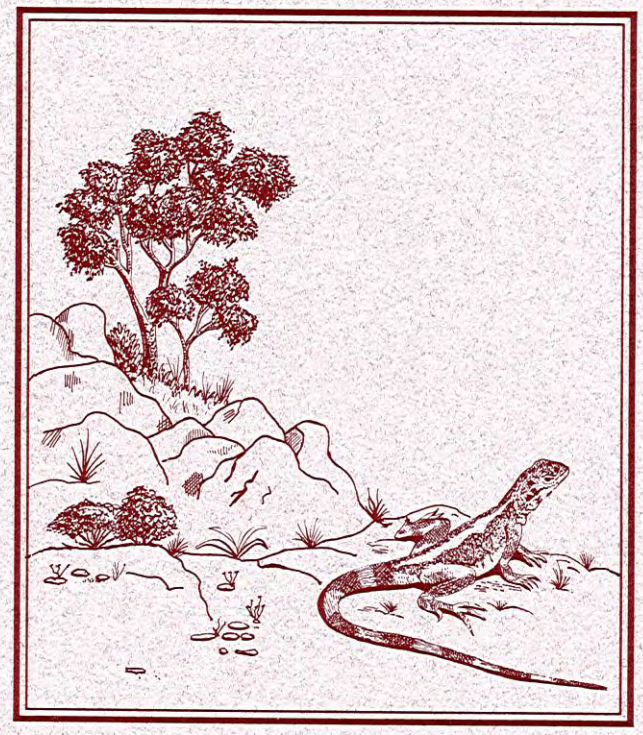
Exploring Granite Outcrops



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INTRODUCTION

The granite outcrops of Western Australia's south-west are special environments. Their shallow soils, baked by sun and drought and chilled by wind and rain, are harsh conditions. Yet each island outcrop has its own distinctive community of plants and animals that have adapted to this environment. Move a rock or disturb a plant, however, and the environment is easily damaged.

Exploring Granite Outcrops is a guide to this fragile, but fascinating, environment. It is written to assist you to understand and appreciate the value of granite outcrops. It also encourages a commitment to their preservation.

The plants, animals and ecological relationships described in this booklet are typical of those found on granite outcrops throughout the south-west.

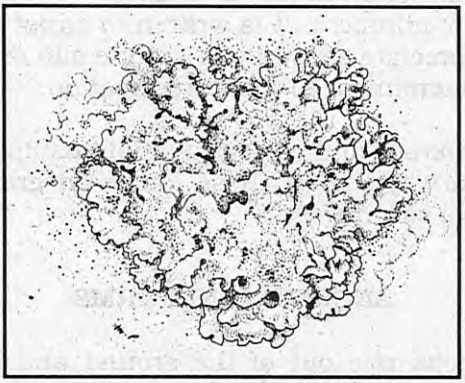
ANCIENT LANDFORMS

Granite outcrops rise out of the ground and dominate the surrounding bushland. They are part of the ancient bedrock that extends many thousands of metres below the surface. Few landforms are more ancient than these scarred and pitted rocks that have survived millions of years of nature's sculpturing. Despite the weathering, lichens, mosses and ferns transform the lifeless rock surfaces into a soil for deeper rooted plants.

THE CYCLE OF LIFE

Many different plants that survive extreme conditions are involved in the slow colonisation of a granite rock. These hardy plants create an environment suitable for the seeds of other plants, developing an increasingly complex community of plants.

Lichens, the first easily visible plants to colonise bare granite, 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 (that is, it contains chlorophyll) that manufactures food by photosynthesis. The fungus does not have chlorophyll so it cannot manufacture food. It can, however, supply shelter and water to the alga. The two plants grow together in order to survive. In summer lichens dry out without dying and in winter they resume their normal growth.



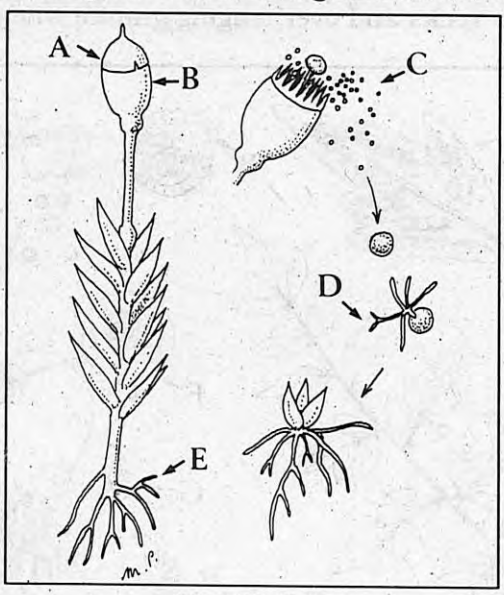
A lichen, Parmelia sp., *an encrusting type that shows growth zones. Grey in colour, or occasionally a dull green.*

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 materials 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 when conditions are warm and moist they develop into young plants that quickly grow and colonise an area.

