/or processing. Residues were observed using an Olympus BX60 microscope in both incident and transmitted mode at magnifications ranging from 50x to 1000x with digital image capture. Residues consisted of downy and pennaceous barbules both clear and coloured. Downy barbules on two artefacts allowed identification of the feather source to the Order Anseriformes [ducks, geese, swans].



Downy barbules

Pennaceous barbules

Feather residues

Pennaceous barbules

Downy & Pennaceous barbules

Pennaceous barbules

Downy barbules

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REFERENCES

Chandler, A.C. 1916 *Structure of Feathers*. University of California Press: Berkeley
 Voitkevich, A.A. 1966 *The Feathers and Plumage of Birds*. Sidgwick & Jackson: London