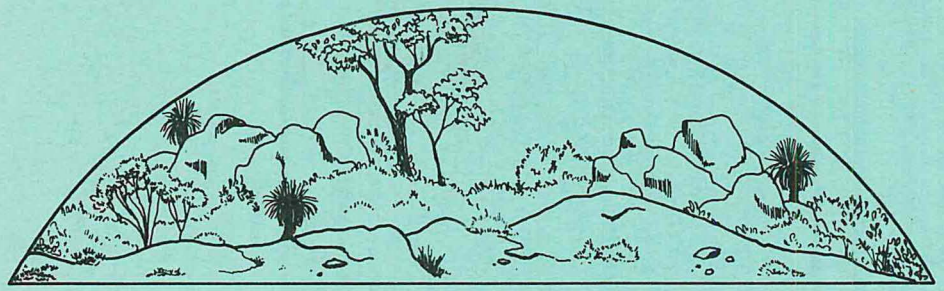
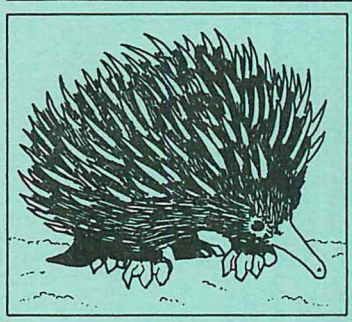
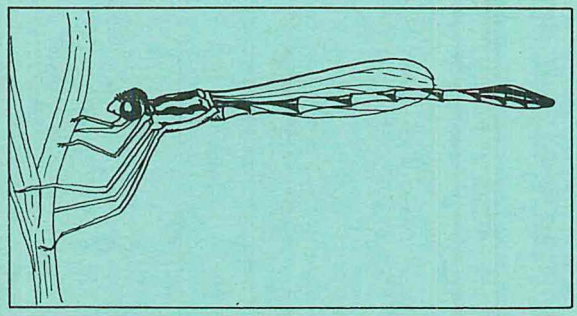
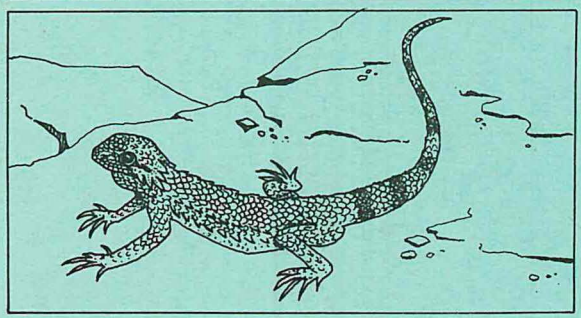
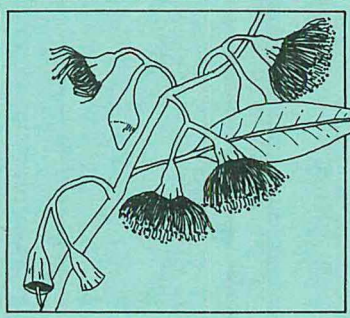


Exploring Granite Outcrops









Department of Conservation and Land Management, W.A.

Exploring Granite Outcrops

INTRODUCTION

The granite outcrops of W.A.'s wheatbelt demonstrate ecology in a microcosm. Set like islands on the undulating plain east of the Darling Scarp each outcrop has its own distinctive community of plants and animals.

Baked by the fierce summer, swept by strong winds, chilled in winter: the shallow soils of the granite outcrops are a harsh environment at the best of times.

This is a short guide to the world of the granite outcrops, and to the intricate series of interrelationships that makes up granite rock ecology.

Based on a description of the Sanford Rocks Nature Reserve, 9 km north-east of Westonia, the ecological relationships described here, and the plants and animals, are typical of those found on granite outcrops throughout the Wheatbelt.

Plants and animals living on the granite outcrops have adaptations which enable them to survive in the harsh conditions. However, their environment is easily damaged, so take care not to move rocks or disturb plants and their surroundings.