In the wet months mosses range between bright and dark green, but in summer they dry out, becoming dark grey-brown. As with the lichens, they do not die and are quickly revived by rain.

Mosses trap dust, sand and organic particles. Dead mosses and trapped particles form a seed bed for larger plants. Mosses do not have true root systems but anchoring structures called rhizoids which help to loosen sand grains from the rock.



Moss Life Cycle

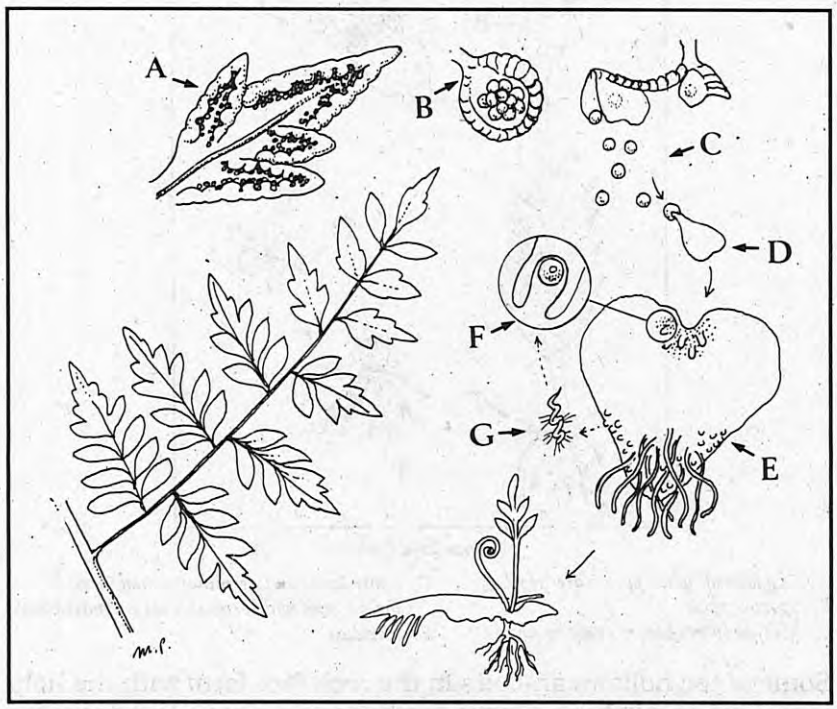
A. Cap falls off when spores are 'ripe'
B. Spore capsule
C. Minute spores blown away by wind
D. Spore lands and germinates then forms a thread from which comes a future moss plant
E. Rhizoids

Some of the hollows and pits in the rock face form with the help of mosses and lichens. They fill with grains of rock and decaying plant matter which enables other plants to grow including ferns.

Ferns have a similar life cycle to mosses, but unlike mosses they anchor to the soil with a root system. They reproduce by growing

underground stems from which grow new fronds. On the underside of a frond small brown structures (known as sporangia) may grow 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 overhanging granite where it is damp

