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THE BORDER RIVERS KARST REGION, QLD & NSW

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Abstract

The Border Rivers Karst Region includes three known cave areas: the Texas, Riverton and Ashford Caves. Development of the Texas Caves involved several epiphreatic (nothephreatic) solutional levels related to the development of Pike Creek. The Glenlyon System is a subterranean cut-off of a meander spur; there stream passage development and collapse of large areas has modified an original phreatic system. On Viator Hill there is no definite evidence of a through-flowing stream system and the caves are mainly shallow phreatic at several levels. Here there are two major phases of deposition of speleothems and soil derived sediments. Erosion and deposition within the caves is thought to be related to similar phases in the evolution of Pike Creek and to climatic fluctuations. The main Ashford Cave is dominantly phreatic but may have been a stream cut-off of a meander spur at one stage in its development. It now contains soil derived sediments. Riverton Cave is high on a spur and may be older than the other cave areas.

Introduction

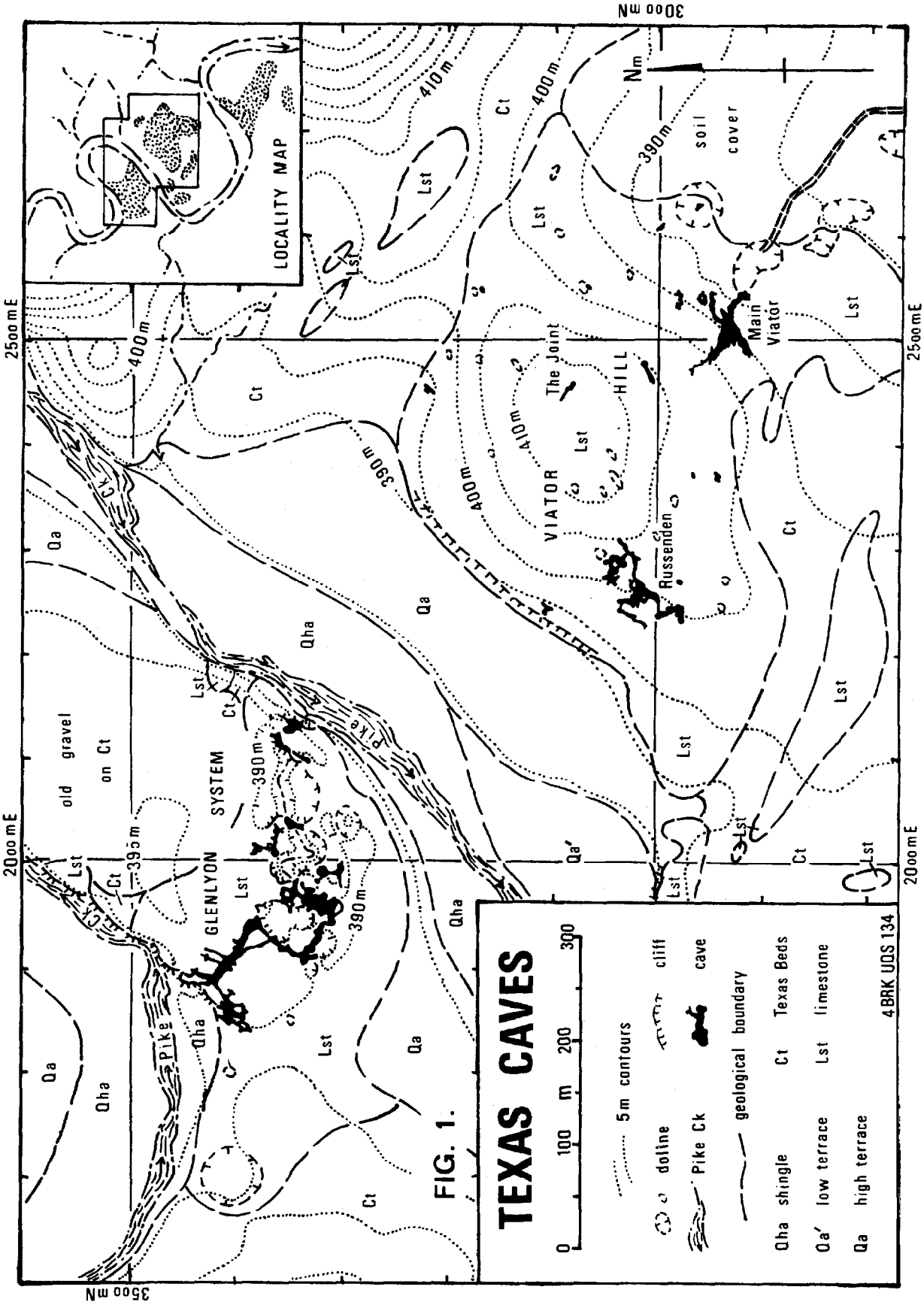
The Border Rivers Karst Region lies astride the Queensland – New South Wales border on the western slopes of the divide. It consists of a series of small limestone lenses within the Upper Devonian to Permian Texas Beds, a part of the New England Fold Belt (Olgers and others 1974). The limestones contain early Carboniferous (Visean) corals. Most of the limestone lenses are small (Seimon 1973) and are non-cavernous, though well developed karren fields can be seen on most outcrops. Only three of the larger lenses contain caves. These are the Texas, Riverton and Ashford Cave areas. The Texas Caves have recently been flooded by the Glenlyon (Pike Creek) Dam. This paper summarises some results of a survey made for the Geological Survey of Queensland (Grimes *in prep*),

