The Nullarbor Karst

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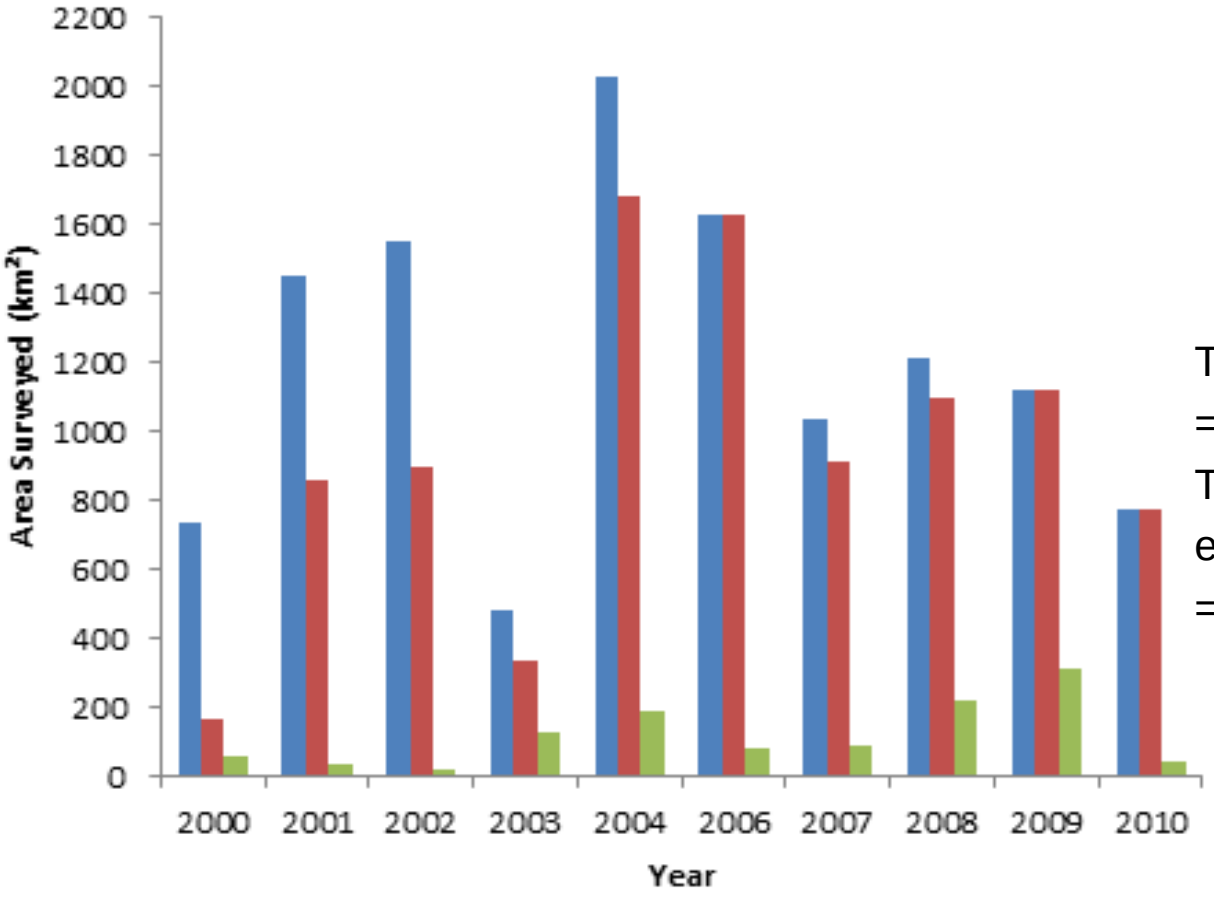
Project Overview

- GIS based project.
- Investigating the physical characteristics of karst features together with the spatial relationships that exist between different karst features, and relationships between the environmental features such as the coastline, ridges and swales, and karst features.
- Physical characteristics were analysed using detailed data from 1,412 karst sites on the Nullarbor Plain.
- Spatial relationships were analysed using less detailed data from 4,720 karst sites on the Nullarbor Plain.