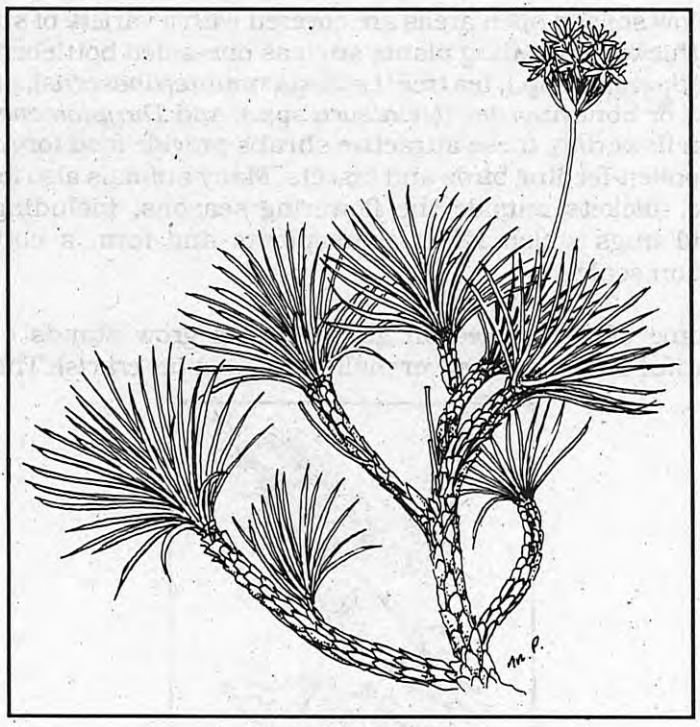


Fern Life Cycle

A. Enlarged underside of Pinnule
B. Sorus
C. Spores released
D. Spore germinates
E. Gametophyte
F. Egg
G. Sperm

and sheltered from direct sun and wind. Both these ferns have adapted to the harsh rock environment and dry out in summer. They quickly revive following heavy rain.

Ferns, like mosses and lichens, help build and trap soil particles, forming a seed bed for the next generation of granite rock plants. Common to all granite outcrops and granitic soils are very prickly members of the lily family, the pincushion plants *(Borya spp).*



Borya sphaerocephala

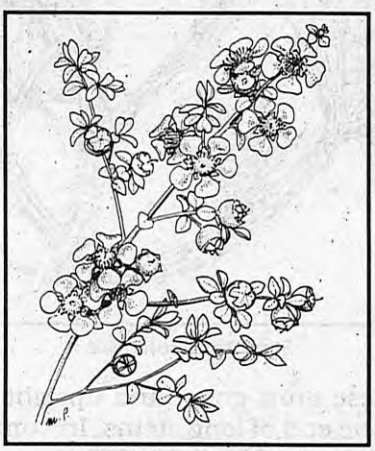
During winter these grow green and upright producing small white flowers on the end of long stems. In summer they dry out to a grey-brown, but quickly revive following rain.

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

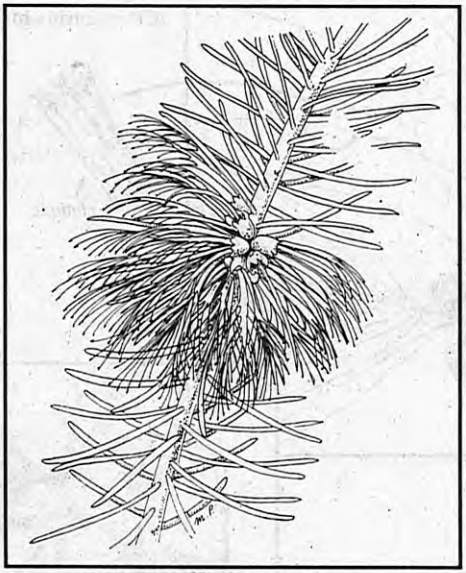
ROCKY SWALES

Shallow soils in open areas are covered with a variety of shrubs and thickets including plants such as one-sided bottlebrushes (*Calothamnus* spp.), tea tree (*Leptospermum erubescens*), paperbarks or honeymyrtles (*Melaleuca* spp.), and *Thryptomene* spp. When flowering, these attractive shrubs provide 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 gullies on granite rocks grow stands of the beautiful and rugged silver mallee (*Eucalyptus crucis*). The tree



