Fanning River Karst Area:
Notes on the Geology and Geomorphology

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[this PDF version has minor corrections]

SUMMARY

The Fanning River Karst Area is 65 km southwest of Townsville, and is developed on a 1 km wide belt of the Devonian Burdekin Formation. The formation comprises alternating zones of thick bedded limestones with good karst development, thinner bedded limestone with poor karst development, and poorly exposed belts of interbedded limestone, sandstone and shale with no karst features.

The surface karst comprises fluted outcrops, some well developed griked limestone pavements and scattered dolines. The 25 known caves are scattered and generally small. Two areas of denser cave development occur: in the northern area, and immediately west of the proposed quarry site in the middle area. This latter area is the most significant and contains the largest caves. The caves are thought to have formed below a higher water table during the mid Tertiary; and were drained, with occasional reflooding, during the late Tertiary and Quaternary.

Rope Ladder Cave (FR-2) is the largest and most complex cave in the area. It may have the best detailed exposure of a fossil reef in Australia, and is an important educational and scientific resource. The Maternity Cave (FR-1) is biologically significant as it is a bat maternity site. One other cave (FR-7) is of uncertain biological significance, and occurs within the proposed quarry site. Two other caves (FR-8 and 20) have minor geological significance.

INTRODUCTION

This preliminary report contains information collected in the area with officers of the Division of Conservation, Parks and Wildlife (CPW) from 31st July to 4th August, 1989. The CPW continued to explore the area for a further week, and discoveries during that period have only been partly integrated with this report. The area inspected lies on Fanning River Station, 65 km southwest of Townsville. The emphasis of the trip was to assess the potential of the whole area, so I only visited one of the previously known caves (FR-2).

Nineteen new caves were found during the visit, and are described herein. A locality map, showing all the cave sites, is being prepared by CPW.

In the following descriptions, the karst district is divided into three areas (Figure 1). The Northern Area lies to the northwest of the Fanning River. The Main Area is the belt of limestone which extends from the River east then south to the Mingela-Dotswood road. It can be further divided into west and south ridges for descriptive purposes. The Southern Area is a complex of outcrops extending from the road south to, and across, the Fanning River. The proposed quarry sites on the mining lease held over the area are located at the northern end of the south ridge of the Main Area (see Figure 1).

The existence of caves in the area was first recorded by Jack (1879). Published descriptions of the caves appear in Dwyer (1970), Graham (1972b), Jolly (1978), and Matthews (1985).

A number of unpublished reports and submissions are held by the Department of Resource Industries on the GSQ "Caves General" file 4-76-1 (Wyatt, 1969; Graham, 1972a) and on file 4-34-11 (Krosch, 1973); and by the University of Queensland Speleological Society (Graham, 1973).

Detailed, but not entirely accurate, maps of four of the previously known caves (FR 1, 2, 3 & 4) are contained in a North Australian Cement Ltd report held on open file at the Department of Resource Industries (Aylmer, 1973). Maps of the caves discovered during the present study are included in the present record (Figs 7-16).

GEOLOGY

The karst area is developed on the richly fossiliferous middle Devonian Burdekin Formation of the Fanning River Group. The formation comprises alternating belts of (a) thick-bedded coarse-grained limestone which forms good outcrops with karst features, (b) belts of thinner bedded limestone which breaks up into rubble with only poor outcrop and rare karst features, and (c) belts of interbedded limestone, sandstone, and shale, which weather to a limestone rubble, but do not develop karst features. The types 'a' and 'b' are shown on the photo-interpretation maps (Figs 2, 3 & 4) in dense and open stipple, respectively. The limestones are very coarse-grained calcirudites, with lesser calcarenites and calcilutites. The coarser, thick-bedded rocks were deposited in a high energy fringing reef environment - much of this coarse material is storm debris. The reefs are dominated by the large, reef-building stromatoporoids (an extinct group, possibly similar to the sponges; Kershaw, 1988), and a variety of coral forms. The finer grained and thinner bedded sediments were deposited in more quiet tidal flat, bay and offshore environments. A granitic coast lay only a short distance to the east, and some granite cobbles are incorporated in the coarser-grained limestones offshore.

The limestone ridges follow the strike of the Burdekin Formation. The big bend between the west and south ridges of the Main Area is a result of a southwest-plunging syncline. Dips on the south ridge are steep to the west, those on the west ridge are gentle to the south. In the Northern Area also there has been some folding, but dips appear to be generally shallow. In the Southern Area, which was not visited by the author, the structure appears complex.

The presence of silcrete between 360 and 370 m altitude on the eastern flank of the south ridge of the Main Area could indicate the presence of a Tertiary land surface at that elevation. Mid and late Tertiary land surfaces occur elsewhere in the region and silcretes are generally associated with the mid-Tertiary surface. However, there are no preserved relics of old land surfaces in the cave area, so the association of these silcretes with the mid-Tertiary surface must remain speculative.

GEOMORPHOLOGY

Surface Karst: The limestone outcrops show some grikes (joints which have been enlarged by solution into narrow fissures), rillenkarren (narrow solution flutes), and solution pans. However, surface solution sculpturing is not well developed when compared with the Chillagoe and Broken River karst areas.

An unusual, dipping limestone pavement occurs at the eastern end of the west ridge of the Main Area. This is a dip surface formed by the stripping away of a thinner bedded muddy limestone which overlays a thicker bedded calcirudite (the contact between these two units can be seen in the main chamber of Ladder Cave, FR-2). The pavement has scattered grikes, some of which connect with caves (e.g. FR-1).

Dolines are rare and restricted to collapse depressions over cave entrances (e.g. those of FR-3, and FR-13). Surface drainage is still integrated; which is not surprising, given the narrowness of the karst-forming limestone belts.

Caves: Individual caves examined during this visit are described in Appendix 1. Sketches of caves which were mapped by the author are also attached. Maps of the caves surveyed by the CPW are being prepared by M. Godwin of CPW. The descriptions in the appendix are based partly on the field sketches and descriptions of the author and partly on those by M. Godwin.

The caves appear to be mainly restricted to the thick-bedded limestone belts, but some extend into adjoining areas of thinner bedded limestone (e.g. the southern end of FR-2). Most are in the west and south ridges of the Main Area, and in the northern part of the Northern Area. Only one cave was found in the Southern Area. Four small caves were found within the proposed quarry areas on the south ridge (FR-7, 9, 10, and 11). One of these (FR-ll) was not entered, as the entrance fissure was very tight; but might be a fissure cave (see Appendix 1). FR-7 might have some biological significance.

Most of the caves have vertical shaft entrances, a few have walk-in entrances from collapse dolines. Many of the smaller caves are 'potholes' - having a simple vertical shaft or fissure entrance with minimal horizontal development at the base. The larger caves show strong joint control of their passage directions.

All caves appear to have formed in a nothephreatic environment (totally water saturated, and with very slow water movement). The evidence for this is the smoothly irregular solution sculpturing of the walls, with the development of honeycomb-like hollows and roof pendants; the strong joint and bedding plane control on passage directions (Fig. 6); and the lack of any evidence for flow-directed conduits, or of horizontal undercuts at old water-tables. In some of the small 'pothole' caves, there is evidence of some sculpturing by vertical vadose seepage - water running down the walls has cut vertical runnels (e.g. FR-20).

Most of the cave development must have been at times of higher and stable watertables, with the slow flow rates implying a low surface relief. This requirement would fit well with the time when the mid-Tertiary land surface existed in the area. The higher water tables could also imply a wetter climate, which existed during most of the Tertiary.

In the smaller caves, the floor is generally covered by rubble which has fallen from above. In the larger caves there are red-brown mud floors, which would be the insoluble residue left after the solution of the limestone. This would have settled to the floor while the cave was still filled with water. In parts of Ladder Cave (FR-2), the mud floor has been cemented by calcite at the surface; and where the underlying softer mud has been washed out, 'false floors' result. In a few caves, the sediments have been reworked by small streams which have flowed through the cave (eg. FR-19), but little stream erosion of the limestone appears to have occurred - the only example seen was a small undercut at floor level in FR-19. Guano forms significant deposits in Maternity Cave (FR-1) and The Shaft (FR-7), but only small and isolated blankets of guano occur elsewhere.

Speleothems (secondary calcite deposits) are not common, and only about half those seen appear to be currently active - the others have a white powdery weathered surface. Common types include carrot-like stalactites, larger compound chandeliers with associated stalagmites, some small straws, shawls on the walls, and some flowstone floors. 'Cave coral' occurs in the smaller, drier caves. Resorbed speleothems occur in a number of caves: some, near entrances, have probably been dissolved by rain water running or seeping in from above; others, further in, are sculptured in continuity with the solid limestone walls - which implies a period of draining and speleothem development followed by flooding and further phreatic solution of both the walls and the speleothems. The presence of old cemented cave earths and breccias exposed in the present walls also supports this interpretation of a prior period of drainage and re-flooding.

The caves are generally warm and dry, but the larger caves are humid. At the time of our visit, the main chamber of FR-2 registered 26˚C and a relative humidity of 96%.

The only pools of water seen were in the entrance passage of FR-2. The absence of water in FR-15, on the flat below the main ridge, indicates that the depth to the present water table is greater than 12 m there, and it would be considerably deeper below the surface of the ridge.

HISTORY OF KARST DEVELOPMENT

The cave features are not compatible with the present topography or climate, thus implying a significant age for the caves. The nothephreatic environment indicated by the cave forms could have existed beneath a mid-Tertiary land surface. The climate was also wetter during the Tertiary, which would have maintained high watertables and a more vigorous vegetation cover, providing aggressive waters to dissolve the limestone.

It is therefore postulated that the main stages of cave development occurred in the mid to late Tertiary. The first drop in water table may have been in the late Tertiary as a result of a drier climate and the dissection of the mid-Tertiary surface.

In Ladder Cave (FR-2), the initial passages were drained and filled with cave earth, breccias, and speleothem deposits. A subsequent rise in water table then flooded the passages again and further solution enlarged the old passages, and formed additional passages, which truncated the older cave deposits. A second draining of the caves was followed by development of more speleothems, some of which have also been resorbed, possibly by another flooding or by aggressive seepage waters.

These subsequent watertable fluctuations could have been due to fluctuating wet and dry climates superimposed on an overall fall in water level related to surface denudation. Fluctuating climates are a feature of the Quaternary period.

The development of the smaller caves may have been less complex. Those found at the present ridge tops may be older than the lower level caves, as they would already have been above the regional water table when the mid-Tertiary surface formed. The fissure on the flat below the ridge (FR-15) is in an anomalous position, and may be a younger cave formed during one of the wetter stages of the Quaternary. Ridge foot caves are commonly associated with gullies which have directed runoff towards them, but there is no corresponding gully on the ridge in this case.

As the land surface was denuded, it exposed the higher parts of the caves, forming entrances where it intersected shafts, and collapse dolines where it intersected large chambers. The known caves are only those which have been intersected by the land surface; it is quite possible that the proposed quarry could break into deeper caves.

At present, cave development appears to be restricted to minor solution by vadose seepage and flow in the wet season, and minor speleothem development, coupled with collapse in unstable areas (especially near the entrances). At the surface, various forms of karren (small scale surface solution sculpturing) are developing on the bare limestone surfaces. Cave development could be continuing at and below the present watertable but this would be well below the surface, and connections with the surface are unlikely.

GEOLOGICAL AND GEOMORPHIC SIGNIFICANCE OF THE AREA

The main geological significance of the area, apart from its limestone resources, lies in the scientific value of the limestone exposures in the caves. Exposures of the Devonian reef facies are particularly good in Ladder Cave (FR-2), and good exposures were also seen in caves FR-8 and FR-20. The CPW descriptions of the limestone in caves FR-22 and FR-25 suggest that a visit by a geologist is warranted.