VSA Search Areas



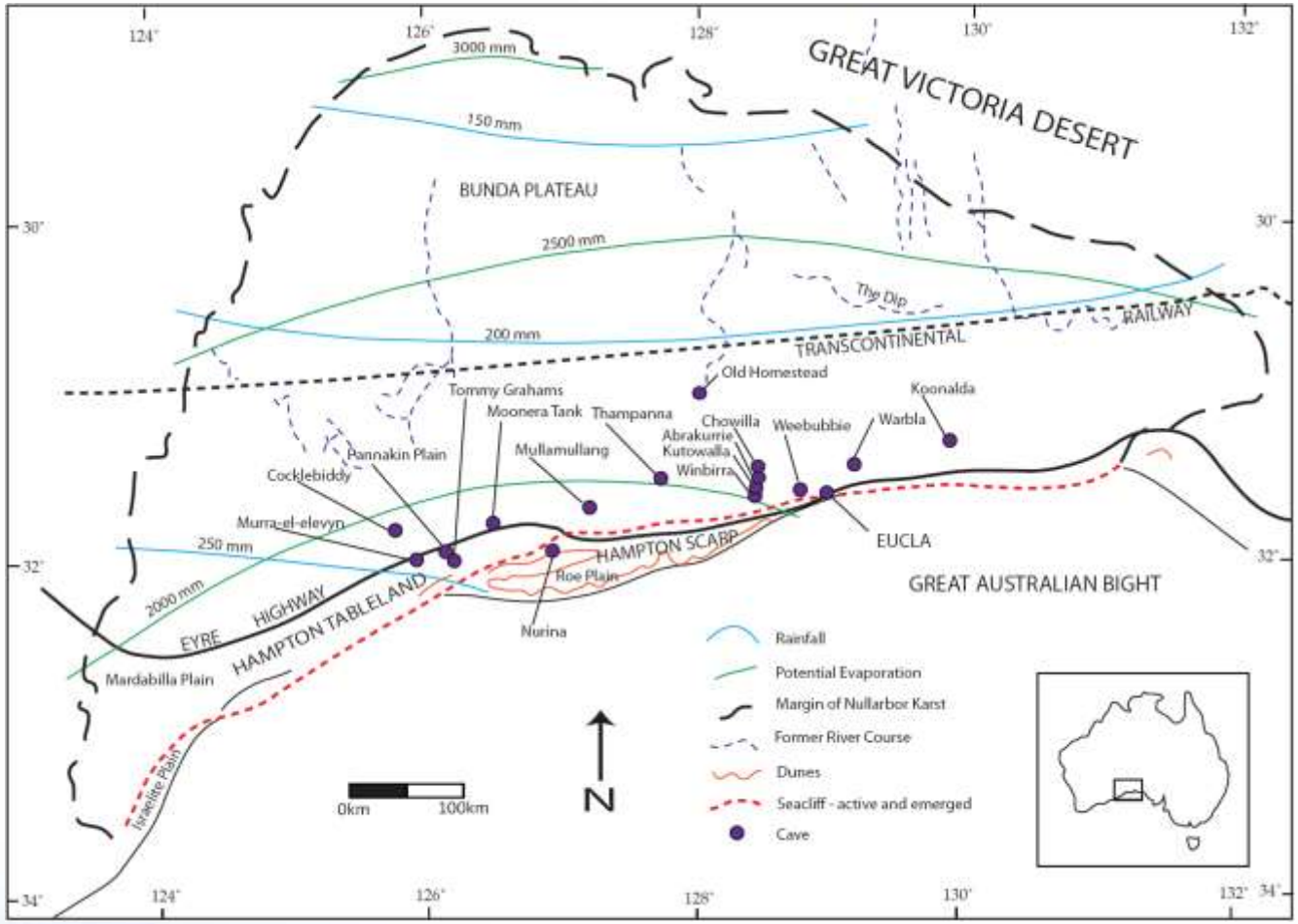
Total area surveyed = 12,021.62km²

Total area surveyed excluding overlapping = 9,454.77 km²

About the Nullarbor Plain

- One of the world's great karst areas.
- This semi-arid environment is famous for its low relief, treeless vegetation and lack of permanent surface water.
- This landscape is often considered featureless but many karst landforms can be found including: collapse and erosion dolines, blowholes, dongas, relict river courses and caves, which contain a variety of speleothems.