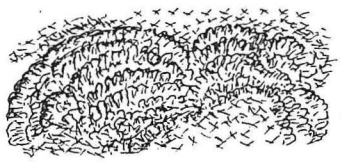
Sanford Rocks Nature Reserve was set aside in May 1899 as a water reserve of about 810 ha. The remains of one of Hall's wells, an original watering place used on the old stock and mining supply route to the Goldfields, is at the entrance to the Reserve on the east side of the road.

As you walk up onto a granite outcrop you are standing on solid granite that extends thousands of metres below the ground.

The surface of the rock is scarred and pitted by the forces of nature: by wind, rain, heat, cold and the growth of plants.

The colonisation of a granite rock is a slow process, in which many different plants take part.

Lichens are rounded growths that lie flat on the rock surface. They are the result of a symbiotic (living together) relationship between an alga and a fungus. The alga is a tiny green plant (i.e. it contains chlorophyll) that manufactures food by photosynthesis. The fungus does not have chlorophyll so it can't manufacture food. It can, however, supply shelter and water to the alga. The two plants grow together in order to survive. In the hot dry months lichens dry out without dying and when the wet weather returns they resume their normal growth.



A Lichen, Parmelia sp., an encrusting type that shows growth zones. Grey in colour, on occasions can be a dull green.

Lichens play a small part in the process of breaking down the granite. They secrete a number of very weak acids that help to fret away tiny grains in the rock surface. These grains form part of the soil in the surrounding countryside.

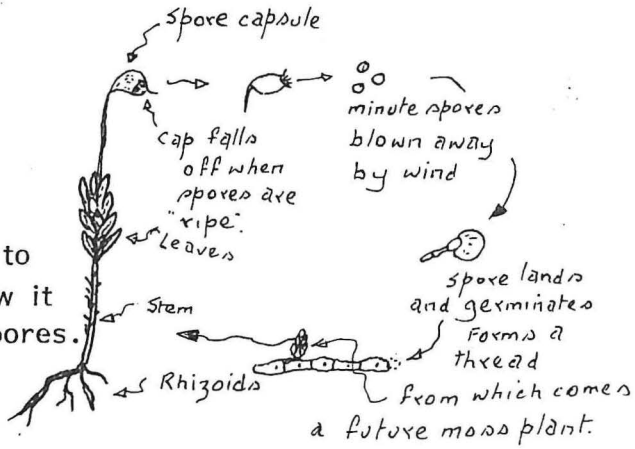
Lichens also trap dust and other material on their upper surface, forming a base for the growth of mosses.

Mosses are established by wind-borne spores. Some of these land in the lichen beds and, with the right conditions of warmth and moisture, they develop into young plants that quickly grow and colonise the area.

In the wet months of the year mosses range between bright and dark green, while in the hot summer months they dry out, becoming dark grey-brown. As with the lichens, they do not die, and quickly revive when rain falls.

Mosses trap dust, sand and organic particles. When they die, the dead moss and trapped particles form a seed bed for larger plants. Mosses do not have true root systems, but

anchoring structures called rhizoids that help to loosen sand grains from the rock.