Ladder Cave may have the best detailed exposure of a fossil reef in Australia, and might even be of world significance. These exposures would make it an excellent study and teaching site for geologists, and also for biologists studying the modern Great Barrier Reef. The slightly acid cave waters have etched out the reef building stomatoporoids and corals. The internal and external growth structures of these fossils are exquisitely preserved, allowing detailed examination, in places in three dimensions, by scientists interested in both modern and ancient reef development. A separate study of the Ladder Cave exposures was made by geologists from the Queensland Department of Mines and James Cook University, and a report is in preparation by S. Lang & others.

The geomorphic significance of the karst lies in its good examples of nothephreatic speleogenesis. However, these are only significant at the local scale - they would be the best in the Townsville region, but good examples can also be seen elsewhere in Queensland. The area is the nearest known karst and cave area to Townsville, and is much more accessible than the Broken River area further to the northwest. The large limestone pavement above Maternity Cave is an unusual surface feature.

The best of the karst features are in the Main Area on the southern side of the west ridge running 1.5 km west from the syncline (Grid reference 444182 to about 430189). This area includes the largest, and most important, of the known caves (Ladder and Maternity Caves). A small area in the Northern Area, at about G.R. 413226, also had a good array of both surface and subsurface karst forms, but no big caves were found during a brief investigation. Cave FR-8 on the south ridge of the Main Area (at G.R. 435169) is a small but complex cave which also has good exposures of the limestone facies.

PROTECTION OF THE CAVES

At present, the caves show little defacing or vandalism, mainly because the landowners have exerted tight control on visitation. However, with increasing publicity and improved access, vandalism could become a problem. Ladder Cave gets some protection from casual visitors because of the need for a rope and ladder in order to enter it, but this would not stop determined vandals. Any suggestions for the provision of a permanent ladder in this cave should be resisted.

J. Toop has noted that there has been a fall of rock in the main chamber of Ladder Cave in the last ten years. The roof is in thin-bedded limestone, which would be naturally less stable than the thicker bedded limestone. This thin-bedded limestone also occurs at the western end of the cave, and that area should also be regarded as potentially unstable. The mass of honeycombed rock at the top of the ladder pitch in this cave has only a few relatively small connections with bedrock, and if any cracking occurred in this area because of nearby blasting, it could become a major danger to people entering and leaving the cave. This area would have to be monitored regularly during any quarrying operations nearby.

It is very difficult to suggest a minimum safe distance for blasting next to these features; only time will show if the limits discussed by W.F. Willmott and J. Toop in December, 1988 (150 m) are large enough. Comparison with Mt Etna seems the best basis at present, but at Fanning River the thin-bedded limestone is obviously weaker than the thick-bedded limestone, and one would suspect that both these may be weaker than the massive limestones of Mt Etna. Speleothems will always be weaker than the bedrock. The author would certainly argue against any reduction in the suggested limits to the nearest location of blasting, and this buffer zone should be increased as much as is compatible with an economic quarry site.

In the author's view, it would appear impossible to see any planning solution that would allow the proposed quarry to exist within the karst area without losing the overall geomorphic and scenic integrity of the area. If quarrying is to proceed at all, this integrity will have to be sacrificed as it could not be restored after the proposed quarrying ceased. At a more detailed level, four of the smaller caves occur within the proposed quarry sites on the south ridge and would also be lost; but this is less important geomorphologically than the overall loss of integrity of the area. The larger and more important caves are outside the currently proposed quarry sites, but the edge of one proposed quarry is only 100 m from the entrance of Ladder Cave.

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APPENDIX 1: CAVE DESCRIPTIONS

FR-1: Maternity Cave
Main Area - west ridge. Not visited by author. 390 m of passage, depth uncertain. A set of joint-controlled, narrow, deep fissures leads to a large dome. Contains extensive guano and is a bat maternity site (Miniopterus spp). This is the biologically most important cave in the area.

FR-2: Rope Ladder Cave
Main Area - west ridge. 800 m of passage, 20 m deep. An entrance passage leads to an 8 m ladder pitch down to the main cave level, which is a horizontal system of large chambers interconnected by a maze of joint-controlled passages. The western part of the cave comprises a set of smaller, damp passages. Contents include some good formations, resorbed formations, local thin patches of guano, some bats, many spiders and insects. The bedrock has excellent exposures of calcirudites (see text).

FR-3: Hovans Hole
Main Area - west ridge. Not visited by author. 85 m of passage, 18 m deep. A large collapse doline leads to a simple inclined passage.

FR-4: Bat Cave
Main Area - west ridge. Not visited by author. 160 m of passage, depth uncertain. Two entrances leads to a set of joint-controlled inclined straight passages. Contains some reasonable decoration.

FR-5: Pretty Cave
Main Area - west ridge. Not visited by author. 60 m long, depth uncertain. A narrow joint-controlled cave with some good decoration.

FR-6: Walk in Cave
This cave is currently lost. It may have been a duplicate description of Bat Cave.

FR-7: The Shaft
Main Area - south ridge. Not visited by author. Described by John Toop (1984). A vertical shaft leads to a dome which contains a large amount of fresh guano. The biological significance of this cave is still uncertain (pending Toop's report).

FR-8: Unnamed Cave
Main Area - south ridge. 110 m of passages, 16 m deep. An 8 m pitch down a vertical shaft leads to a small complex of interconnected chambers and passages. An additional 2 m pitch needs a handline. There is a final fissure which was not fully explored. Contents include some reasonable decoration (flowstone and cave coral), occasional bats (Rhinolophus), and spiders. There is an old, partly dissolved coarsely crystalline flowstone in the entrance shaft. The limestone is steeply dipping stromatoporoid (reef-building sponges) cobble calcirudite, alternating with a pebble-sized shell and coral calcirudite with a dark mud matrix. The floors are of rubble, red earth, and solid limestone.

FR-9: Bother Cave
Main Area - south ridge. 15 m of passage, 7 m deep. A steep inclined shaft leads to a small chamber and passage. Contents include some dead, and a little live karst formation.

FR-10: Plumtree Cave
Main Area - south ridge. 20 m of inclined passage, 20 m deep (not bottomed). A steep inclined shaft leads to a small tight fissure guarded by cave coral which was not entered. Pebbles were falling at least 5 m down the fissure. Contents include some decoration (cave coral), and spiders.

FR-11:
Main Area - south ridge. A tight entrance, not yet penetrated. Rocks were dropping at least 10 m down the entrance fissure. The occurrence of several nearby small rubble-filled dolines suggests that the development may be a fissure running along strike.

FR-12: Warragal Cave
Main Area - south ridge. 20 m of passage, 5 m deep. A large collapse doline, with the remains of what would once have been a large chamber at its NW margin. Contents include numerous large old stalactites, some of them broken. The bedrock is poorly exposed, and comprises steeply dipping (45˚) calcirudite, with alternating beds of stromatoporoid cobbles and tube-coral gravel. The floor is of rubble, dust and timber.

FR-13: Nightshade Cave
Main Area - south ridge. 25 m of passage, 10 m deep. A collapse doline leads to a single large chamber aligned along strike. Contents include extensive good carrot-shaped stalactites, and some chandeliers, columns and stalagmites. Some of the stalactites have small bumps on them which might be incipient helictites. There is some breakage and graffiti. There were some bats (Rhinolophus). The bedrock is a stromatoporoid calcirudite.

FR-14: Graveyard Cave
Main Area - south ridge. 14 m of passage, 5 m deep. A small collapse doline leads to a single, long rubble-floored chamber that follows the strike. It contained little decoration apart from some flowstone near the entrance. There were several macropod skeletons in the cave. The bedrock is of interbedded pebble coral calcirudite and cobble stromatoporoid calcirudite; dipping at 50˚ to the northwest.

FR-15: Flat Fissure
Main Area - west flank of south ridge. A 10 m long, 8 m deep fissure with a 4 m shaft at the bottom occurs on the flat to the west of the main ridge. Its location is unusual (see text).

FR-16: Two Shawls Cave
Main Area - west ridge. Not entered by author. 10 m of passage, 6 m deep. A deep grike and shaft leads to two short low passages. Contents include two flowstone shawls. The sketch map is based on a description by M. Godwin.

FR-17:
Northern Area - in scrub. 19 m of passage, 7 m deep. A wide entrance fissure has short passages extending from each end. Contents include some reasonable decoration (flowstone and shawls), moths and spiders. The fissure is in limestone, but the NE passage is in a moderately soft, faintly mottled, massive calcareous material which might be an old cave fill or fault gouge material.

FR-18: The Pit
Northern Area - in scrub. Not inspected by author. 2 m of passage, 6 m deep. A large shaft opens into a chamber with three small passages.

FR-19: The Fissure
Northern Area - in scrub. 48 m of passage, 10 m deep. A single long curving fissure has a complex cross section, with vertical branches and high-level chambers. There are a few small side fissures. It contains some flowstone and cave coral. A small intermittent stream channel appears to have undercut the wall at one spot. The floor is of rubble and stream sediment. The far end, which rises into a widened fissure, is very humid. The walls are partly in solid limestone and partly in softer calcareous material similar to that seen in FR-17.

FR-20: Calcirudite Cave
Northern Area - in scrub. 12 m of passage, 7 m deep. A pit leads to a pair of short passages. The large one has at its end vertical runnels (20 cm across) cut into the walls by vadose seepage. The floor at the end of this is of loose rubble in a sump, and might be a possible dig for future exploration. Leaf litter in cracks in the walls suggests at least partial flooding during the wet season. The bedrock is of stromatoporoid cobble calcirudite and tube coral pebble calcirudite, with some muddy beds, and would make a useful, but small, reference site for the geological description of the area.

FR-21:
Northern Area - in scrub. 19 m of chamber and passage, about 5 m deep. A large tumble-block doline leads to a single daylit chamber with a few short passages. The floor is of rubble and dusty earth. There is a little flowstone. The walls are of thin to medium bedded limestone with cobble, pebble, and sandy beds; but the bedrock exposure is not good. The limestone dips 8˚ to the SW.

FR-22: Toe Cave
Northern Area - on open ridge. Not visited by author. 23 m of passage, 4 m deep. An entrance slot drops into a SW trending chamber, with two small passages. The CPW reported fossiliferous rocks. It contains a little dead cave formation. There is also an untagged pit about 100 m west of this cave.

FR-23:
Main Area - west ridge. Over 50 m of passage, not fully explored. A large grike leads to a short passage to the NE and a larger joint controlled set of passages to the west. There is a high level set of low roofed chambers and passages above the main floor level, which appear to have been controlled by a soluble bed in the limestone. This cave warrants further exploration.

FR-24:
Northern Area - in scrub. Not visited by author. 13 m of passage, 4 m deep. The entrance shaft leads to three short joint-controlled passages. Contains some dead formation, spiders, and snail shells.