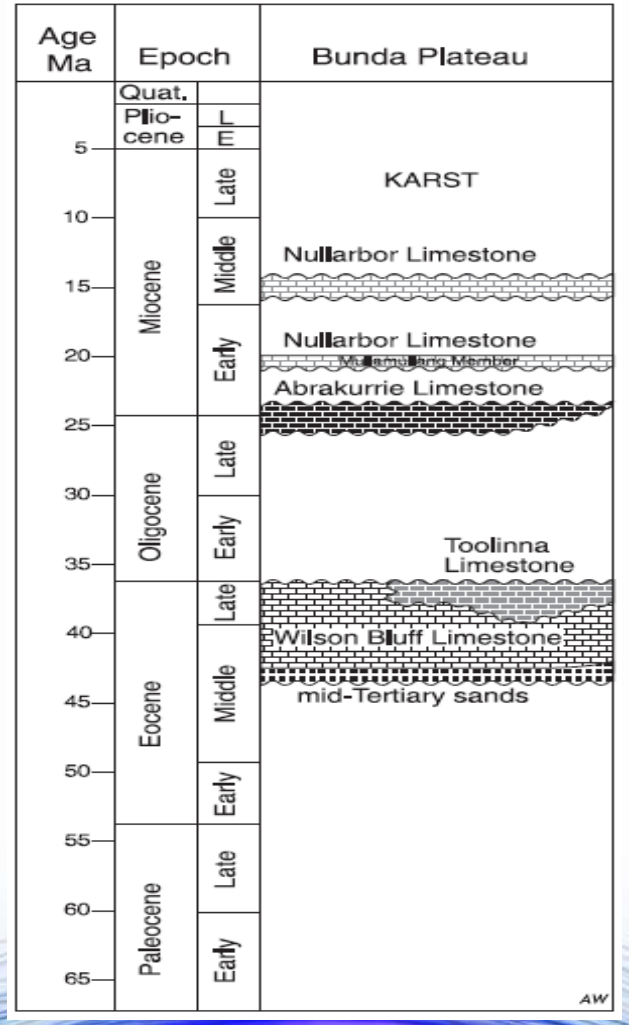
The Nullarbor Plain



(After James, 1992)

A Treeless Plain

Geology



- Dominated by three flat-lying units of Eocene and Miocene limestone.

(Webb and James, 2006)

Blowholes

- Most numerous feature except for rockholes.
- Most common type of cave entrance.
- Up to 15m in width and 35m deep.

Dolines

- 68% of sites have a doline.

Characteristic	Dolines with cave(s)	Dolines with blowhole(s)	Dolines with insignificant feature(s)
Minimum length	0.7m	0.5m	1.5m
Maximum length	290m	105m	240m
Median length	10.3m	8m	25m
Minimum width	0.7m	0.5m	1m
Maximum width	100m	85m	210m
Median width	8.5m	5.5m	19m
Minimum depth	0.05m	0.1m	0.3m
Maximum depth	43m	23m	18m
Median depth	1m	0.70m	1.6m

Caves

- 41.4% of sites contain a cave.

- 28.39% of sites contained chambers.

- 20.11% of sites contained passages.

