Springvale Springs Supergroup

Hydrogeology and ecology

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Queensland Government

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Front Cover: Edgbaston Springs and a spring (imaginatively) called “New Big”. There is Spinifex in the foreground, free water in the mid-ground, with some scalding in front and the far right rear. Photo: Queensland Herbarium.

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Overview

Of all the desert springs, the Springvale supergroup seems to most epitomise the lure of water in a dry land, its strangeness and mystery, and also the rapidity with which the accumulated layers of natural history have become obscured: the ghost springs of the pale Hamilton River flats; the forgotten weed-infested depressions where once precious water rose from the ground on vast grasslands; the tiny mud-puddles fringed by ancient human tools, now glimpsed only by passing cattle and the shadows of black kites.

The Springvale supergroup is comprised solely of discharge springs and covers about 8000 km^2. The main line of springs follows the alluvial plains of the Hamilton River, which flows south by south-west into the Georgina (Figure 2). To the south, Elizabeth and Springvale springs are situated beside Spring Creek, a tributary of the Diamantina River. There are two outlying groups of small mud springs 70 km to the south-west on the vast open plains east of the Georgina River. Only 18% of the springs at the individual wetland scale are extinct, but this is largely because of the large number still active at Elizabeth and Mt Datson Springs. Of the 12 spring complexes five are completely inactive and three are partially inactive.

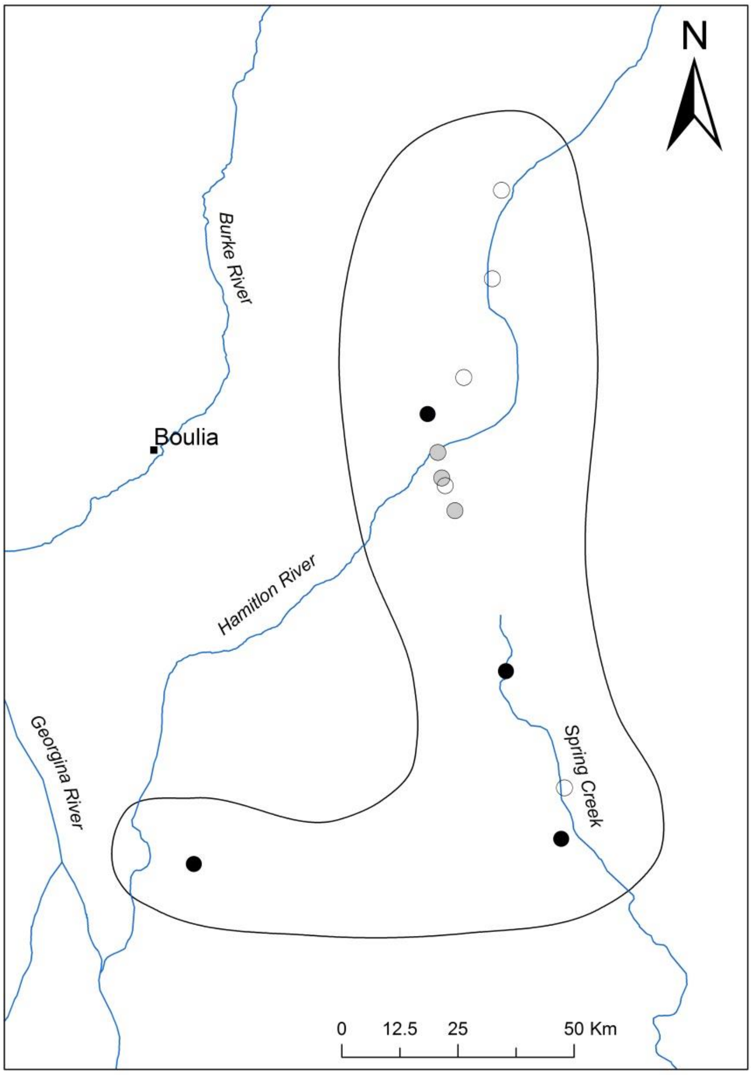

Figure 1. Spring complexes within the Springvale supergroup. Spring complexes with 100% active springs (solid), partially (1%-99%) active (grey) and 100% inactive (open symbols) are identified.

Table 1. Summary of the status of the springs in the Springvale supergroup at the complex, wetland and vent scale.