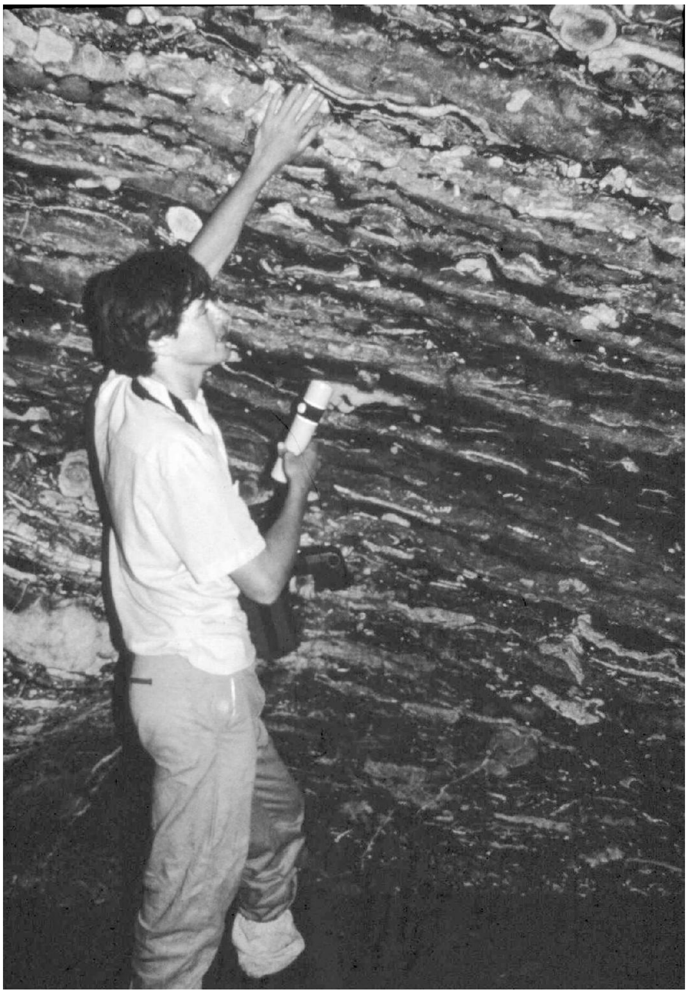
FR-25: Bullanticlimax
Southern Area. Not visited by author. 9 m of passage, 8 m deep. An 8 m shaft leads to a curving passage. Contains some active formation (flowstone, gours and shawls), some dead formation, bones, spiders, shells; and a live rat and bull-ants. The limestone has well exposed thin beds that dip at about 10˚.

PLATE 1

Limestone exposures in Rope Ladder Cave (FR-2)

(a) Bedded, low energy, facies

(b) Rubble facies



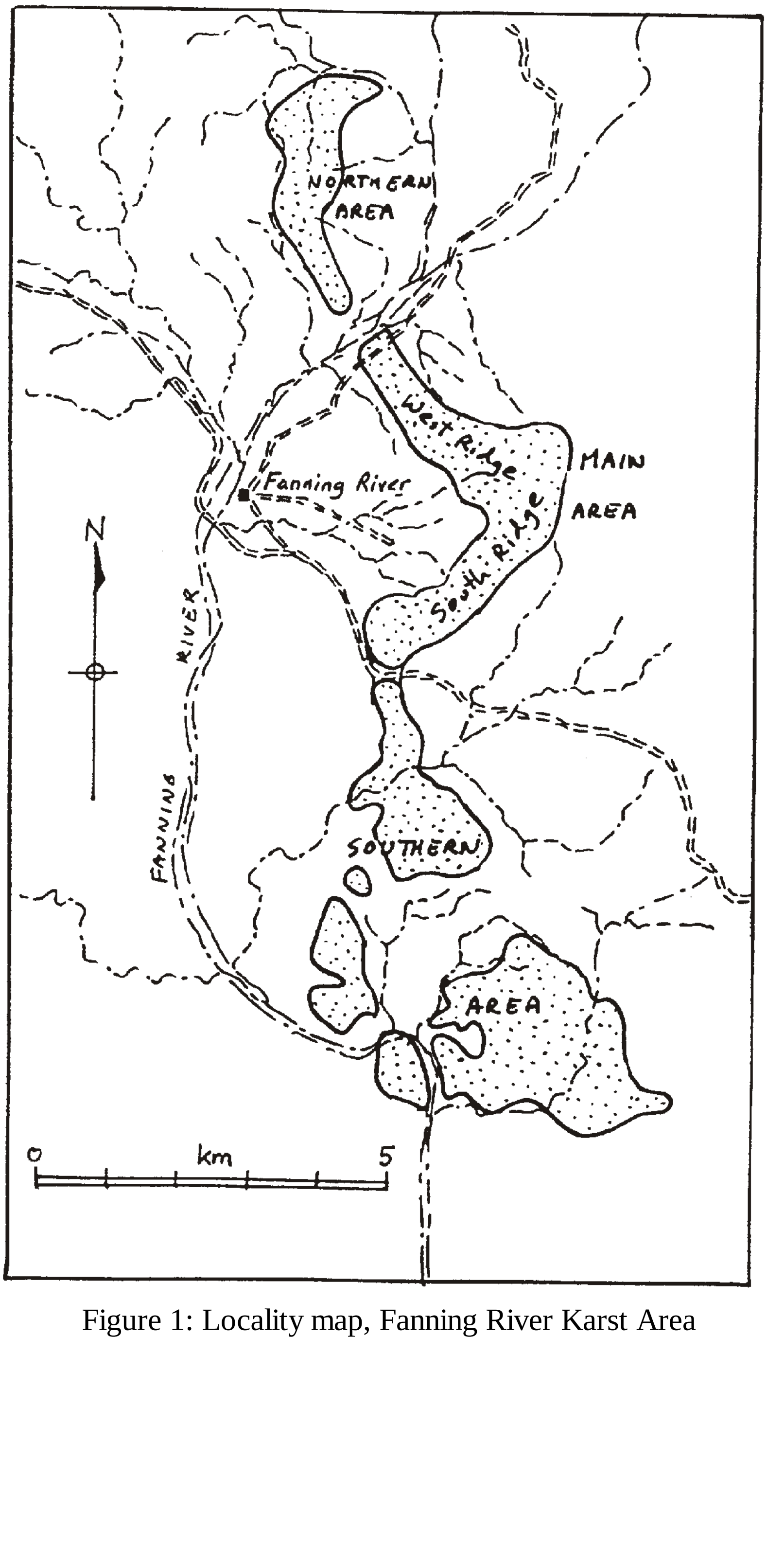
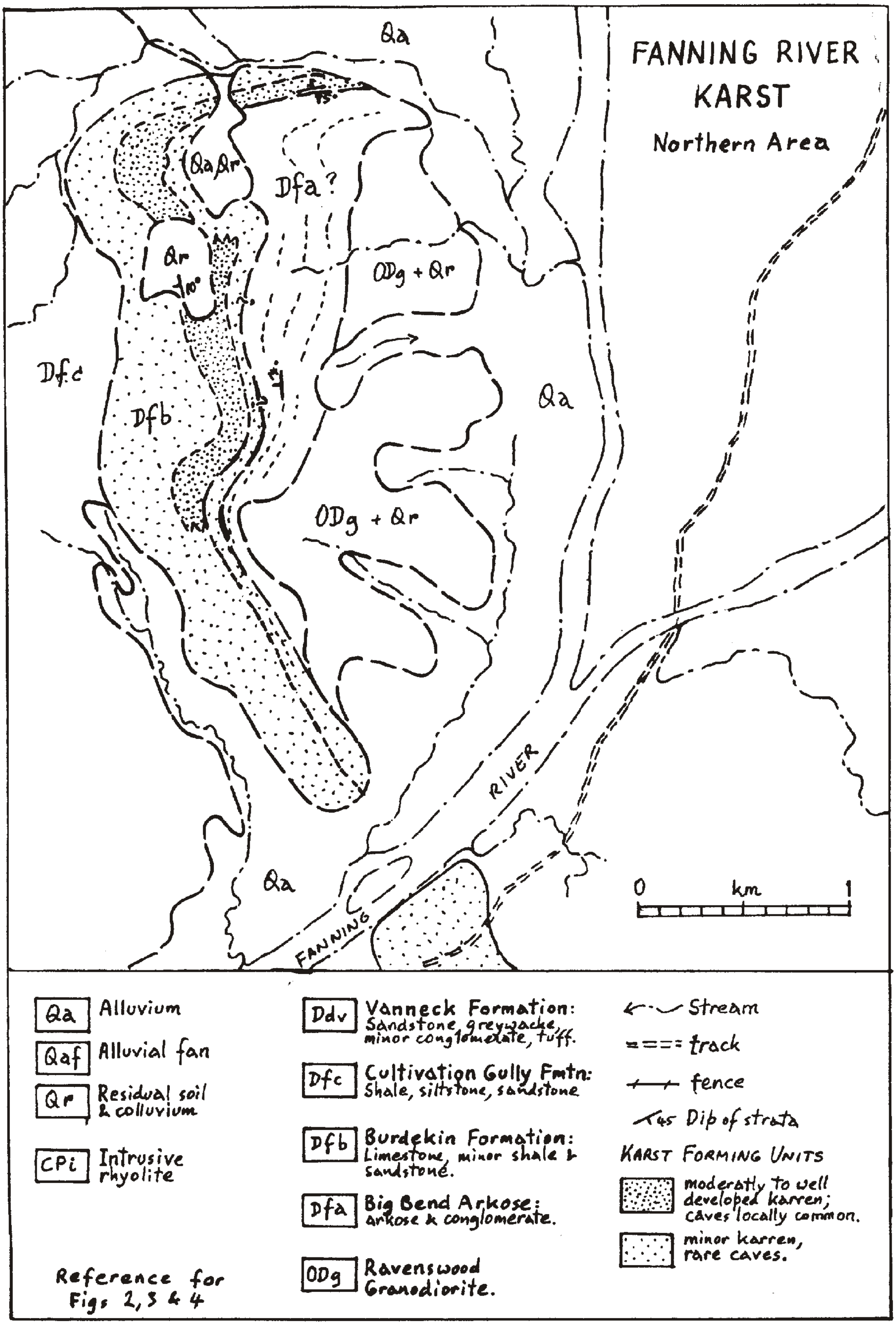


Figure 1: Locality map, Fanning River Karst Area



FANNING RIVER KARST
Northern Area
Qa
Qa Qr
Dfa ?
Qr
ODg + Qr
Dfc
Dfb
Qa
ODg + Qr
RIVER
FANNING
Qa
0 km 1
Qa Alluvium
Qaf Alluvial fan
Qr Residual soil & colluvium
CPi Intrusive rhyolite
Ddv Vanneck Formation: Sandstone, greywacke, minor conglomerate, tuff.
Dfc Cultivation Gully Fmtn: Shale, siltstone, sandstone
Dfb Burdekin Formation: Limestone, minor shale & sandstone.
Dfa Big Bend Arkose: arkose & conglomerate.
ODg Ravenswood Granodiorite.
Stream
track
fence
Dip of strata
KARST FORMING UNITS
moderatly to well developed karren; caves locally common.
minor karren, rare caves.
Reference for Figs 2, 3 & 4