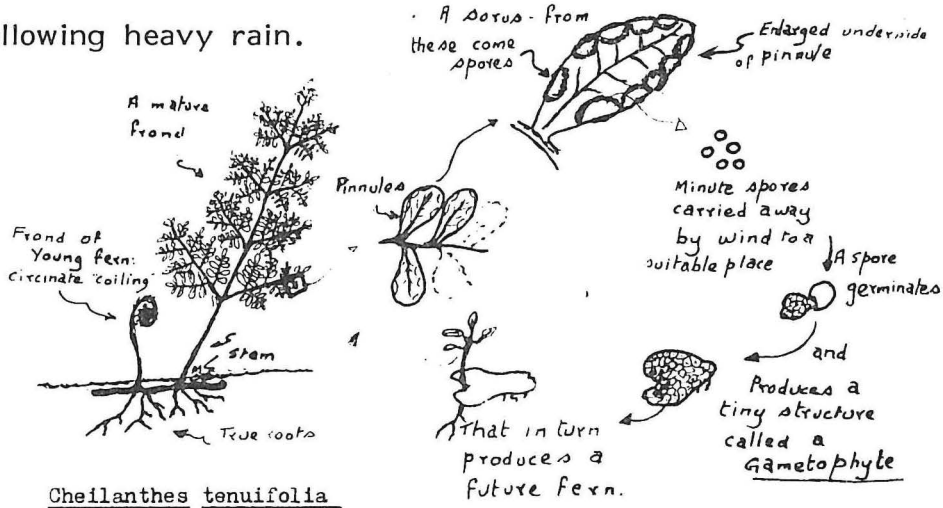


Moss plant, a diagram to show structure and how it can be dispersed by spores.

Some of the hollows and pits in the rock face, formed with the help of mosses and lichens, fill with sand grains and humus. In these places grow other types of plants including ferns.

Ferns have a similar life cycle to mosses, but instead of rhizoids they anchor to the soil with a true root system. They propagate by growing underground stems from which grow new fronds. On the underside of a fern leaf you may find small brown structures (known as sporangia) in which the spores develop. These spores, like those of the mosses, are carried by the wind.

Ferns that grow in open moss swards and in the cracks of rocks are rock ferns (*Cheilanthes austrotenuifolia*). Another kind of fern, the blanket fern (*Pleurosorus rutifolius*), can be found under hollow rocks and overhangs of granite where it is damp, and sheltered from direct sun and wind. Both of these ferns are adapted to the harsh rock environment and dry out over the hot summer months. They quickly revive following heavy rain.

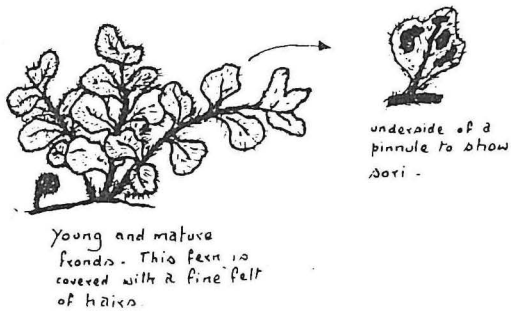


Cheilanthes tenuifolia

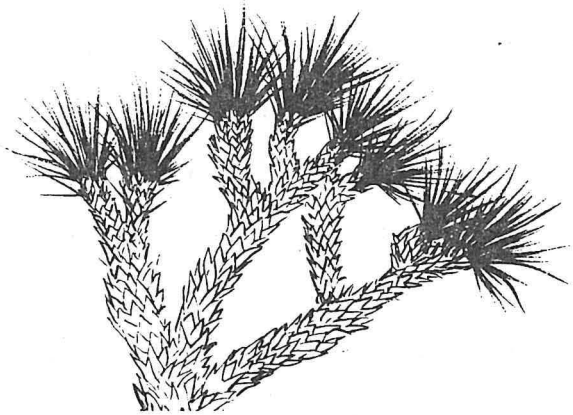
(Rock Fern). These ferns are glabrous (they have no hairs), the obvious leafy fronds produce spores , they are known as the Sporophyte generation.

Pleurosorus rutifolius

(Blanket Fern) . These ferns are covered by fine hairs. They have a similar life cycle to the Rock Fern.



The ferns, like mosses and lichens, help to build and trap soil particles, forming a seed bed for the next generation in the succession of granite rock plants. An example, common to all granite outcrops and granitic soils, is a very prickly member of the lily family, the pincushion plant (*Borya constricta*).



During the winter these grow green and upright producing flowers on the end of long stems. In the summer they dry out to a grey brown, but quickly revive with rain.