	Complex			Spring		Vent	
	Active	Partially active (1-99% of wetlands)	Inactive	Active	Inactive	Active	Inactive
Outcrop	0	0	0	0	0	0	0
Discharge	4	3	5	121	26	339	26

Hydrogeology

Regional hydrology

The basement of the Eromanga Basin in the vicinity of the Springvale supergroup is up to 1000 m deep and is variously composed of Proterozoic sediments and granites. There is a major unconformity between this basement and the overlying Longsight Sandstone of lower Cretaceous age. The Longsight sandstone (Hooray Sandstone equivalent) is the main aquifer unit in the region and in the vicinity of the springs is between 15 and 110 m below the surface. The Longsight Sandstone is overlain by a sequence of Cretaceous sediments, mostly comprised of fine-grained sediments including the Wallumbilla Formation, the Toolebuc Formation (limestone), the Allaru Mudstone and the Mackunda Formation. There are also Tertiary deposits including sandstones and limestones.

Fault structures are generally aligned north-south and probably arose in the Proterozoic (Figure 2). Minor movements along these structures, including the Burke River structure, during the early Tertiary have created faults and folds in the Cretaceous sediments allowing groundwater to discharge through springs.

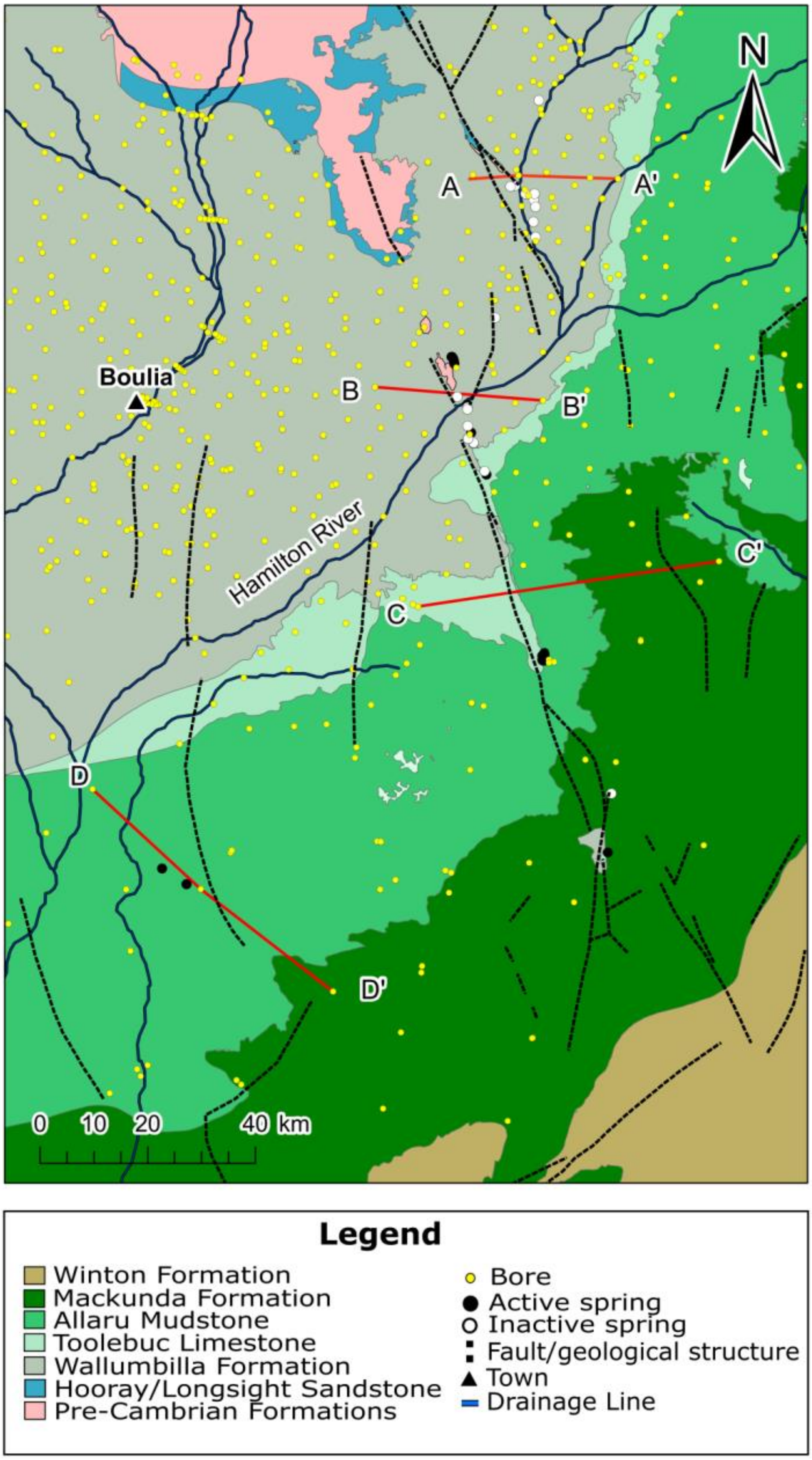