Figure 2

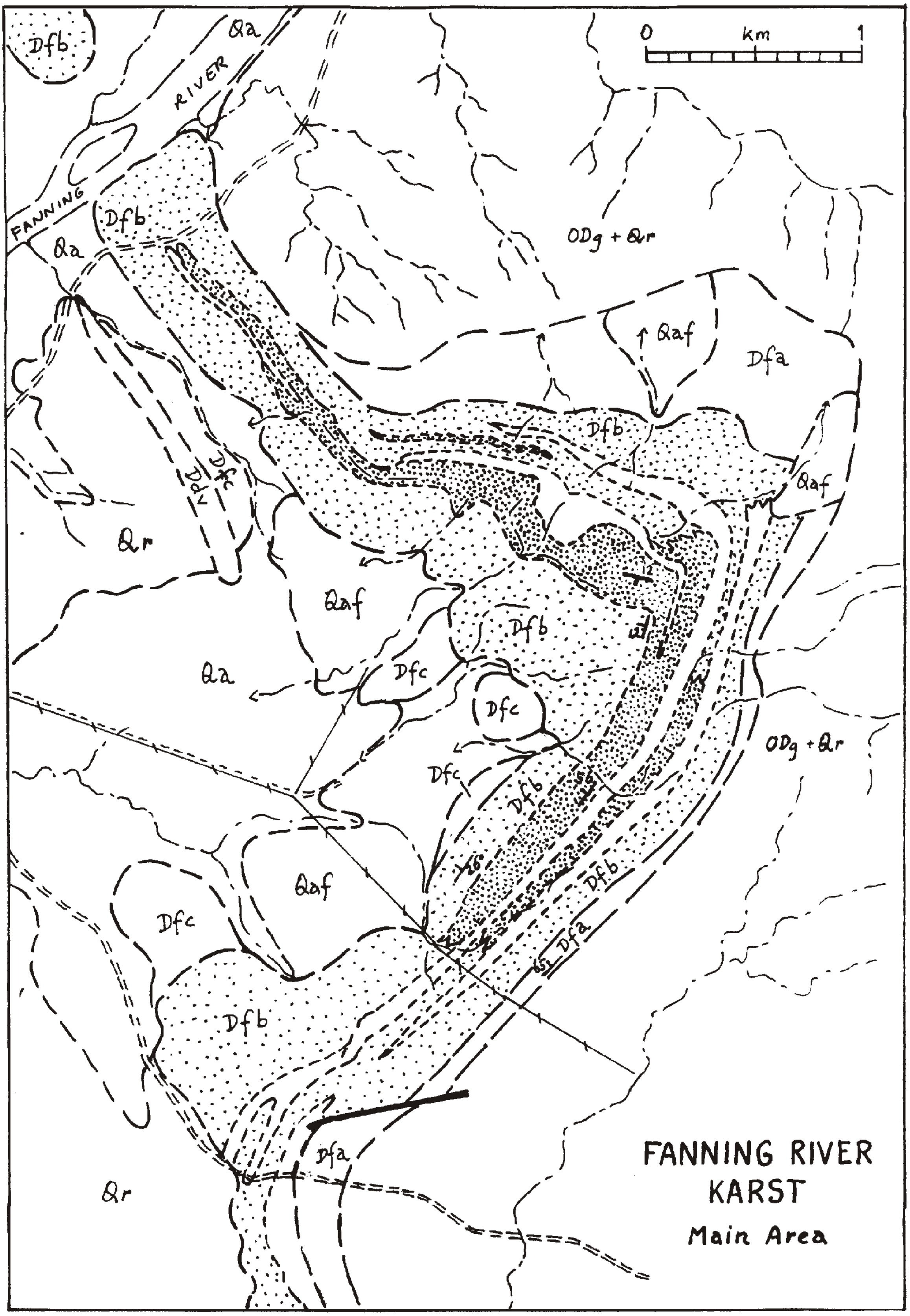
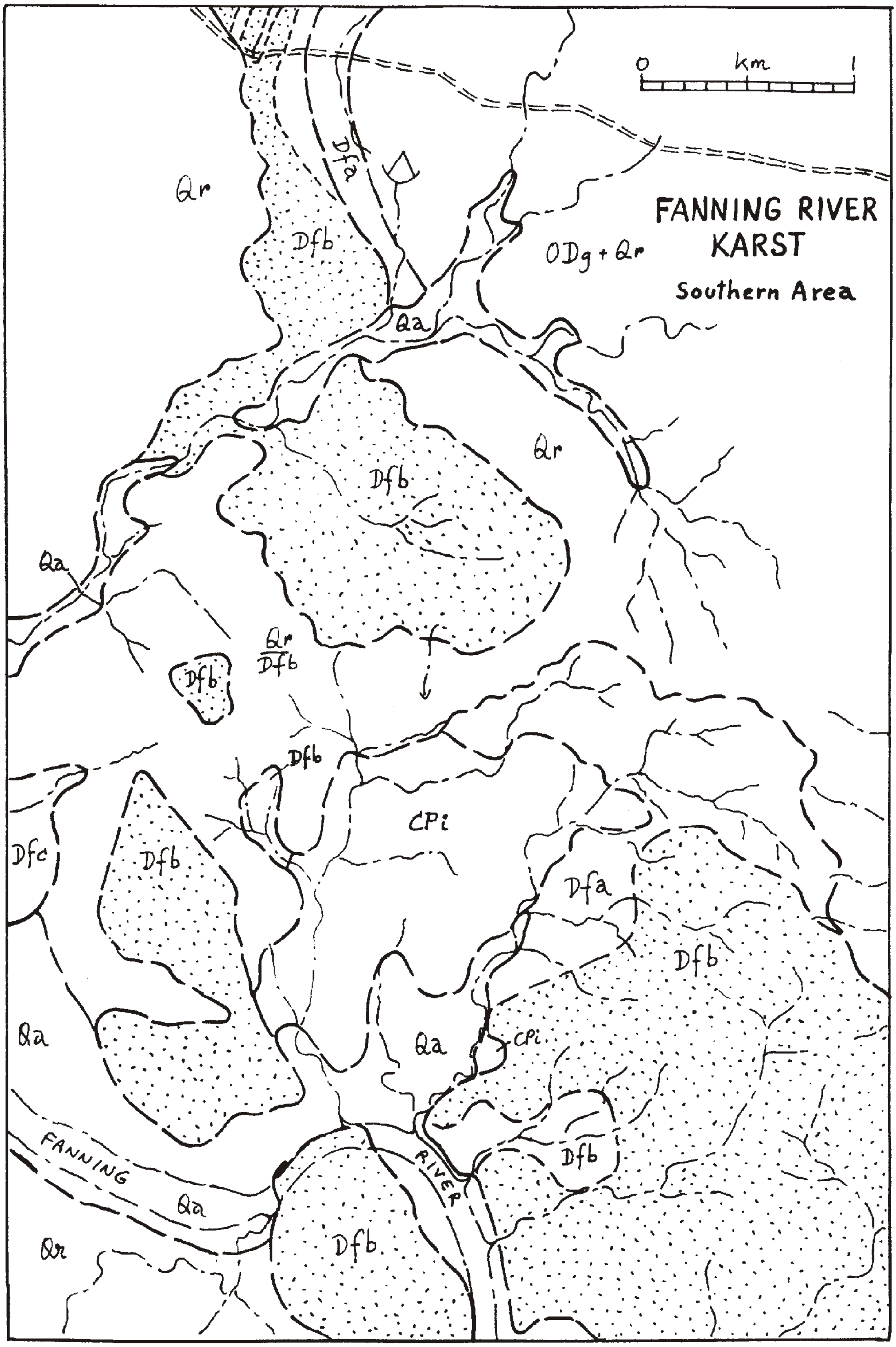

FANNING RIVER
KARST
Main Area
0 km 1
FANNING RIVER
Qa
Dfb
ODg + Qr
Qaf
Dfa
Qr
Dfc
Dfv
Qa
ODg + Qr

Figure 3



FANNING RIVER
KARST
Southern Area
0 km 1
Qr
Dfa
Dfb
ODg + Qr
Qa
Qr
Dfb
Qa
Qr
Dfb
Dfb
Dfb
CPi
Dfc
Dfb
Dfa
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Qa
Qa
CPi
Dfb
FANNING
RIVER
Qa
Qr
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Figure 4

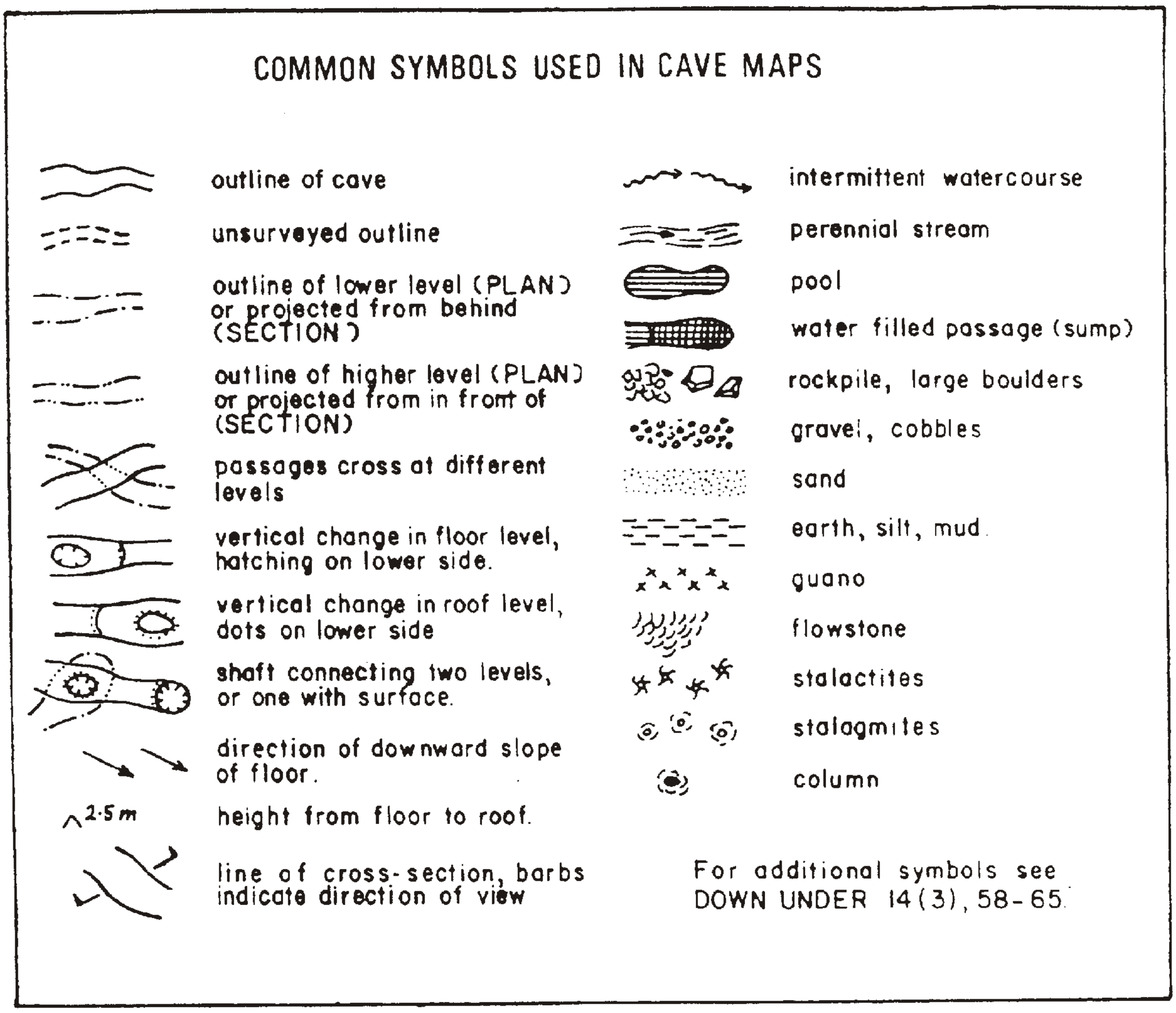

COMMON SYMBOLS USED IN CAVE MAPS
outline of cave
unsurveyed outline
outline of lower level (PLAN) or projected from behind (SECTION)
outline of higher level (PLAN) or projected from in front of (SECTION)
passages cross at different levels
vertical change in floor level, hatching on lower side.
vertical change in roof level, dots on lower side
shaft connecting two levels, or one with surface.
direction of downward slope of floor.
2·5 m
height from floor to roof.
line of cross-section, barbs indicate direction of view
intermittent watercourse
perennial stream
pool
water filled passage (sump)
rockpile, large boulders
gravel, cobbles
sand
earth, silt, mud
guano
flowstone
stalactites
stalagmites
column
For additional symbols see DOWN UNDER 14(3), 58-65