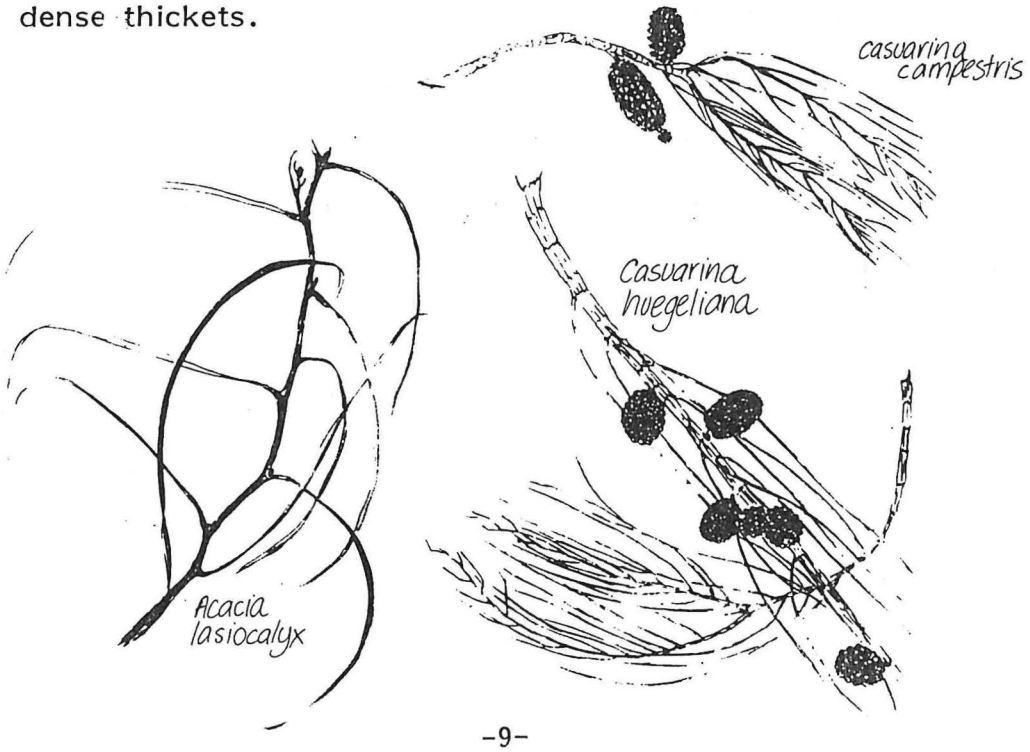
Where soils are somewhat deeper, shrubs, and even trees, are able to survive. Hop bushes (*Dodonaea* spp.) and granite kunzeas (*Kunzea pulchella*) cling tenaciously in large cracks and crevices. Granite kunzeas in the wild are found exclusively on granite rocks, and grow into very old, gnarled trees which may resemble Japanese bonsai plants.

Shallow soils in open areas are covered with a variety of shrubs and thickets including plants such as one-sided bottlebrushes (*Calothamnus* spp.), tea trees (*Leptospermum erubescens*), paperbarks or honeymyrtles (*Melaleuca* spp.), and *Thryptomene* sp. When flowering, these attractive shrubs provide a wealth of food for nectar and pollen feeding birds and insects. Many animals also feed in these thickets outside the flowering seasons, including the coccid bugs, which infect some plants and form a cottony-cushion scale.

In some of the valleys on granite rocks grow stands of the beautiful, rugged silver mallee (*Eucalyptus crucis*). The tree is found on a number of granite rocks from Kununoppin and Kellerberrin to north-east of Southern Cross. Like the caesia or silver princess (*Eucalyptus caesia*), this mallee only grows naturally on granite rocks, although both species are often grown in gardens. The trees have beautiful colours and patterns on their trunks, twisted and gnarled branches, and an interesting arrangement of the leaves on their stems.

In hollows in the rock, where soils are deeper, small trees and shrubs form dense thickets and low forests. The larger trees are commonly either wattles (e.g. *Acacia lasiocalyx*) or rock sheoaks (*Allocasuarina huegeliana*). Rock sheoaks are called "sighing gins" by Aborigines in some parts of Australia because of the mournful sound of the wind blowing through their branches.

A relative of the rock sheoak, tamma shrub (*Allocasuarina campestris*), is also common in granite areas, and may form dense thickets.