The Texas Caves, Qld.

(1) Development of the Viator Hill Caves

On Viator Hill there are two large caves (Russenden and Main Viator – see Fig. 1) and a number of smaller 'potholes'. The latter are basically vertical shafts and fissures formed by rainwater infiltration, though some have horizontal epiphreatic development in their lower parts. The two large caves are basically horizontal systems, Russenden has two levels of development, Main Viator has only one. This horizontal development together with the presence of flat roofs and horizontal wall undercuts suggests that the main development of the caves was by epiphreatic solution at and immediately below a water table which subsided in a series of stages. The hill is in a vertical lens of limestone with the channel of Pike Creek abutting on each side (see inset in Fig. 1) so the main control on water levels would be the level of the stream channel and the concept of a water table seems permissible in this case. The highest caves would have formed first and progressively lower caves would have developed as the creek cut down beside the hill. Thus The Joint would be the oldest cave on the hill and it contains the oldest bone deposits in the area (Archer *in prep.*).

The sequence of development deduced for these caves is based on an elaboration of Butler's (1967) K-cycle model of valley development and of Frank's (1972) model of non-fluvial cave development. In humid climates there is a strong vegetation cover which stabilises slopes; stream incision and cave development can then occur. With a deterioration of climate – either towards colder or more arid conditions, or both – the vegetation cover will be disrupted and slope erosion will occur. Sediment will be delivered to the streams which will build up their beds to form terraces (Butler *op cit*). Sediment may also enter cave entrances and with time will eventually fill any non-fluvial caves (Frank *op cit*). However, if the climate returns to humid conditions the slopes will be stabilised and the streams will once again begin



downcutting. Increased circulation of ground water will allow further cave enlargement to occur. If the stream incision is sufficient the cave development will be at lower levels and the earlier cave sediments will subside or be washed into these levels. If stream capture occurs with the formation of a throughflow system then the sediment may be removed from the system entirely.

In the larger Viator Hill caves there is evidence for two ages of sediment, both younger than the bone beds in The Joint. Formation of the upper levels of Russenden Cave, which have a horizontal roof level, may have occurred when Pike Creek was at the similar level to the old gravels on the Glenlyon meander spur. Main Viator Cave may have commenced its development at much the same time. Draining of the upper level was probably a result of continuing stream incision. Removal of hydrostatic support would have caused some ceiling collapse and this, coupled with surface denudation, would have opened the caves.

With the appearance of an arid phase of surface instability rubble, soil and bone material were washed into the caves. These deposits have been cemented to form the 'red earth breccias', and old coarse grained speleothems are associated. This material contains the older of the two Russenden faunas (Archer *in prep*). This instability could also have caused aggradation of the creek bed but no terraces have been recognised from this period.

The subsequent erosion of the red earth breccias and older speleothems is probably related to a return to a humid climate and further cavern development at lower levels. The Foul Air Section in Russenden and probably some low extensions of Main Viator Cave would have formed at this time. A line of shallow depressions leading southeastward from Viator Hill towards Pike Creek could indicate a low level system which drained water from the hill. The stream cliffs on the northwest side of the hill may have been cut at this time and there is a possibility of partial stream capture and the existence of a through flowing system beneath the hill. There is no direct evidence for this, however, and augering in the caves did not intercept any stream sediments. The wall features in the Foul Air Section suggest sluggish epiphreatic conditions – nothephreatic in the sense of Jennings (1976).