Figure 5

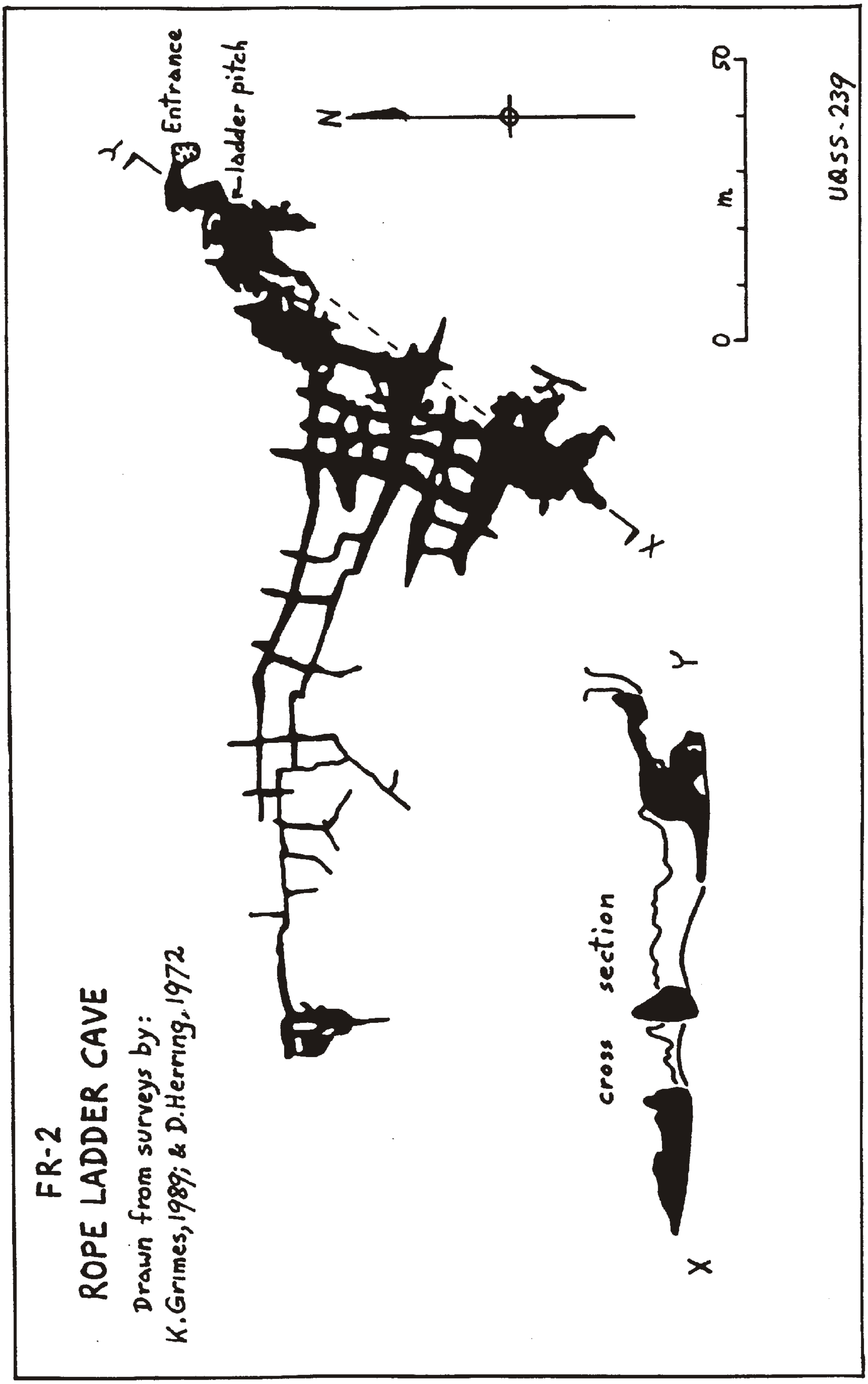
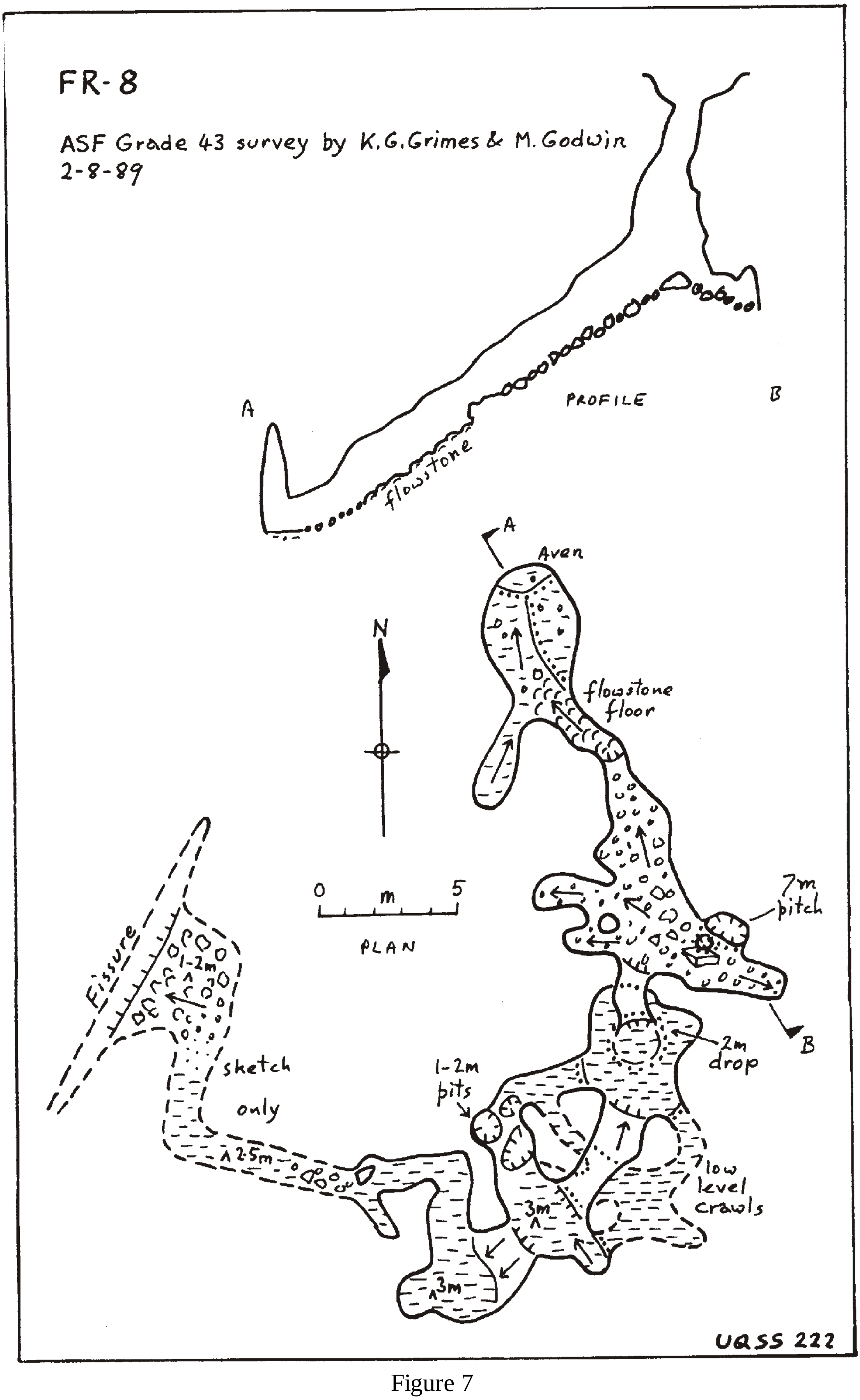
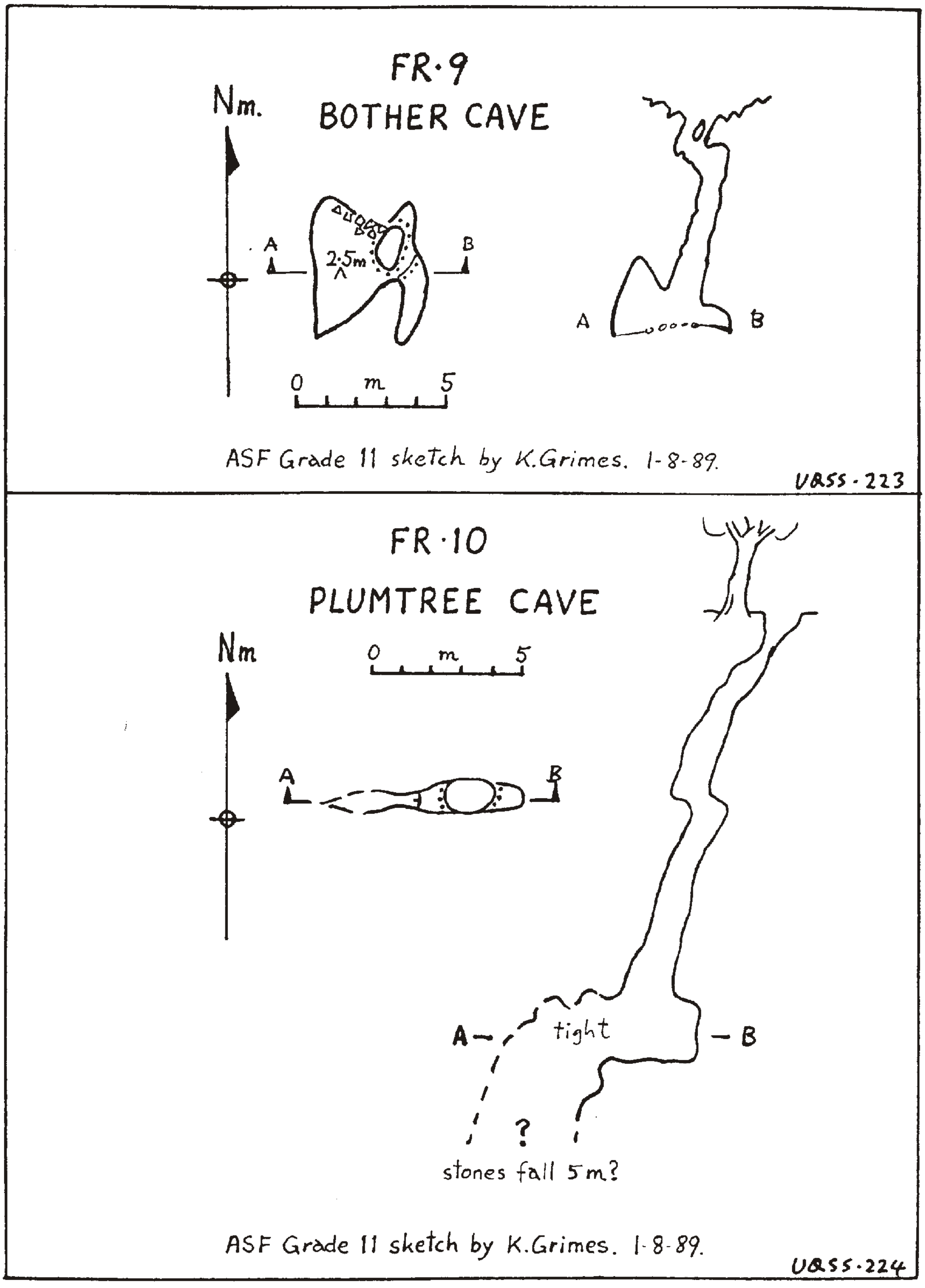