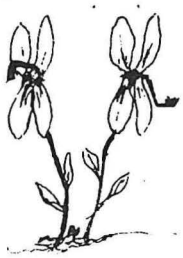


Sheoaks have separate male and female plants. Pollen from the male plants is carried by wind or insects to the female flowers: small red structures with sticky, receptive stigmas that trap the pollen grains. The fertilised flowers develop into hard, wood cones.

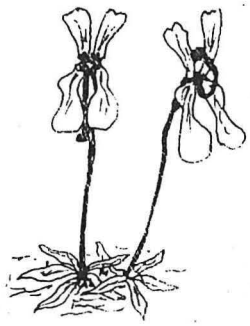
Sheoaks do not have leaves, instead modified stems called cladodes carry out the functions of leaves. The cladodes ensure that the plants survive during the hot, dry months of the year. A cladode has a series of joints; at each joint are tiny triangular structures, which are all that remain of the original leaves. The points of these lie at the end of grooves in the stem, and along these grooves are the stomata: the pores through which the plant transpires water and releases oxygen to the atmosphere during photosynthesis. Sheoaks belong to a group of plants known as xerophytes, which means they are able to grow in very dry conditions.

At the perimeter of sheoak thickets, plants such as the star of Bethlehem (*Calytrix* spp.), and or trigger plants (*Stylidium* spp.) occur.

Trigger plants have a labellum or lower lip of petals. When an insect lands on the petals, a long elastic column is stimulated and flips up like a hammer, shedding pollen on the visiting insect or receiving pollen from another plant previously visited by the insect. Some plants have "sideways" columns, but most have upright ones.



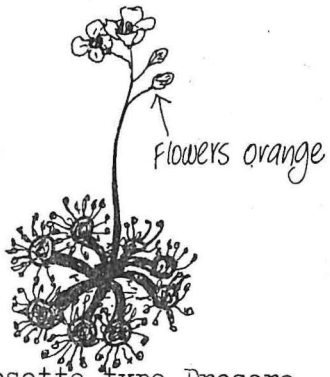
A Trigger plant with the sideways type hammer.



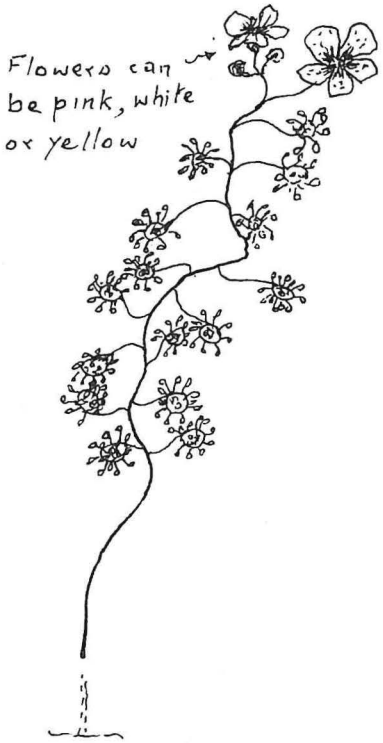
A Trigger plant with the upright type hammer.

Sundews (*Drosera* spp) are plants which catch insects for food. Some have a flat rosette of leaves covered with sticky tentacles, each with a glistening drop of trapping "glue". Other sundews are either twining climbers or upright. These have modified leaves with sticky tentacles around a hollow pit.

A Rosette or Flat feaf type Drosera.



A Rosette type Drosera with tentacle leaves. These plants can be very small.



A Climbing type Drosera

these have their leaves modified with sticky tentacles forming around a hollow pit.

The sundew's open modified leaves glisten in the sun. When an insect lands, the tentacles close over the struggling prey and more liquid is secreted. Protein is absorbed by digestive

glands in the tentacle tips. When the meal is over, the leaf dries out, the tentacles open and the insect remains are discarded. The leaf then re-secretes trapping liquid. If you look carefully on the stems of upright and climbing sundews you can often see tiny cleaner bugs (*Muridae*) moving among the sticky tentacles. These bugs feed on captured insects, but are not themselves caught by sundews.

Orchids are common in sheoak thickets. Among these are donkey orchids and spider orchids that survive in the shelter of the shrubs, where few other plants are seen.