Leptospermun erubescens

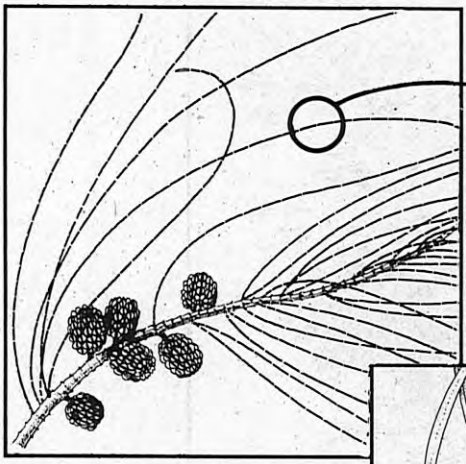


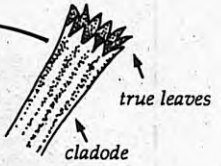
Calothamnus quadrifidis

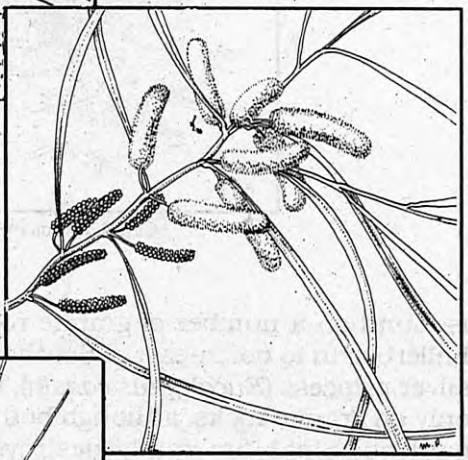
is found on a number of granite rocks from Kununoppin and Kellerberrin to north-east of Southern Cross. Like the caesia or silver princess (*Eucalyptus caesia*), this mallee grows naturally only on granite rocks, although both species are often grown in gardens. Since fire rarely destroys the vegetation cover on granite outcrops, many trees reach a great age. These 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 either wattles (e.g. *Acacia lasiocalyx*) or rock sheoaks (*Allocasuarina huegeliana*). Sheoaks are called "sighing gins" by Aborigines in some parts of Australia because of the mournful sound the wind makes when blowing through their branches.

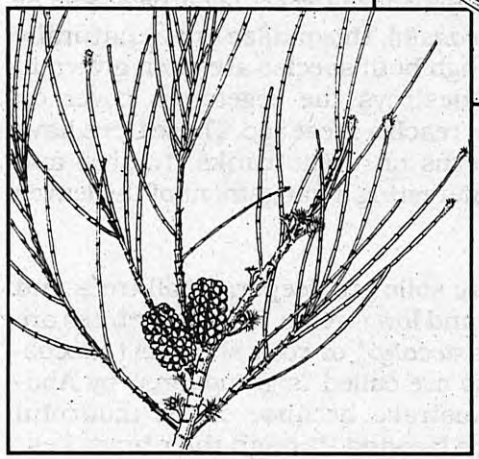
Allocasuarina huegeliana







Acacia lasiocalyx

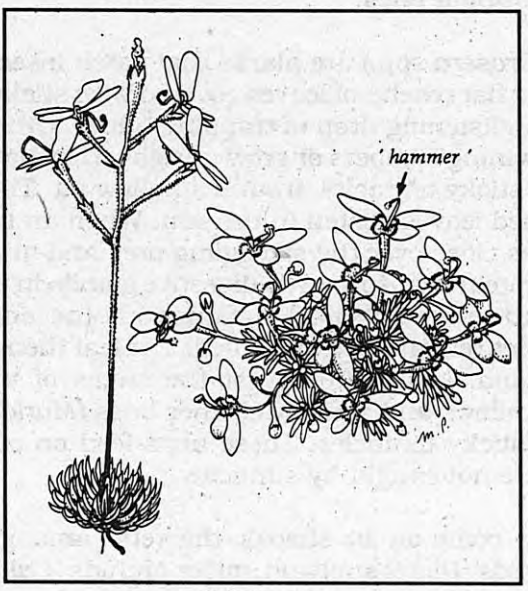


Allocasuarina campestris

A relative of the rock sheoak, the tamma shrub (*Allocasuarina campestris*), is also common in some 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 which are small red structures with sticky, receptive stigmas that trap the pollen grains. The fertilised flowers develop into hard, woody cones.

Instead of leaves, sheoaks have modified stems called cladodes which carry out the functions of leaves. The cladodes help the plants survive 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



Stylidium spp..