FR-2
ROPE LADDER CAVE
Drawn from surveys by:
K.Grimes, 1989; & D.Herring, 1972
Entrance
ladder pitch
N
0
m
50
UQSS-239
cross section
X
Y

Figure 6


FR-8
ASF Grade 43 survey by K.G.Grimes & M.Godwin
2-8-89
A
PROFILE
B
flowstone
A
Aven
N
flowstone
floor
0
m
5
PLAN
7m
pitch
B
2m
drop
Fissure
1-2m
sketch
only
1-2m
pits
2·5m
low
level
crawls
3m
3m
UQSS 222
Figure 7



FR·9
BOTHER CAVE
Nm.
A
B
2·5m
0 m 5
A
B
ASF Grade 11 sketch by K.Grimes. 1-8-89.
VQSS-223
FR·10
PLUMTREE CAVE
Nm
0 m 5
A
B
A
tight
B
?
stones fall 5m?
ASF Grade 11 sketch by K.Grimes. 1-8-89.
VQSS-224

Figure 8

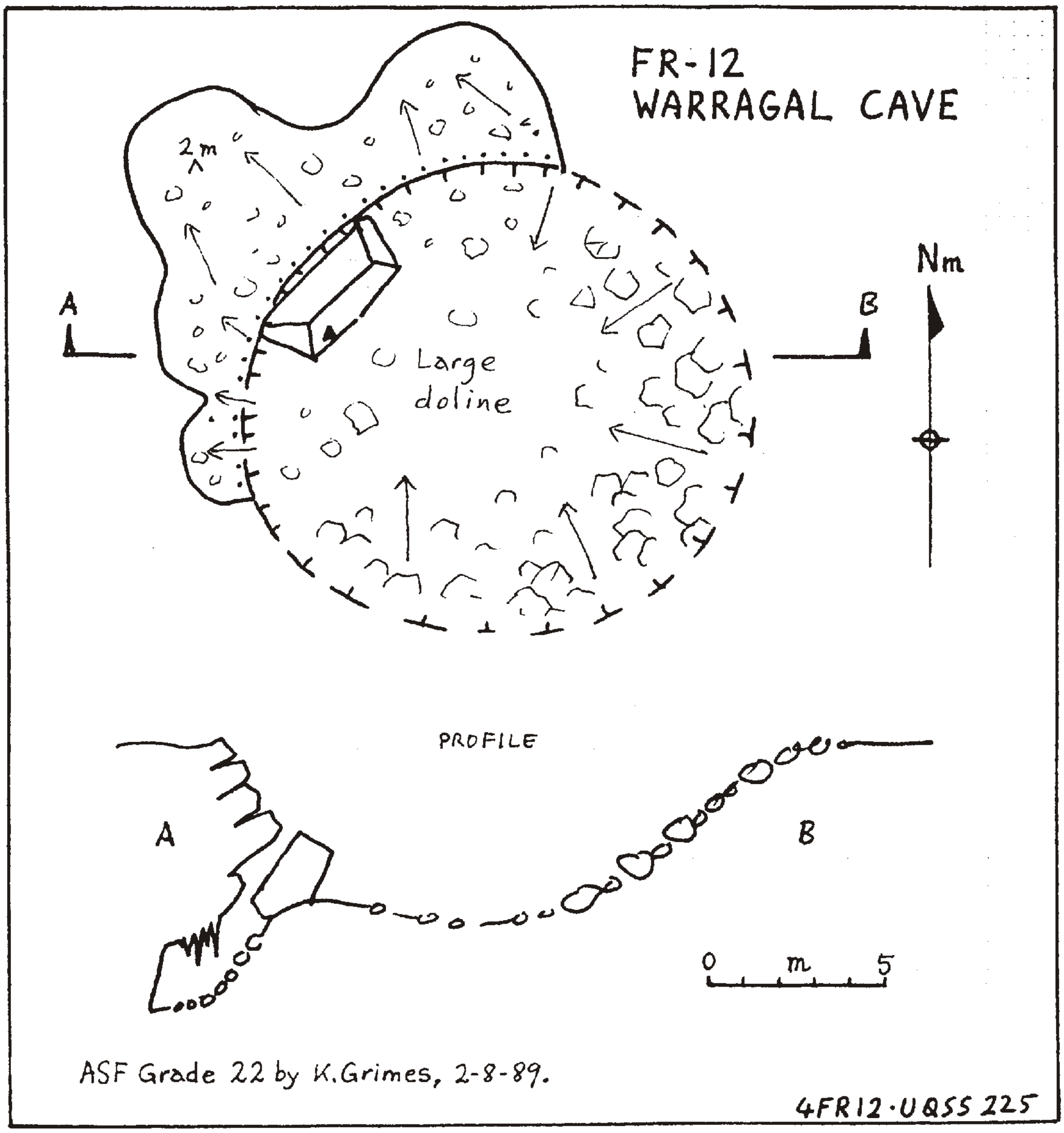

FR-12
WARRAGAL CAVE
2m
A
B
Nm
Large
doline
PROFILE
A
B
0 m 5
ASF Grade 22 by K.Grimes, 2-8-89.
4FR12·UQSS 225

Figure 9

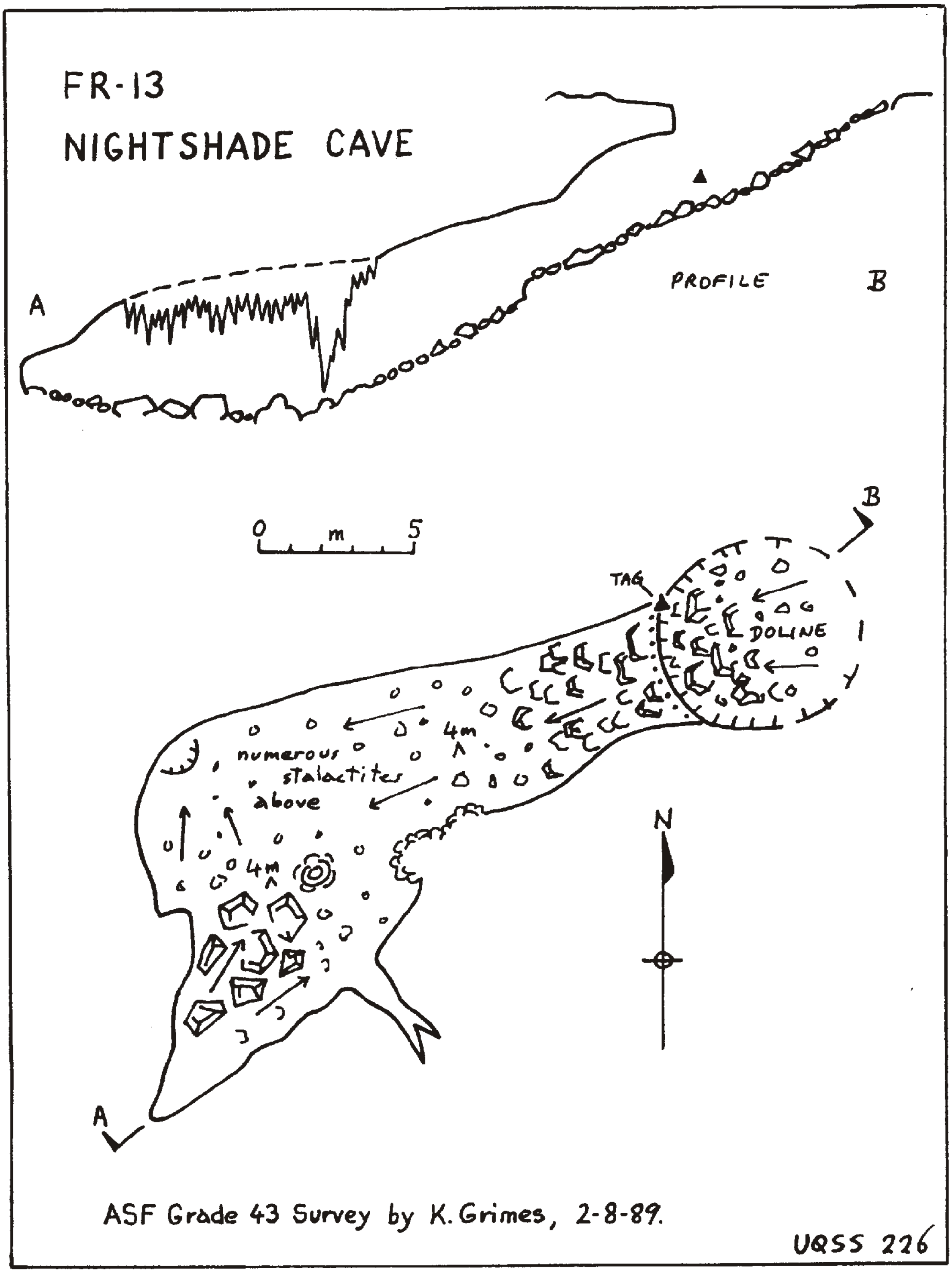

FR-13
NIGHTSHADE CAVE
A
PROFILE
B
0 m 5
TAG
DOLINE
4m
numerous
stalactites
above
4m
N
A
B
ASF Grade 43 Survey by K. Grimes, 2-8-89.
UQSS 226