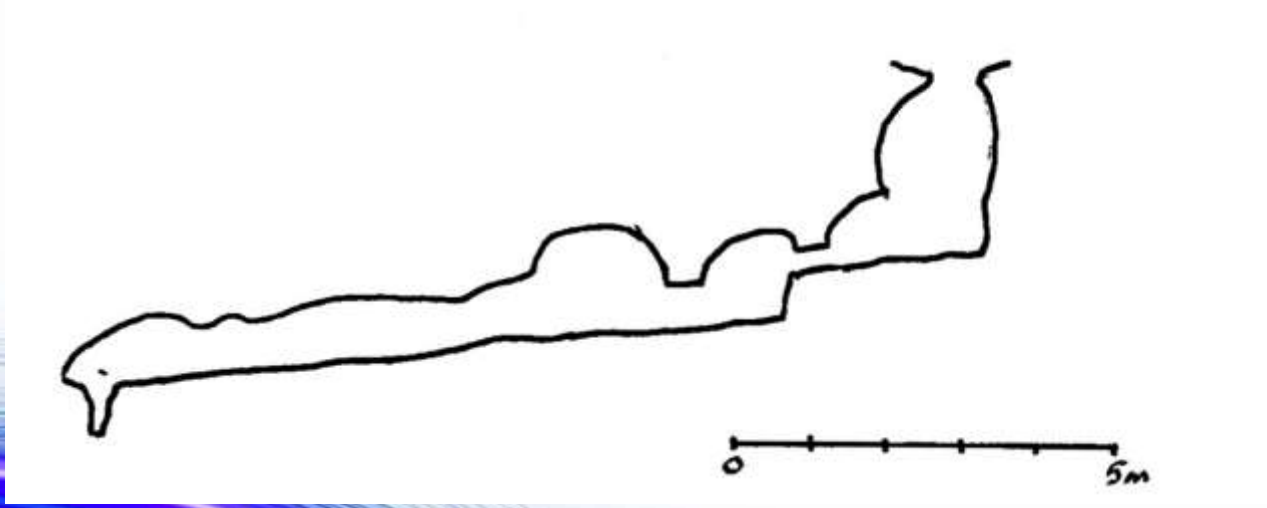
- Median cave length = 7.5m.

- 8% of caves contain speleothems.

Speleothems

Shallow Caves

- ~86% of caves are shallow caves.
- 81% of caves have a blowhole entrance.
- Significant relationship between length and depth for shallow caves <50m long.
- Formed by mixing corrosion.



Deep Caves

- ~14% of caves are considered deep caves.
- Most do not have a blowhole entrance.
- The median cave length is 227m.
- Can have complex layouts.
- Formed by collapse processes.