Figure 2. Discharge springs in the Springvale supergroup and the associated surface geology with some important structural features identified. The position of the stratigraphic lines represented below is indicated.

Hydrology of the springs

Springs in the Warenda area occur where the Longsight Sandstone approaches the ground surface along the Mommedah anticline in the vicinity of the channels associated with the Hamilton River (Figure 3). There is also some possible faulting assisting the flow of groundwater through the aquitard that is only ~10 m thick in this area (Figure 3). In this area there has been considerable reduction in the potentiometric surface and the springs are currently inactive.

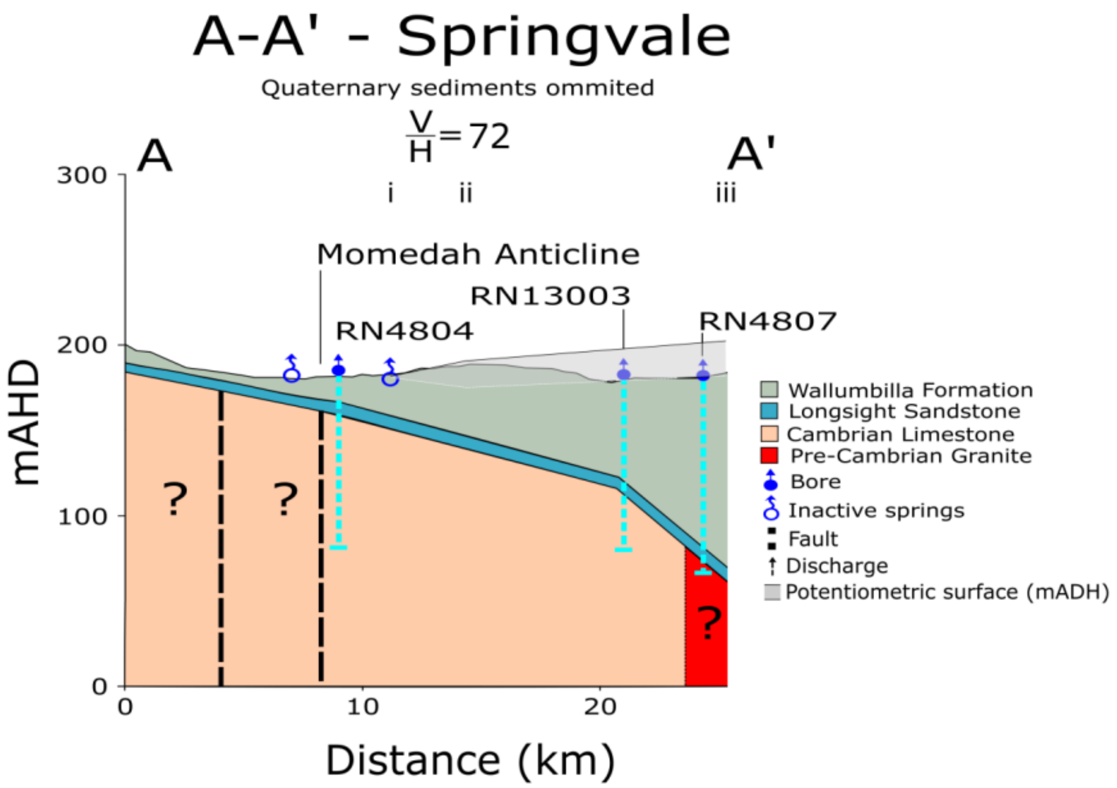

Figure 3. Stratigraphy through Springvale discharge springs (see A-A', Figure 2 for location). Where bores are projected onto the stratigraphic line the difference in elevation is indicated by the position of the bore symbol in relation to the ground surface. The range in the potentiometric head over time is represented by the limits of the grey bar and the roman numerals indicate the location of the bores that inform the head. i: RN4794, min. date 1891: SWL 0.7, max.date 1896: SWL 1.52; ii: RN4808, min.date 1926: SWL: -13.72, max.date 1896: SWL 2.74; iii: RN4806, min.date 1965: SWL -4.88, max.date 1896: SWL 15.54.