Figure 10

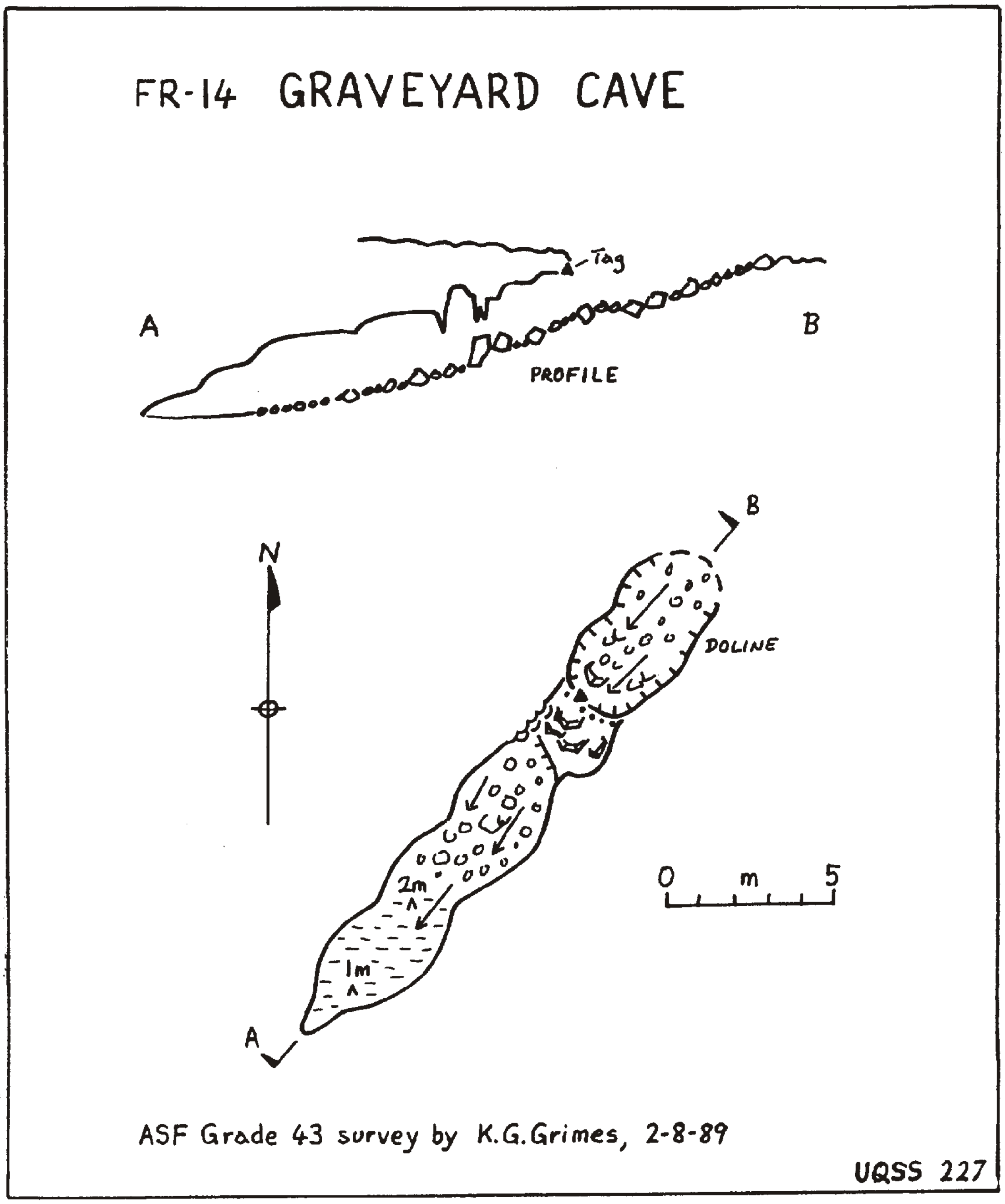

FR-14 GRAVEYARD CAVE
Tag
A
B
PROFILE
B
N
DOLINE
0 m 5
2m
1m
A
ASF Grade 43 survey by K.G.Grimes, 2-8-89
UQSS 227

Figure 11

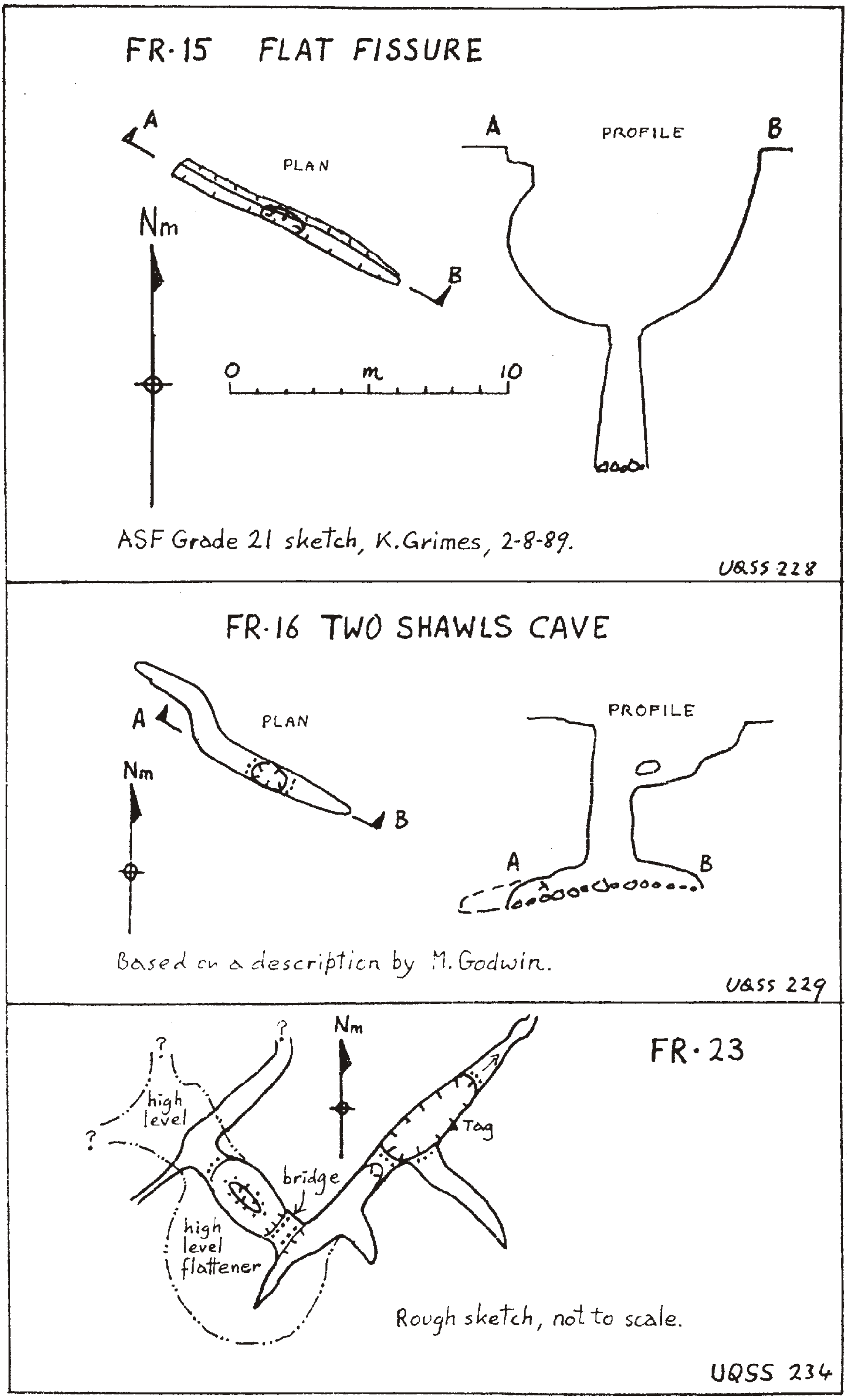

FR·15 FLAT FISSURE
A
PLAN
B
Nm
0
m
10
A
PROFILE
B
ASF Grade 21 sketch, K.Grimes, 2-8-89.
UQSS 228
FR·16 TWO SHAWLS CAVE
A
PLAN
B
Nm
PROFILE
A
B
Based on a description by M. Godwin.
UQSS 229
FR·23
Nm
high level
high level flattener
bridge
Tag
Rough sketch, not to scale.
UQSS 234

Figure 12

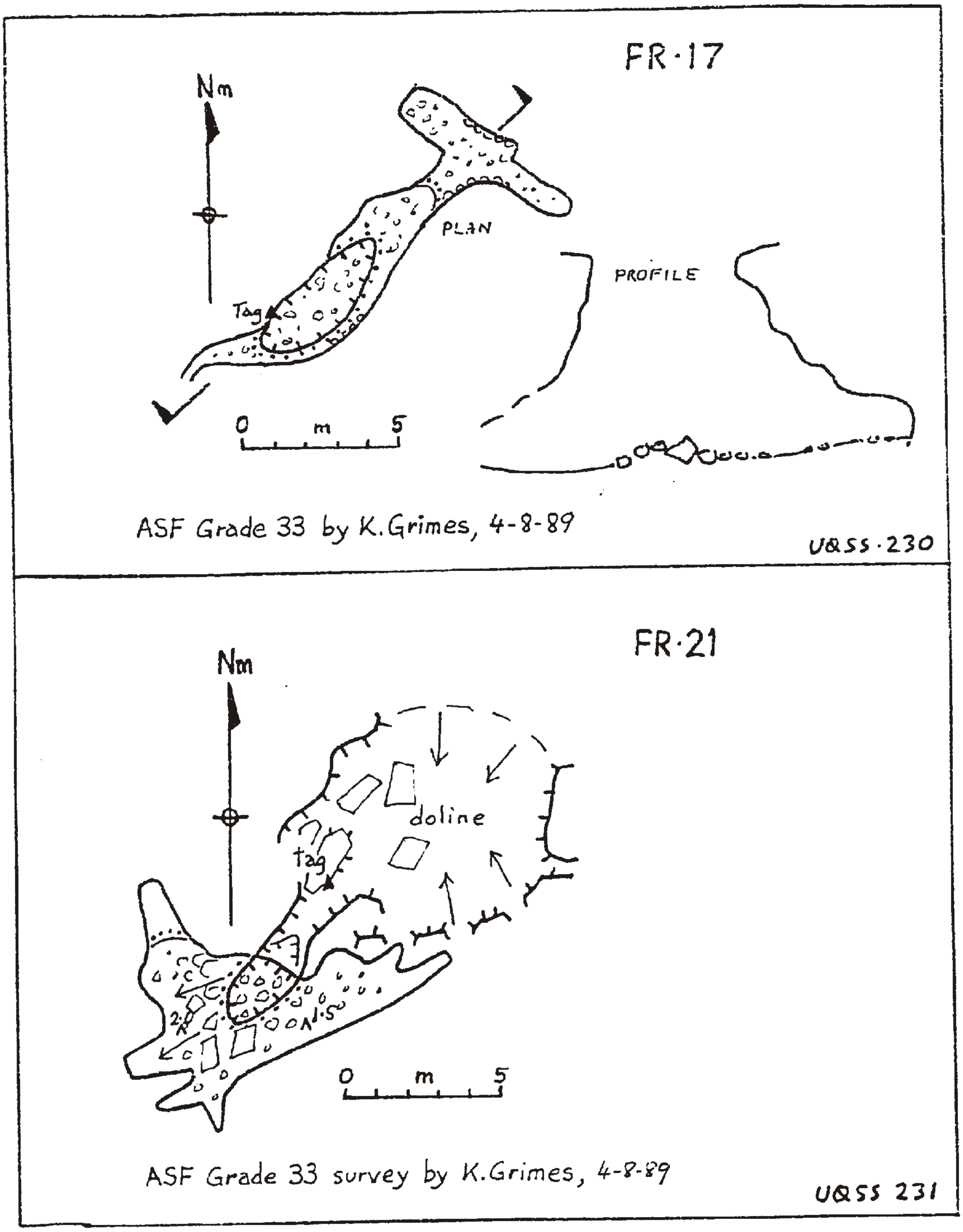

FR·17
Nm
PLAN
PROFILE
Tag
0 m 5
ASF Grade 33 by K.Grimes, 4-8-89
UQSS·230
FR·21
Nm
doline
tag
2.0
1.5
0 m 5
ASF Grade 33 survey by K.Grimes, 4-8-89
UQSS 231