Karst Feature Locations

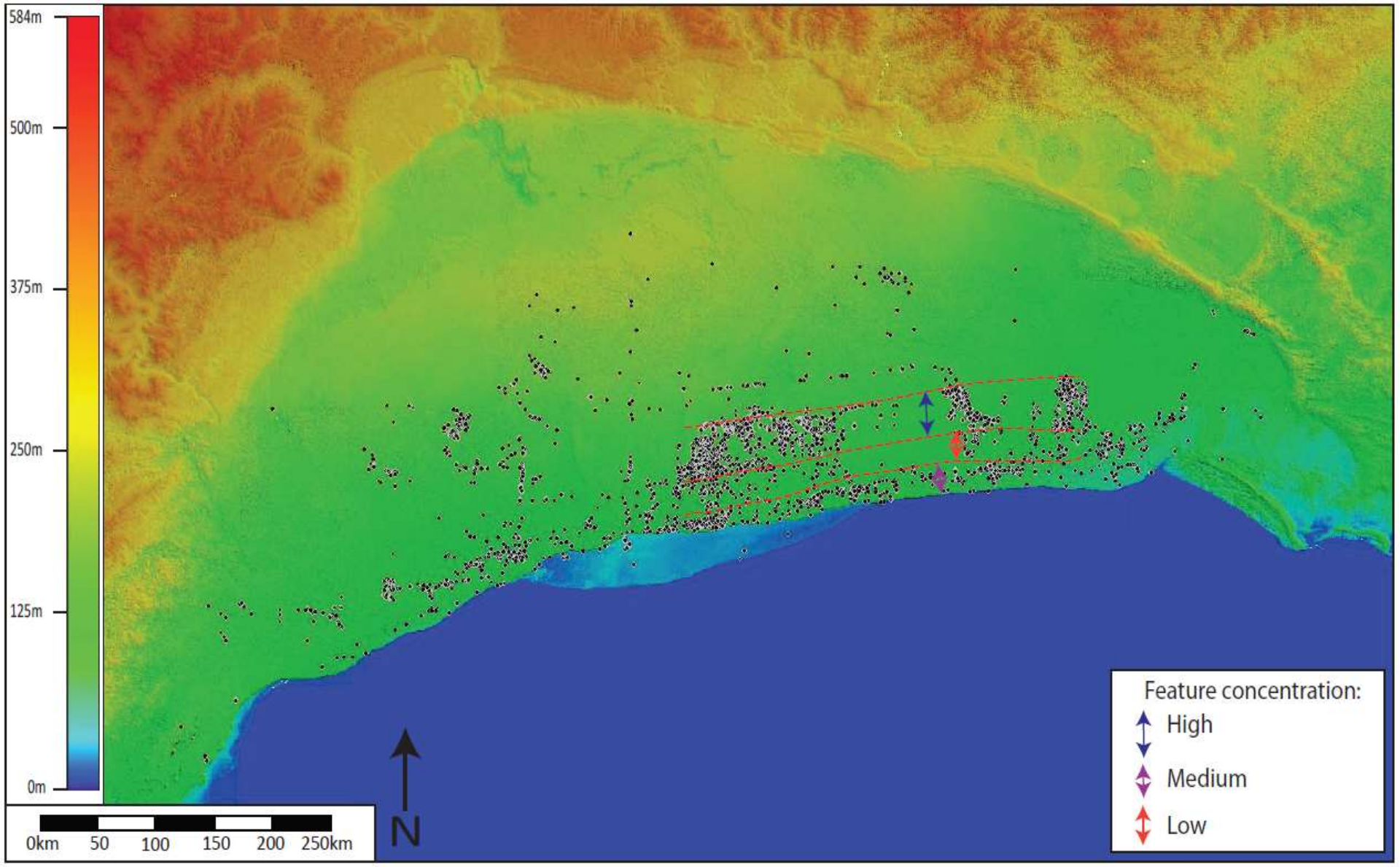
• Almost all karst sites are located south of the Trans-Continental Railway, which is 102km north of the coast.

• However, most sites are located in either of two bands.

•A ~20km high concentration band.

• Highest concentration band ~50-85km inland from the coastal scarp in the east and ~45-80km in the west has the highest concentration of karst sites.