Most of the springs in this supergroup are aligned along a northerly trending fault the Burke River Structure (Figure 2, Figure 4) (Habermehl, 1982). The fault has resulted in substantial displacement of the underlying Proterozoic and Paleozoic rocks and folded and faulted the Mesozoic sediments to the extent that groundwater discharges from the uppermost water-bearing aquifer the Longsight Sandstone (Hooray Sandstone equivalent). The Elizabeth Springs are clearly aligned with the southern end of the Burke River Structure a prominent fault (approximately 30m displacement) providing a conduit between the aquifer and the springs through 190 m of aquitard sediments (Figure 75).

The fault structure seems to provide a discontinuity for groundwater flows represented by a standing water level of 184 m, 15 km east of the fault and 143 m, 15 km to the west of the fault (Figure 5). Diminished groundwater flows during the pastoral period have resulted in substantially reduced flows at Elizabeth Springs.

Figure 4. Burke River Fault structure in the vicinity of Elizabeth Springs, with outcropping Toolebuc Limestone.

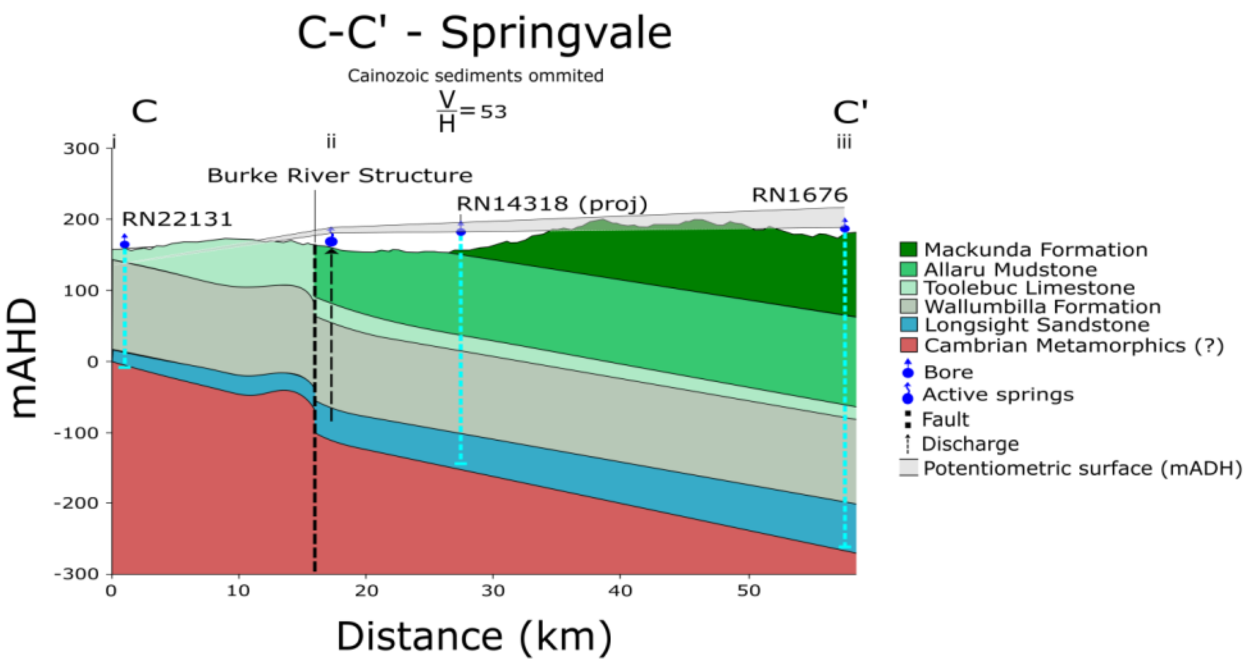

Figure 5. Stratigraphy through Springvale discharge springs (see C-C', Figure 2 for location). Where bores are projected onto the stratigraphic line the difference in elevation is indicated by the position of the bore symbol in relation to the ground surface. The range in the potentiometric head over time is represented by the limits of the grey bar and the roman numerals indicate the location of the bores that inform the head. i: RN4869, min. date 1969: SWL -9.14, max.date 1939: SWL 0; ii: RN5102, min.date 1995: SWL: 2.04, max.date 1970: SWL 7.04; iii: RN1676, min.date 1996: SWL 6.23, max.date 1917: SWL 33.1.