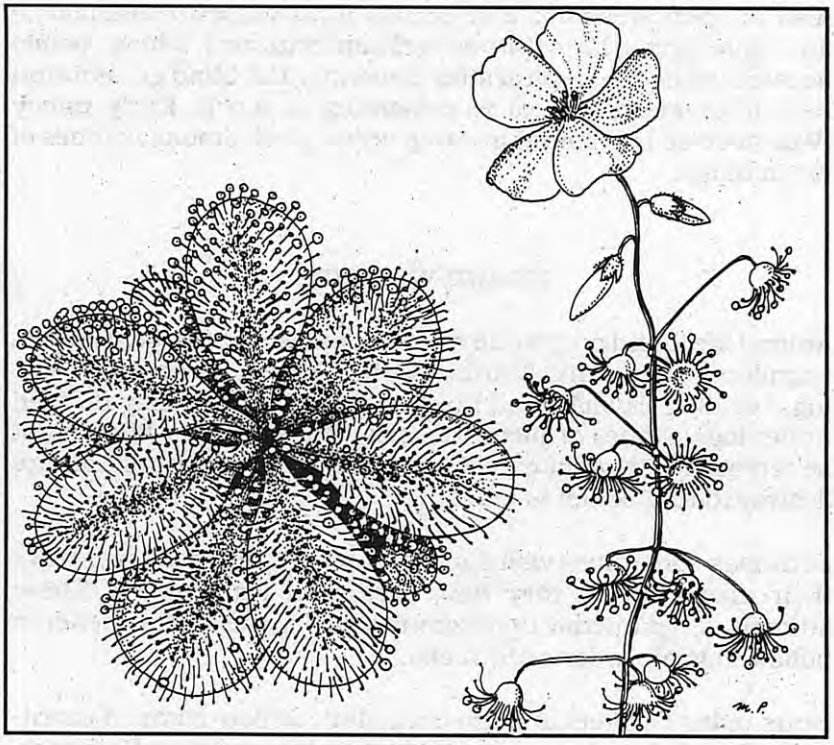
these lie at the end of grooves in the stem, and along the grooves are the stomata: the pores through which the plant transpires water and releases oxygen to the atmosphere during photosynthesis. Sheoaks belong to a group of plants known as xerophytes, which means they are able to grow in very dry conditions.

At the perimeter of sheoak thickets occurs plants such as starflowers (*Calytrix* spp.), and trigger plants (*Stylidium* spp.).

Trigger plants have a strap-like hammer which carries the flowers reproductive parts. When an insect lands on the petals, the hammer is triggered and flips over, 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.

Sundews (*Drosera* spp.) are plants that 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 grow upright. They have modified leaves with sticky tentacles 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. Look carefully at the stems of upright and climbing sundews and see tiny cleaner bugs (*Muridae*) moving among the sticky tentacles. These bugs feed on captured insects, but are not caught by sundews.

Orchids are common in sheoak thickets. Among these are donkey orchids (*Diuris* spp) and spider orchids (*Caladenia* spp) that survive in the shelter of the shrubs where few other plants are seen.



Drosera spp..

Orchids also can be found in open spaces. The bee orchid (*Diuris laxiflora*), a relative of the larger donkey orchids (*Diuris* spp), grows in places where it is protected from wind and can take advantage of sunlight. Cowslip orchids (*Caladenia flava*), blue sun orchids (*Thelymitra canaliculata*) and lemon-scented orchids (*Thelymita antennifera*) grow in damp, open places. Spider orchids (*Caladenia* spp) can sometimes by found in these conditions. One of the more interesting orchids of open places is the elbow orchid (*Spiculaea ciliata*), which keeps flowering and sets seed long after the stems have died. Specimens in the Kew Gardens in England sent by Charles Darwin from Western Australia were alive months after collecting.

Also in open areas are blue squills (*Chamaescilla corymbosa*) and blue grass lilies (*Agrostocrinum scabrum*) whose petals become twisted in a spiral after flowering. The blind grass found here (*Stypandra glauca*) is poisonous to stock. Early nancy (*Wurmbea* sp.) are found in damp areas, often among patches of green moss.

ISLAND WILDLIFE

Animal life found on granite rocks includes spiders, centipedes, scorpions, insects and lizards. Most creatures are 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 marks where they have scratched for termites. These animals either burrow underground during the day or shelter in hollow logs or under piled rocks.

Birds using thickets and groves include yellow-rumped thornbills (*Acanthiza chrysorrhoa*), singing honeyeaters (*Lichenostomus virescens*) and brown honeyeaters (*Lichmera indistincta*) which fossick in the flowering shrubs of Kunzea, *Thryptomene* and in the needles of the sheoaks. Others such as quails (*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.

On the surface of many granite rocks are boulders that have been hollowed out over thousands of years. The hollows shelter many animals, including mud-wasps which build their nests here. Often many cells in a mud-wasp nest are empty, but if a cell is sealed the inmate has not yet developed its wings.

Female wasps build the nest by carrying mud from up to 500m away. The completed cells are stocked with 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.

Sometimes nests of fairy martins (*Cecropis ariel*) can be seen in some hollows and caves.