Overall Karst Site Distribution



High Concentration Band

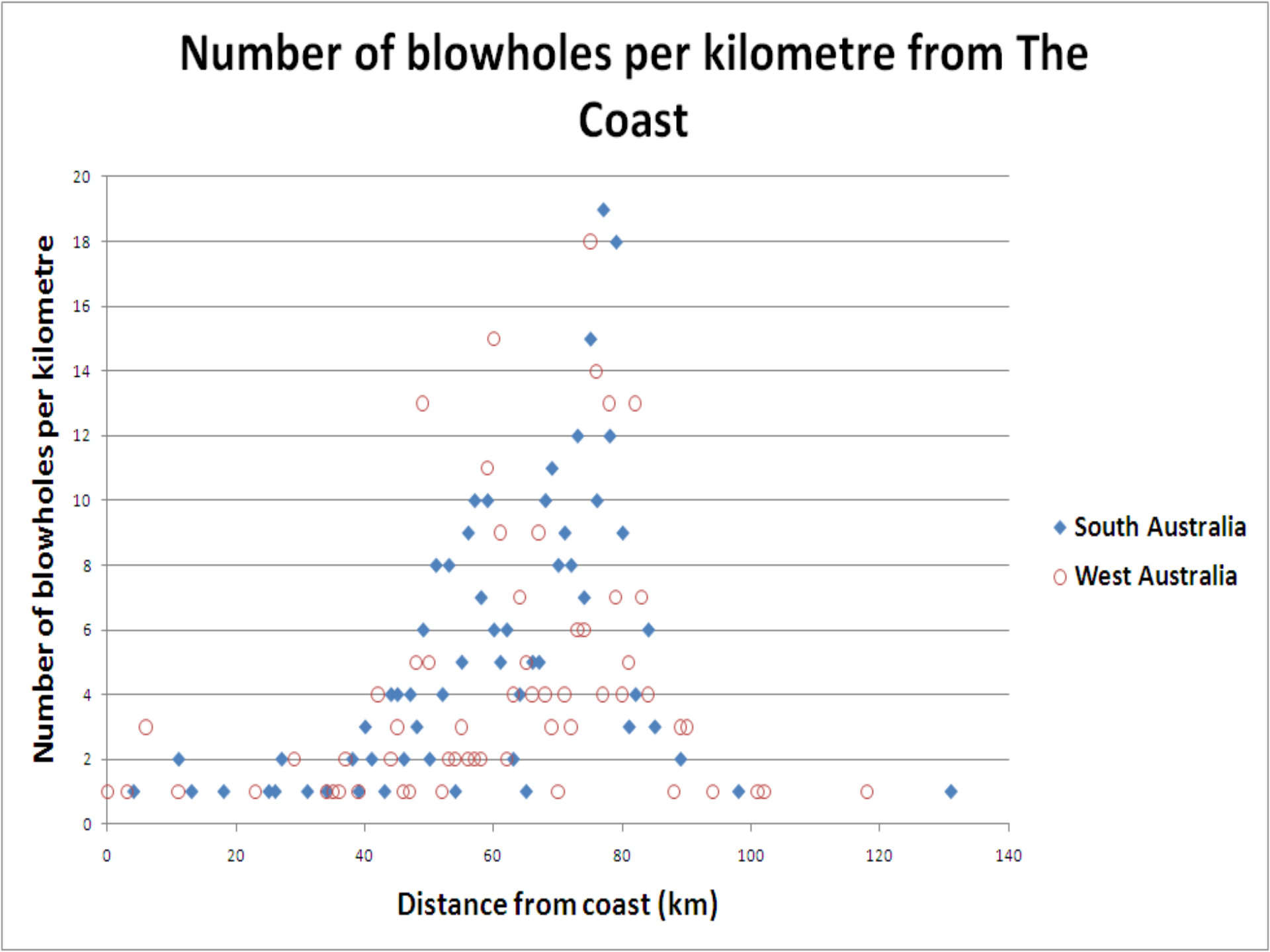
- Runs parallel to the coastal scarp, inland of the Hampton Scarp backing onto the Roe Plain.
- Up to ~20km inland.
- Most deep caves are located in this band.