Early measurements of artesian head are up to 33 m and recent measurements are in the vicinity of 6 m. This substantial decline has resulted in some bores to the west of the Burke River fault having become sub-artesian. Historical estimates of flows at Elizabeth Springs suggest that flows have declined from 53 l/sec in 1896 to between 9 and 13 l/sec between 1951 and 2002 (determined from aerial photography and satellite imagery, R. Fensham unpublished data). Many of the springs in the Springvale supergroup have ceased to flow altogether (Table 1).

Springs on Warra, south of the Hamilton River, many of which are inactive, are also aligned with the Burke River Structure (Figure 2). At the northern end of the Burke River Structure and north of the Hamilton River, the Mt Datson Springs are associated with folding and perhaps also faulting of outcropping Cambrian limestone at Mt Datson to the north of the springs (Figure 2). In this location the aquifer is relatively shallow and the springs coincide with an area of relatively low elevation and therefore maximal artesian head which is in the vicinity of 7 m, despite considerable drawdown during the pastoral period (Figure 6). The springs in this location occur in association with drainage channels bisecting a shallow Tertiary limestone ridge (Figure 2; Figure 7).

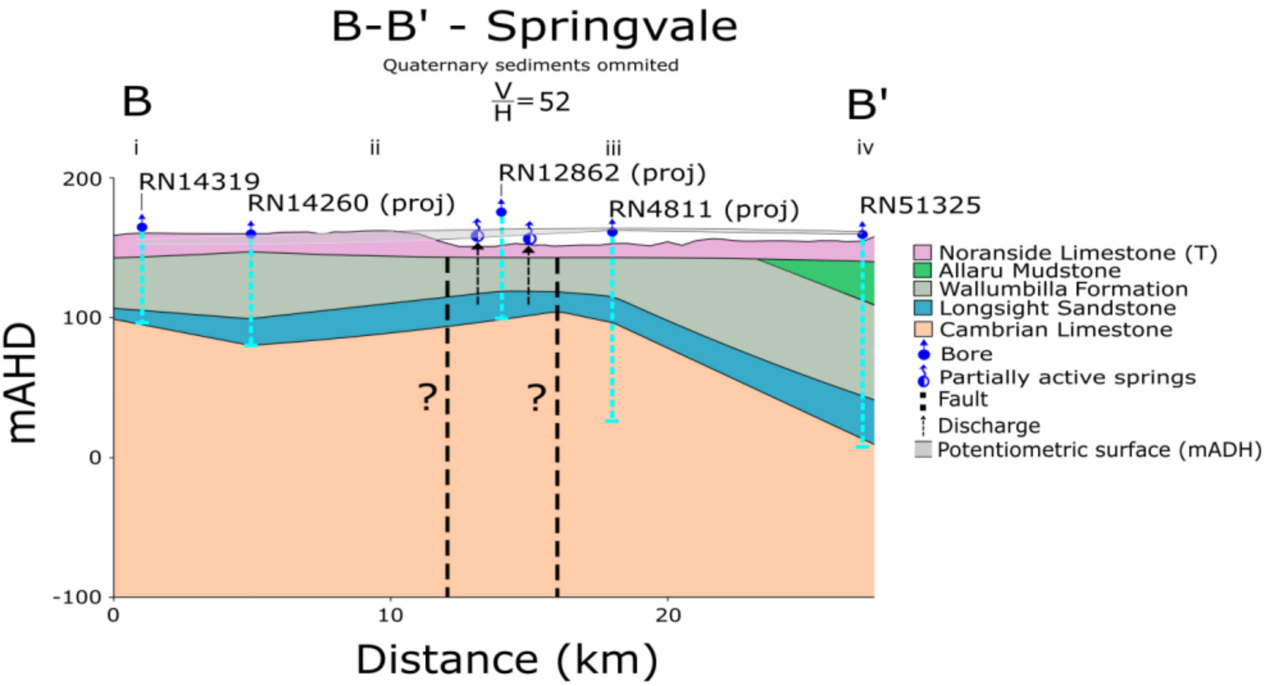

Figure 6. Stratigraphy through Springvale discharge springs (see B-B', Figure 2 for location). Where bores are projected onto the stratigraphic line the difference in elevation is indicated by the position of the bore symbol in relation to the ground surface. The range in the potentiometric head over time is represented by the limits of the grey bar and the roman numerals indicate the location of the bores that inform the head. i: RN4866, min. date 2001: SWL 3.47, max.date 1918: SWL 7.01; ii:RN12880, min.date 1992: SWL: 3.76, max.date 1955: SWL 9.86; iii: RN4811, min.date 1896: SWL 4.27, max.date 1913: SWL 5.64; iv: RN51325, min.date 1998: SWL: 4.35, max.date 2013: SWL 6.55.