Figure 13

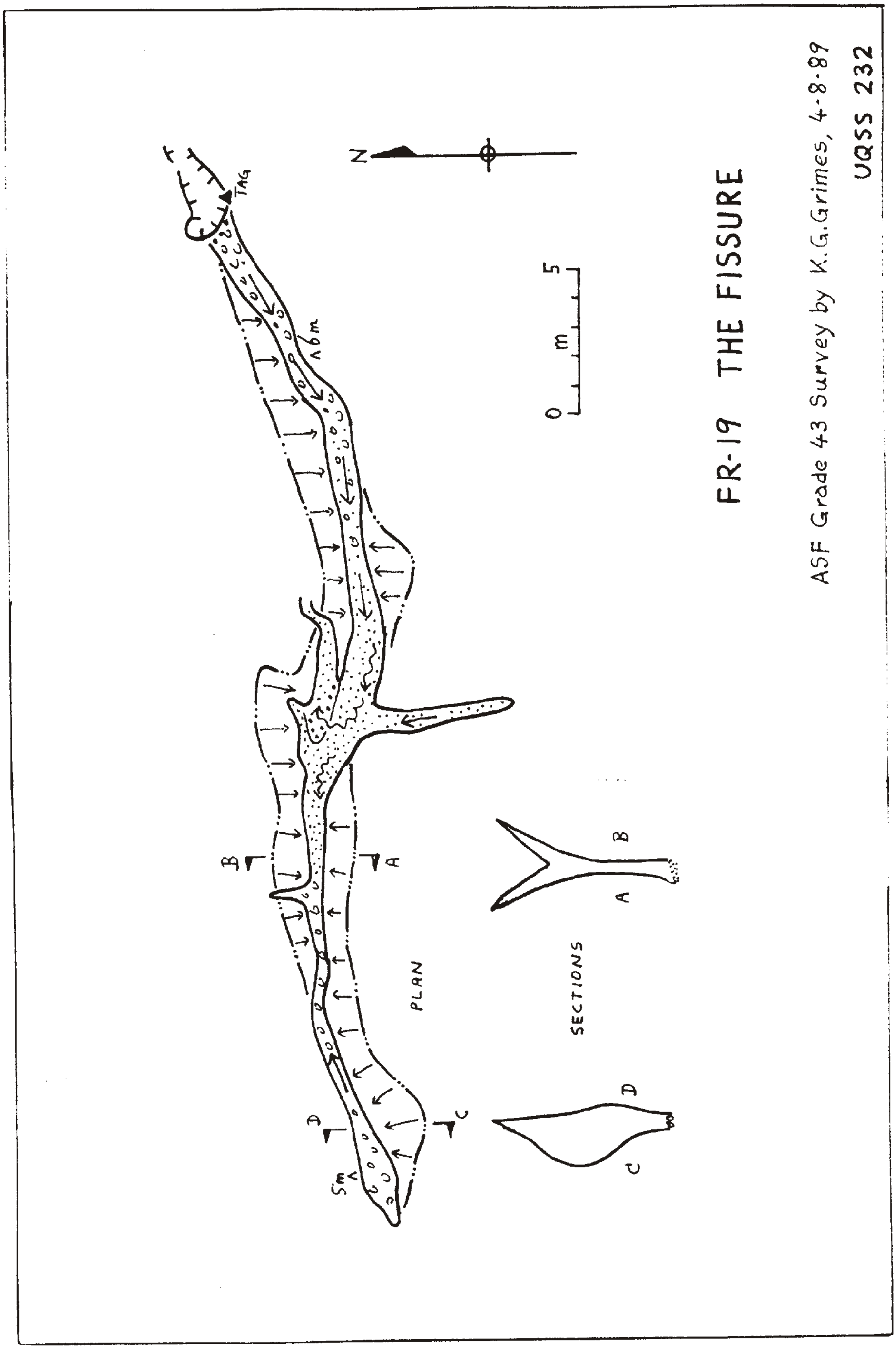

FR-19 THE FISSURE
ASF Grade 43 Survey by K.G.Grimes, 4-8-89
UQSS 232
PLAN
SECTIONS
N
0 m 5
TAG
16m
5m
A
B
C
D

Figure 14

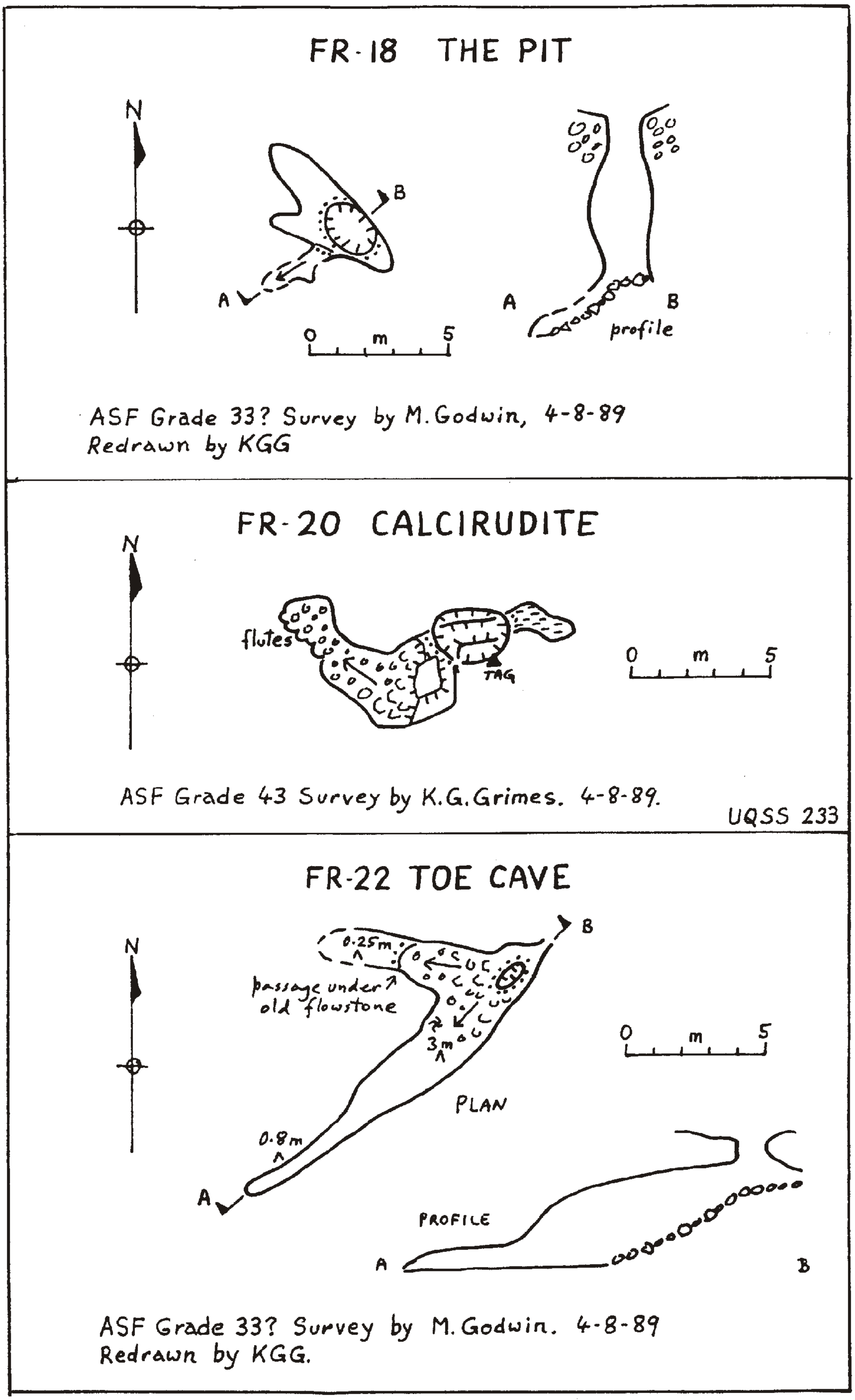

FR-18 THE PIT
N
B
A
A
B
profile
0 m 5
ASF Grade 33? Survey by M.Godwin, 4-8-89
Redrawn by KGG
FR-20 CALCIRUDITE
N
flutes
TAG
0 m 5
ASF Grade 43 Survey by K.G.Grimes. 4-8-89.
UQSS 233
FR-22 TOE CAVE
N
B
0.25m
passage under old flowstone
3m
0 m 5
PLAN
0.8m
A
PROFILE
A
B
ASF Grade 33? Survey by M.Godwin. 4-8-89
Redrawn by KGG.

Figure 15

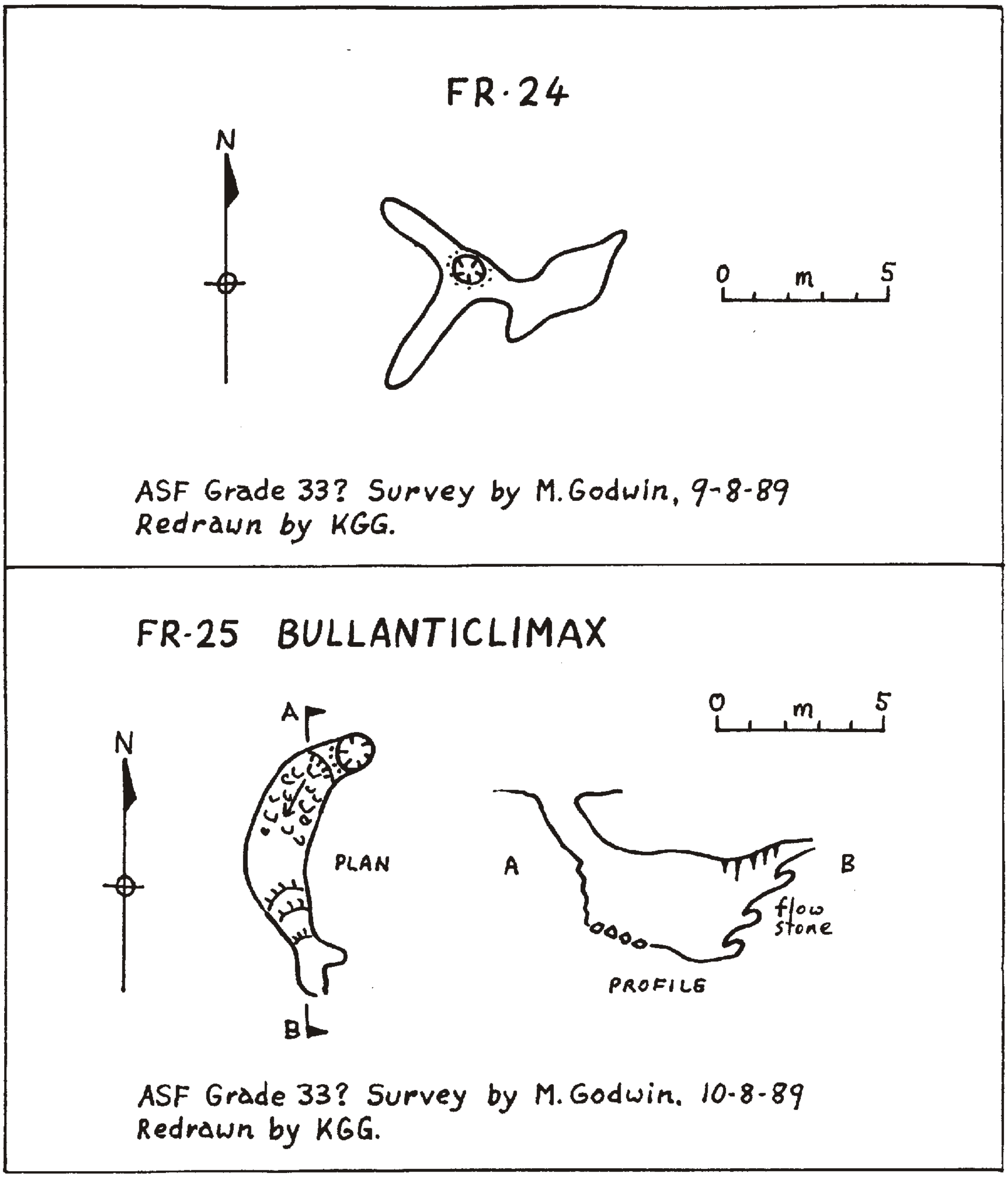

FR·24
N
0 m 5
ASF Grade 33? Survey by M.Godwin, 9-8-89
Redrawn by KGG.
FR-25 BULLANTICLIMAX
N
A
B
PLAN
0 m 5
A
B
flow stone
PROFILE
ASF Grade 33? Survey by M.Godwin. 10-8-89
Redrawn by KGG.

Figure 16