Orchids also can be found in open spaces. The small bee orchid, a relative of the larger donkey orchid, grows in places where it is protected from wind and can take advantage of sunlight. Cowslip orchids, blue orchids and lemon-scented orchids grow in damp, open places and spider orchids can sometimes be found. One of the more interesting orchids of open places is the small elbow orchid (*Spiculaea ciliata*) which keeps flowering and sets seed long after the stems have died. Specimens in the Kew Gardens sent by

Charles Darwin from Western Australia were alive months after collecting.

Also in open areas are blue squill lilies (*Chamaescilla corymbosa*) and false blind grass (*Agrostocrinum scabrum*), which is sometimes called the blue-grass lily. After flowering, its petals become twisted in a spiral. Milkmaids (*Wurmbaea* sp.) are found in damp areas, often among patches of green moss.

Animal life amongst the granite rocks includes spiders, centipedes, scorpions, lizards, and insects. Most creatures are very shy and retiring, avoiding daylight and hunting at night. They may be seen under logs, stones, or pieces of bark but any cover lifted must be replaced with great care otherwise habitat and nurseries are destroyed and lichen is killed.

Echidnas sometimes visit sandy hollows in the rocks and leave their mark - "digs" where they have scratched for termites. These animals either burrow underground during the day or

shelter in hollow logs.

Birds using thickets and groves include Yellow-rumped Thornbills (*Acanthiza chrysorrhoa*), Singing Honeyeaters (*Lichenostomus virescens*) and Brown Honeyeaters (*Lichmera indistincta*) fossicking in the flowering shrubs of Kunzea, Thryptomene and in the needles of the sheoaks. Others such as Quail (*Coturnix* sp.) and Common Bronzewings (*Phaps chalcoptera*) are occasionally seen in thickets either sheltering or looking for seeds, while Richards Pipits (*Anthus novaeseelandiae*) may search for food over the open rock.

Many granite rocks have boulders on their surface which have been hollowed out over thousands of years. The hollows shelter many animals, including mud wasps which build their nests here. If you find mud wasp nests, you will notice that many cells are empty. If a cell is sealed, the inmate has not yet developed into the winged form and left.

To construct the nests, female wasps carry mud from areas often up to 500 m away. The completed cells are stocked

with a larder of moth larvae or spiders, depending upon the species of wasp. The female deposits an egg in the cell and seals it. The egg hatches into a grub (larva) that feeds upon the food store. It develops into a pupa and emerges as an adult wasp, a process that can take a year to complete.

If you are lucky, you may also see the nests of Fairy Martins (*Cecropis ariel*) in some hollows and caves.

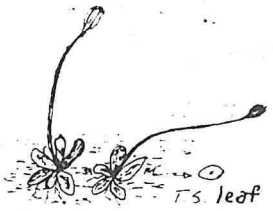
Lizards are common on rock areas and are seen on warmer days when they are most active. However lizards such as the geckoes are nocturnal, and pass the daylight hours hidden under rocks and in crevices.

Restricted to granite rocks is the handsome Ornate Dragon Lizard (*Ctenophorus ornatus*) which is often seen running across the rocks. They are harmless and when still, bob their heads up and down. There may also be Bobtail lizards (*Tiliqua rugosa*) in some sheltered spaces in the scrub. They too are harmless and may open their mouths to display large blue tongues.

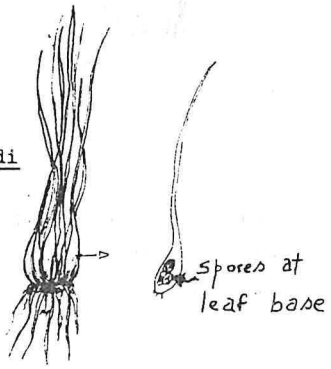
Large pools sometimes form at the base of granite rocks. Tadpoles and frogs thrive in these, and rushes around the edges provide shelter for small birds and lizards.

Water is scarce on granite rocks, however, their relatively smooth surfaces often have hollows which hold water during winter or after summer rain storms. Some may contain many plants and small animals. For example there may be the tiny rush-like quillwort (*Isoetes drummondii*), a primitive plant, whose ancestors lived over three hundred million years ago, and grew 30 m high.