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

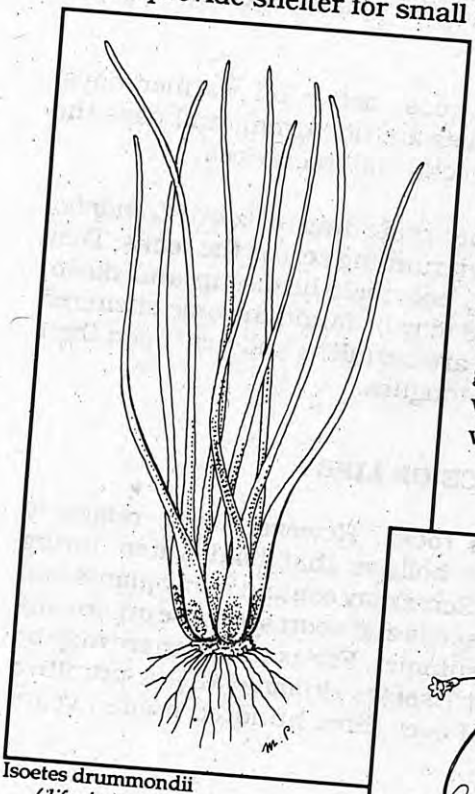
Restricted to granite rocks is the ornate dragon lizard (*Ctenophorus ornatus*), which is often seen running across the rocks. They are harmless and, when still, bob their heads up and down. Bobtail lizards (*Tiliqua rugosa*) may be found in some sheltered spaces in the scrub. They too are harmless and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

SOURCE OF LIFE

Water is scarce on granite rocks. However, their relatively smooth surfaces often have hollows that hold water during winter or after summer rain. Some may contain many plants and animals. Drought-resistant seeds and spores of these organisms lie in the dried mud during summer. 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 30m high.

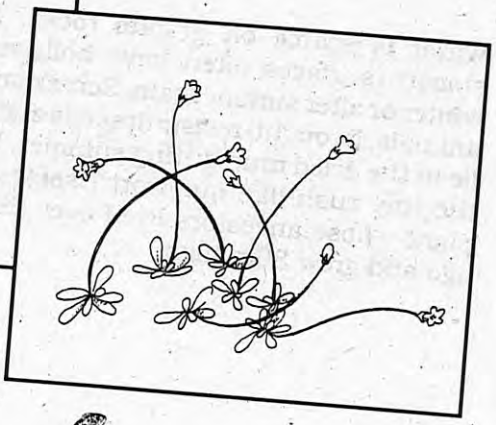
Also present may be mudmat (*Glossostigma drummondii*), a small, elongated white-stemmed plant with tiny leaves, which grows from the mud beneath the water along with strands of green algae. These green plants supply oxygen for many of the small animals that live in the pools.

Large pools that form on the granite rocks provide habitat for tadpoles and frogs. Rushes around the edges of pools near rock bases provide shelter for small birds and lizards.



Isoetes drummondii
(life size)

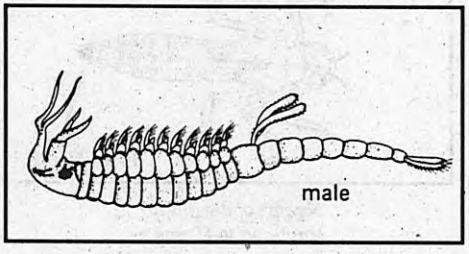
Known as gnamma holes to Aborigines, many of these granite rock pools were an important source of drinking water for tribespeople in the wheatbelt. They were also an important water source for early pioneers, and even today some towns still utilise granite outcrops as natural water catchments for their water supply.



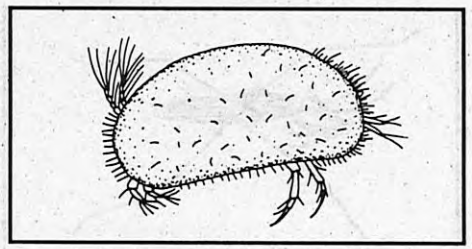
Glossostigma drummondii
(life size)

The following drawings show some of the animals which live in the granite rock pools.

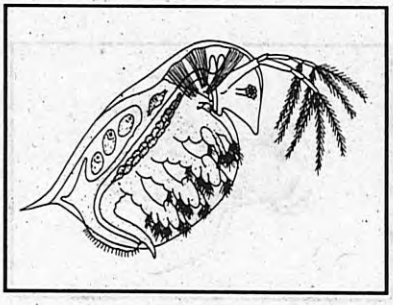
Crustaceans



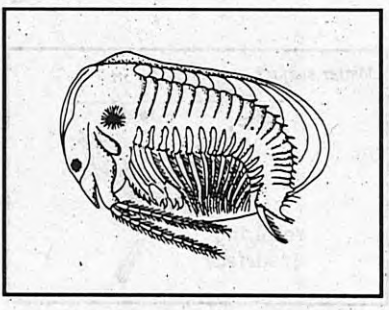
Anostraca *(fairy shrimps)*
1 to 3 cm in size