Low Concentration Band

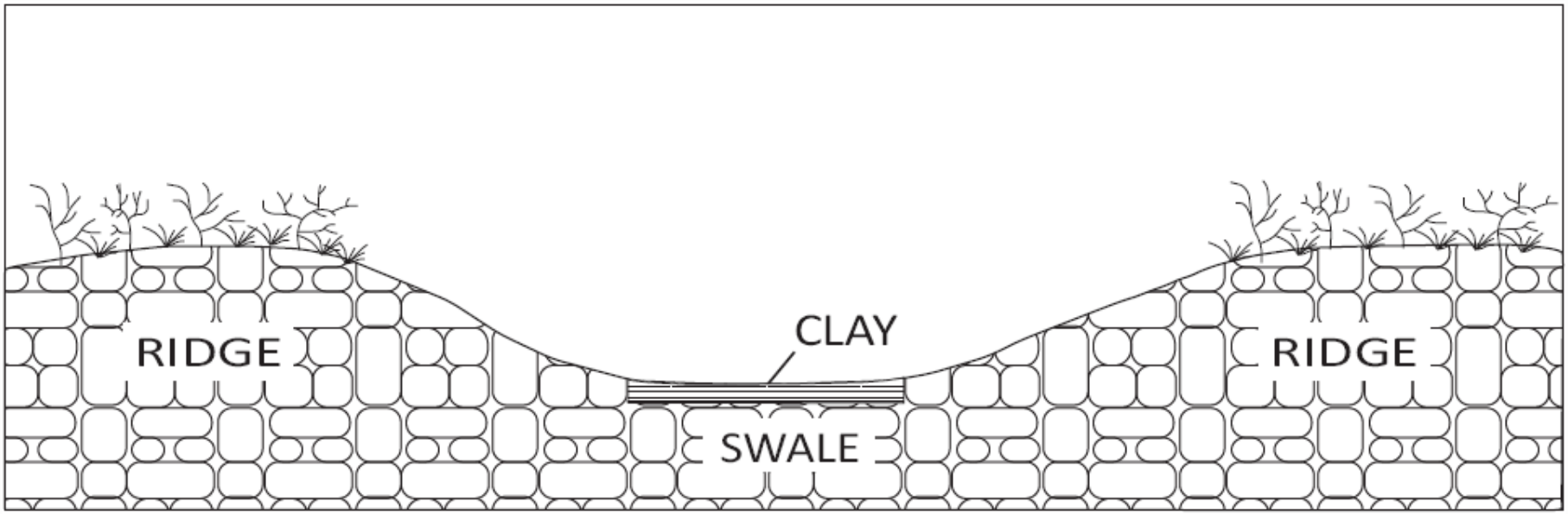
- Located in between the high and highest bands of karst site concentration.
- Formed when the area was inundated with sea water.
- Inhibits dissolution of limestone.