Also present may be mudmat (*Glossostigma drummondii*), a small, elongated white-stemmed plant with tiny leaves, which grows from the mud beneath the water along with strands of green algae. These green plants supply oxygen for many of the small animals that live in the pools.



Glossostigma drummondi
(Mud Mat)



Isoetes drummondi
(Quillwort)

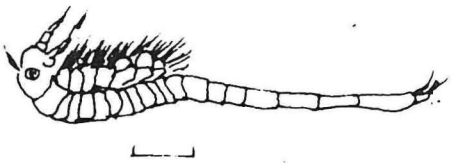
Following are drawings and descriptions of those animals.

Flatworms - Harmless relatives of the Liver Fluke.

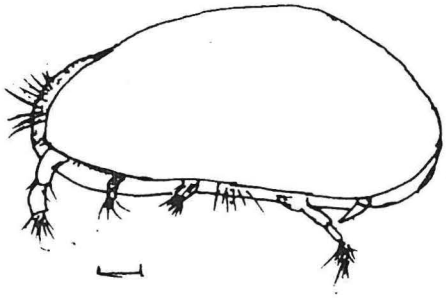
A pale brown form
2 to 5mm in size

A black form
5 to 10 mm in size

Crustaceans

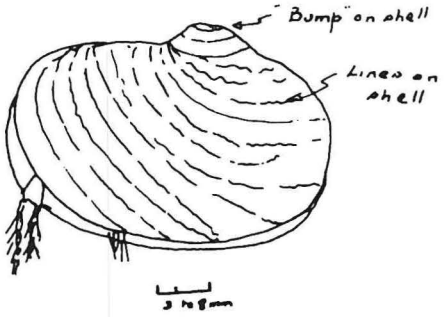


Anostraca (Fairy Shrimps)
Can reach 1cm in size

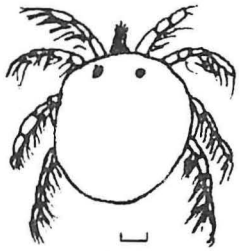


Ostracoda (Seed Shrimps)
2 to 5 mm in size

Daphnia (Water Fleas)
About 3 mm in size



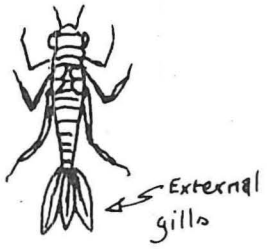
Conchostraca (Clam Shrimps)
3 to 8 mm in size



About 3 mm

Hydracarina (Water Mite)
Specimens are usually
red , some can be blue.

Insects - Odonata - Damselflies , Dragonflies

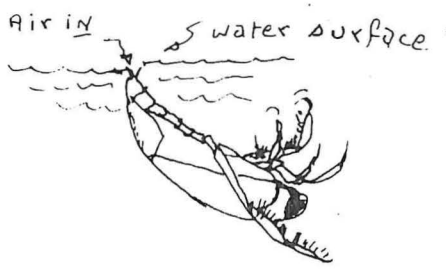


Nymph of Damselfly

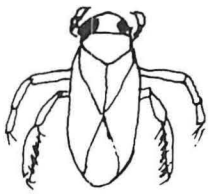
Nymph of Dragonfly

Insects - Bugs

Gerridae (Water Striders)

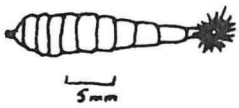


Notonectidae (Backswimmers)

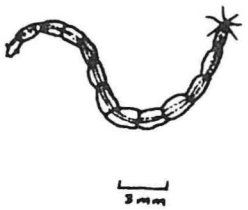


Corixidae (Water Boatmen)

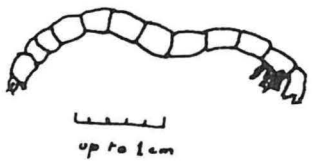
Insects - Flies (Larval Stages)



Stratiomyidae (Soldier flies)