The next stage in the development of the caves was one of aggradation of the bed of Pike Creek to form the Qa terrace (Fig. 1) and the formation of a further series of cave sediments and speleothems. The sediments suggest instability and a deteriorating climate once again. The younger Russenden fauna of Archer (*in prep*) comes from these deposits and is sub-recent in age. The soil of the Qa terrace is of the red-brown earth type which if correlated with dated terraces elsewhere would suggest an age of about 4000 years BP. Deposition in the caves appears to have continued up to the present but the occurrence of a lower Qa' terrace on the surface could indicate a minor break.

The younger deposits include a considerable quantity of clay aggregates, especially in Main Cave. These range in size from one to ten mm or more and come in a variety of colours. They appear to be soil particles and their preservation argues for minimal water transport: mass movement would seem to be the main process. In Russenden the earthy deposits are interbedded with an entrance scree and an old guano mound. Peter Bridge (pers. comm.) has identified a number of unusual phosphate minerals from this guano mound. A section in one locality consists of – from the top down – 10 cm of hard nodular cemented material; 10 cm of soft powdery gypsum; about 60 cm of dark brown earth with some almost black bands which contains whitlockite, taranakite, and apatite in guano dust. Below this was a basal unit more than 75 cm thick which extends into the nearby subsidence pit. This is composed of hard buff to white material containing taranakite, with minor leucophosphite, quartz and apatite.

In Main Cave the upper parts of the sediments are acidic with pH values as low as 3, but with depth they become alkaline with pH up to 8.5. The acidity may be due to recent organic material, guano, and/or bat urine which becomes neutralised with depth. The entrances to Russenden Cave were only reopened with the cave's discovery in 1967 so recent organic material could not have entered this cave: here the deposits are uniformly alkaline (pH 7 - 8) with the exception of the old guano mound which is acidic.

(2) Development of the Glenlyon System

This system differs from the Viator Hill caves in being all on the one level, and in having captured a part of the flow of Pike Creek fairly early in its development. Throughflow stream passages have modified the original phreatic network and in addition, the system has suffered from a series of major collapses of large chambers. These have formed large dolines which have disrupted much of the downstream part of the system. The continuing history of collapse also restricted the stream flow through the system and it appears that complete capture of Pike Creek never occurred. The surface stream channel has therefore been able to develop independently of the underground system.

The initial phreatic development of the system may have been contemporaneous with the development and draining of the upper levels of Russenden and Main Viator Caves. Collapse of the older dolines may have commenced shortly after the initial stream capture as these contain small terrace deposits which may correlate with the Qa terrace. The depositional sequence found on Viator Hill does not occur in the Glenlyon System. Instead there are fluvial silts, with minor sand and gravel.

The most recent collapse was that of the upstream cliffs which blocked the cave stream at its inflow point. The present cave stream appears to be underfit: it meanders between large silt mounds and the wall scallops do not appear to be in equilibrium with the present hydrology.

The Ashford Caves, NSW

Only a quick reconnaissance study was made of this area. There is only one large cave known, located on a meander spur of a medium sized creek. It is basically a horizontal epiphreatic system. Old stream cliffs similar to those of Viator Hill occur next to its upstream entrance and it is possible that some stream capture may have occurred. The cave sediments are similar to those of the Viator Hill Caves and there has been some guano mining. The northern wall of the main chamber follows the limestone – volcanic rock contact. This cave is a maternity site for *Rhinolophus megaphyllus* (Dwyer 1966).

Riverton Cave, Qld.

This is in one of the largest limestone lenses in the region but only one sizeable cave is known. This is high up on a ridge and could be older than the caves at Texas and Ashford. No detailed study has been made but it appears to be a phreatic system with soil derived sediments and guano. Guano mining has occurred and the cave is the maternity site for the *Miniopterus schreibersii* population of the region (Dwyer and Hamilton-Smith 1965) and is also a breeding site lor *Rhinolophus megaphyllus* (Dwyer 1966).

Some form of protection and a definite management plan is urgently needed for this cave as visitation pressure is likely to increase now that the Texas Caves have been destroyed. A complete embargo should be placed on visitation during the summer bat breeding season.

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