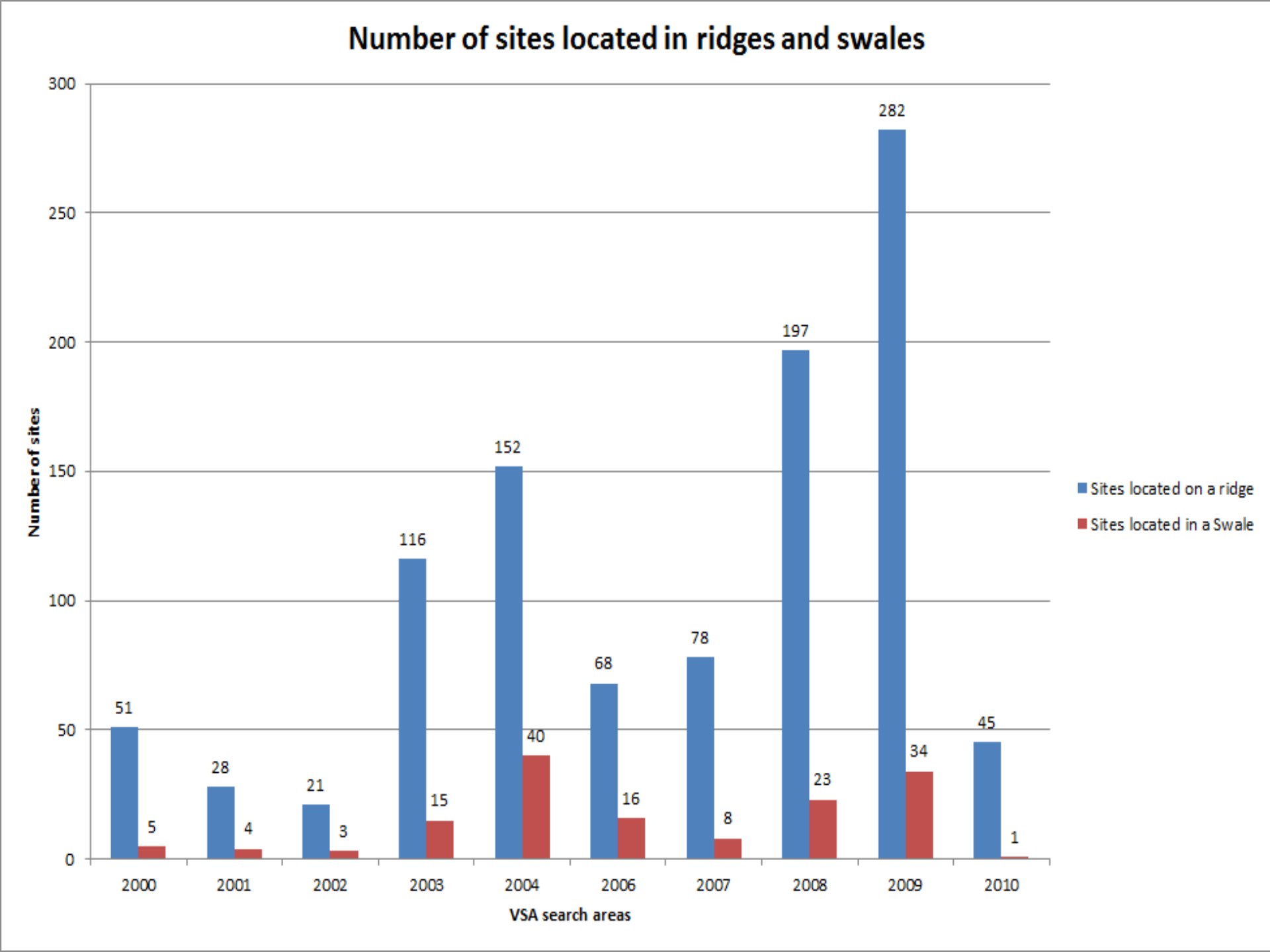
Highest Concentration Band

- Highest band of karst site concentration.
- Runs parallel to the coastal scarp, inland of the band of low concentration.
- Formed during a sea level stillstand, when the shoreline probably lay at the southern edge of the band.


Number of blowholes per kilometre from The Coast
Number of blowholes per kilometre
Distance from coast (km)
0
2
4
6
8
10
12
14
16
18
20
0
20
40
60
80
100
120
140
South Australia
West Australia

Karst Feature Locations Relative to Ridges and Swales




Number of sites located in ridges and swales
300
250
200
150
100
50
0
Number of sites
51
5
28
4
21
3
116
15
152
40
68
16
78
8
197
23
282
34
45
1
2000
2001
2002
2003
2004
2006
2007
2008
2009
2010
VSA search areas
Sites located on a ridge
Sites located in a Swale

Karst Site Position Relative to Ridges and Swales

- The number of sites on a ridge is always greater than those in a swale.
- Amount of relative relief is not related to the position of sites.
- The relative lack of sites in swales can be explained by the infilling of features or plugging of entrances.

What are the Ridges and Swales?

- Not joint controlled as previously thought.
- Footprints of multiple linear sand dune systems, that have since been eroded away.
- Dune forking preserved.
- One small, previously undescribed remnant linear dune system still exists.

Ridge and Swale Formation

1. Freshwater collects in the swales of the sand dunes.
2. Percolating water dissolves underlying Nullarbor Limestone, causing incision of limestone surface beneath the swales.
3. Redeposition of calcium carbonate forms kanker layer within the limestone.

References

Bowler, J.M., 1976, Aridity in Australia: Age, Origins, and expression in Aeolian Landforms and sediments: *Earth-Science Reviews,* **v. 12,** p. 279-310.

James, J., 1992, Corrosion par mélange des eaux dans les grottes de la Plaine de Nullarbor, *in* Salomon, J.N., and Marie, R., eds., *Karst et evolutions climatiques*: Bordeaux, France, Presses Universitaires de Bordeaux, p. 333-348.

Webb, J.A., and James, J.M., 2006, Karst evolution of the Nullarbor Plain, Australia, *in* Harmon, R.S., and Wicks, C., eds., *Perspectives on karst geomorphology, hydrology, and geochemistry—A tribute volume to Derek C. Ford and William B. White*: Geological Society of America Special Paper 404, p. 65–78.