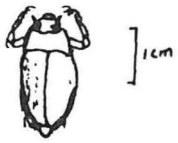


Ceratopogonidae (Sandflies)

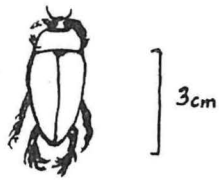


Chironomidae (Midgies)

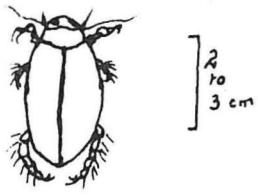
Insects - Beetles



Gyrinidae (Whirligig Beetles)



Dytiscidae (Water Tiger)



Hydrophilidae (Water Lovers)

Insects - Larval stages of Beetles

Gyrinidae

Hydrophilidae

Dytiscidae

At the highest point on Sandford Rocks is a Trig Point, a reference point used by surveyors. As granite rocks are often the highest point for many kilometres, they have frequently been used to establish Trig Points.

Looking over the rock from these high points the constant weathering process is obvious from the jumbled boulders, deep crevices and loose sheets of granite. Weathering often exposes the different rocks that comprise granite. For example, across the surface of many granite rocks there are raised, straight, narrow sections of rock of a different composition to the surrounding granite. These formations are dikes, which were formed by molten rock being forced into a cleft in the granite rock many millions of years ago. Dikes, made of a more resistant material than the surrounding granite, stand out from the rock as the softer neighbouring rock erodes away. Such differences, together with other marks caused by weathering, may form complex patterns.

Weathering of the quartz in granite forms sand, while the feldspars break down to clay. These two types of soils

provide shelter for some small animals.

In open, sandy places look for wolf spider holes (family Lycosidae). These are round with entrances surrounded by lumps of soil and small stones, and the spider may appear at the entrance if undisturbed. Wolf spiders are active at night.

Sandy areas also provide a good place for scorpions to make their burrows. The entrances are the size and outline of a scorpion with rounded top and flat base.

Within clay areas are entrances to earwig burrows -- round holes surrounded by lumps of clay -- as well as ant nests, from which ants trail to nearby flowering shrubs or trees.

There are many varieties of ant colonies. Some construct volcano-like structures at the entrance, others form burrows at the roadside, and some construct well-concealed entrances.

The influence of granite rocks on flora and fauna is not restricted to the rock itself, but spreads into the surrounding countryside.

On patches of deeper, more fertile soils around granite rocks, there are usually woodlands of wandoo (*Eucalyptus wandoo*) or salmon gums (*Eucalyptus salmonophloia*), which provide habitats for a number of animals. The flaky bark hides spiders and insects and the leaves are eaten by other insects, which in turn are the food for birds such as pardalotes (*Pardalotus* spp), thornbills (*Acanthiza* spp) and weebills (*Smicrornis brevirostris*). The hollows provide nesting spots for parrots and cockatoos, tree martins (*Cecropis nigricans*), owls and small hawks. When in flower, the wandoo blossom is visited by native bees, wasps, beetles, honeyeaters, lorikeets and other parrots.

The hollows in fallen wandoo trees are often occupied by creatures such as lizards, snakes, echidnas, insects and spiders. Trunks are eaten by termites, and boring beetle

larvae and fungi grow in the wood. All these organisms contribute to the breakdown of the wood, and its eventual return to the soil as organic material to be used by future generations of trees and other plants.

This description of a granite rock is far from complete, but it provides an insight into the varied and interesting plants and animals living in this environment. If we look after these fascinating areas, they will be homes for flora and fauna for many years to come.

Where to look for more information:

"Between Wodjil and Tor" by Barbara York Main has many descriptions of the flora and fauna of a granite rock.

"Flowers and Plants of Western Australia" by R. Erickson, A.S. George, N.G. Marchant and M.K. Morcombe Reed; has an informative section on the flora of granite outcrops which includes pictures of many plants mentioned. Your local library should be able to obtain both of these books.

There are many guides to Australian birds, and most local libraries have copies of some of them. For those interested in frogs and reptiles, the W.A. Museum is producing a series of excellent books for identification.

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