Ostracoda *(seed shrimps)*
2 to 5 mm in size

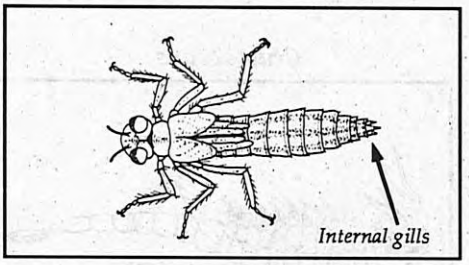


Daphnia *(water fleas)*
1 to 3 mm in size



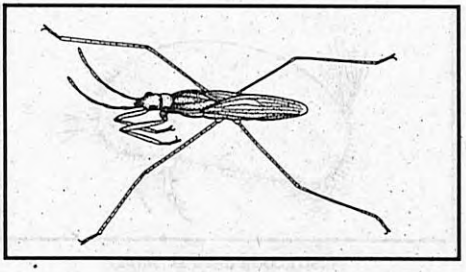
Conchostraca *(clam shrimps)*
3 to 8 mm in size

Insects - dragonflies

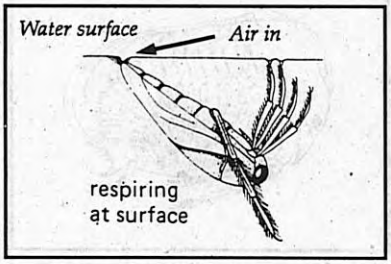


Nymph of dragonfly
length up to 40 mm

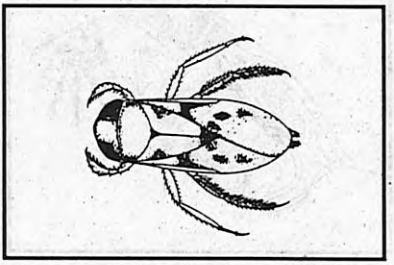
Insects - bugs



Gerridae *(water striders)*
length 8 to 12 mm

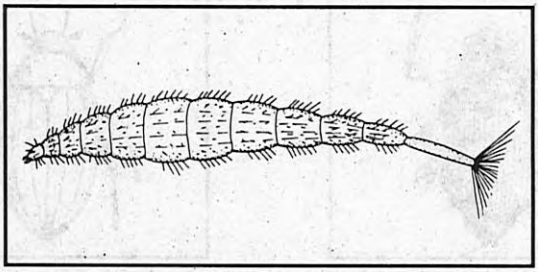


Notonectidae *(backswimmers)*
5 to 15 mm

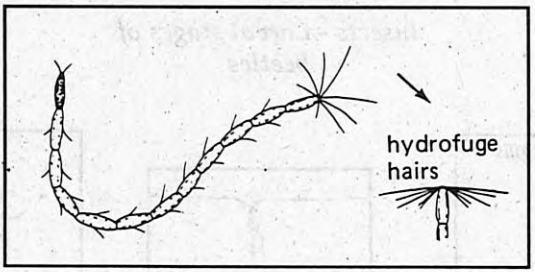


Corixidae *(water boatmen)*
5 to 15 mm

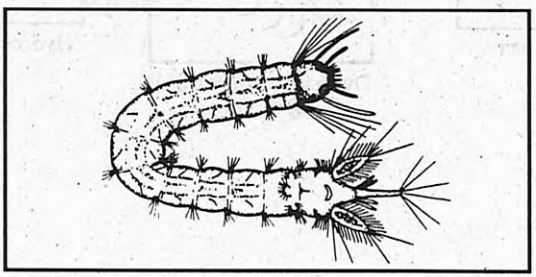
Insects - flies (larval stages)



Stratiomyidae *(soldier flies)*
up to 5 mm

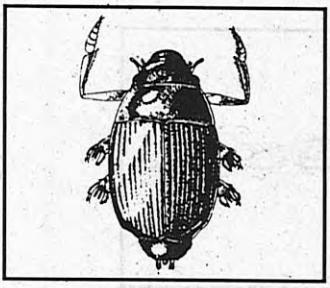


Ceratopogonidae *(sandflies)*
up to 8 mm

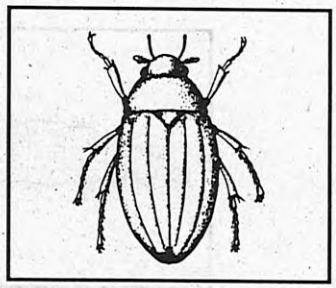


Chironomidae *(midgies)*
up to 1 cm

Insects - beetles



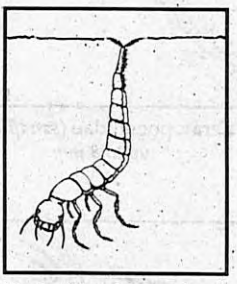
Gyrinidae *(whirligig beetles)*
up to 1 cm



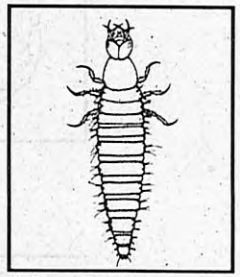
Hydrophilidae *(water lovers)*
2 to 3 cm

Insects - Larval stages of beetles

Gyrinidae *8 mm*



Dytiscidae *(water tiger)*
up to 3 cm



Hydrophilidae *2 cm*

WEATHERING TIME

As granite rocks are often the highest feature in the surrounding landscape, many have been used as Trig Points and are often mentioned in the journals of explorers and early surveyors.

Looking over the granite outcrop from these high points the constant weathering is obvious from the jumbled boulders, deep crevices and loose sheets of granite. Across the surface of many granite rocks there are raised, straight, narrow sections of rocks of a different composition from the surrounding granite. These formations are dykes, which were formed by molten rock being forced into a cleft in the granite rock many millions of years ago. Dykes, 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 granite quartz forms sand, whereas the feldspars break down to clay. These two types of soils provide shelter for some small animals.

In open, sandy places the holes of wolf spiders (family *Lycosidae*) may be found. 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 which are round holes surrounded by lumps of clay, as well as ant nests from which ants trail to nearby flowering shrubs or trees. Ant nests are varied. Some construct volcano-like structures at the entrance, others form burrows at the roadside, and some construct well-concealed entrances.

BUSHLAND RETREAT

The influence of granite rocks on plants and animals is not restricted to the rock itself, but spreads into the surrounding countryside. Importantly, the rock face catches even the lightest rainfall and sheds the water to the bushland below.

On patches of deeper, more fertile soils around granite rocks, there are usually woodlands of wandoo (*Eucalyptus wandoo*), inland wandoo (*Eucalyptus capillosa*) or salmon gums (*Eucalyptus salmonophloia*), which provide habitat for a number of animals. Spiders and insects hide in the flaking bark. Leaves are eaten by other insects, which 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 lorikeets and other parrots and honeyeaters, native bees, wasps, and beetles.

The hollows in fallen trees are often occupied by lizards, snakes, echidnas, insects and spiders. Trunks are eaten by termites and the grubs of boring beetles. 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 introduction to granite rock outcrops provides an insight into the varied and interesting plants and animals living in this special environment. If we look after these fascinating areas, they will be homes for plants and animals for many years to come, and a rewarding place to visit.

WHERE TO LOOK FOR MORE INFORMATION

- Resource Note No 21: Granite rock plant succession, Department of Conservation and Land Management
- Poster "Granite outcrops : living rocks" Department of Conservation and Land Management
- "Between Wodjil and Tor" by Barbara York Main; has many descriptions of the plants and animals of a granite rock.
- "Flowers and Plants of Western Australia" by R Erickson, A S George, N G Marchant and M K Morcombe; has an informative section on the plants of granite outcrops which includes pictures of many plants mentioned.
- There are many guides to Australian birds, and most local libraries have copies of some of them.
- For frogs and reptiles, the Western Australian Museum is producing a series of excellent books for identification.
- "Orchids of South West Australia" by N. Hoffman and A. Brown.
- Many of the animals found in rock pools are described in "Australian Freshwater Life: The Invertebrates of Australian Inland Waters" by W. D. Williams and "Freshwater Invertebrates" by Ralph Miller.

PLACES TO EXPLORE GRANITE ROCK ECOLOGY

Boyagin Rock (south-west of Brookton)
Sandford Rocks (near Westonia)
Wave Rock (near Hyden)
Mt Madden (between Ravensthorpe and Lake King)
Sullivan Rock (40km from Perth on Albany Highway)
Kokerbin Rock (north-east of Quairading)
McCurds Rock (Wongan Hills)
Yorkrakine (north of Tammin)

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