Figure 7. Mt Datson springs emanating from drainage depressions flowing off a low limestone ridge (background).

The Coorabulka springs are associated with a fault structure providing a conduit through the aquitard which is more than 100 m thick in this area (Figure 8). Some of the springs which are not directly aligned with a mapped fault probably identify the location of other unmapped structures. There is a substantially positive artesian head in this area, although this has diminished substantially during the pastoral period. This has possibly resulted in diminished spring flows, but this is not evident from the sparse historical record.

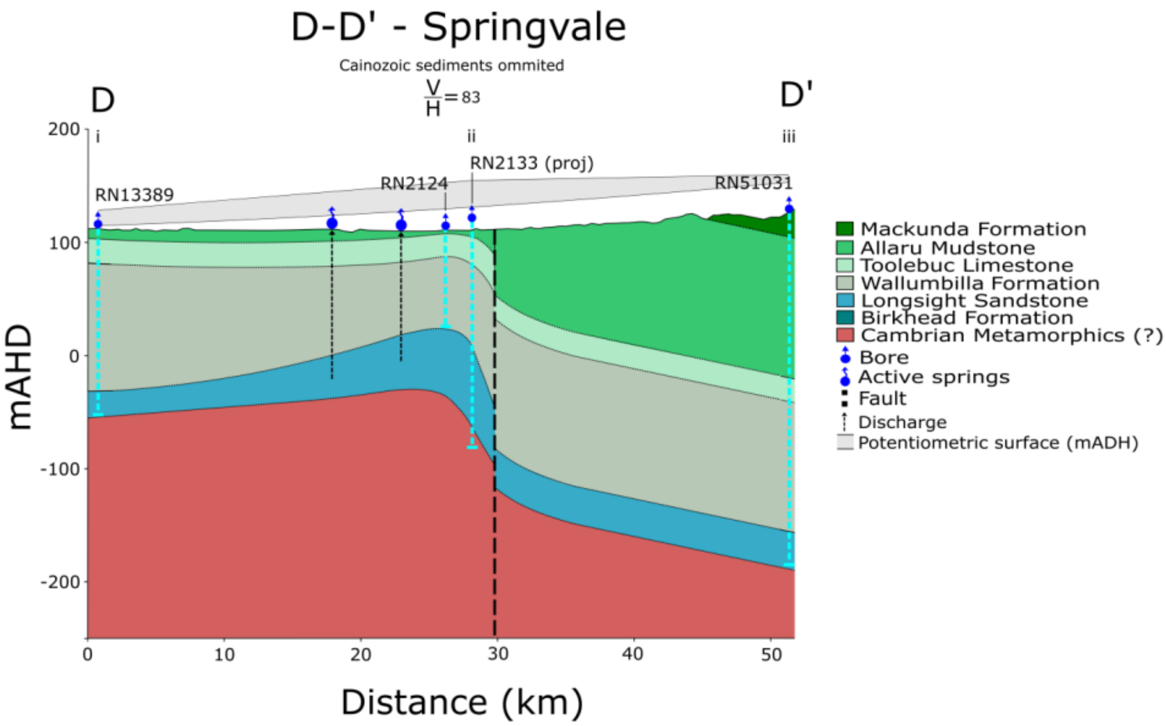

Figure 8. Stratigraphy through Springvale discharge springs (see D-D', Figure 2 for location). Where bores are projected onto the stratigraphic line the difference in elevation is indicated by the position of the bore symbol in relation to the ground surface. The range in the potentiometric head over time is represented by the limits of the grey bar and the roman numerals indicate the location of the bores that inform the head. i: RN13389, min. date 2001: SWL 2.06, max.date 1957: SWL 17.61; ii:RN2123, min.date 1973: SWL: 11.88, max.date 1987: SWL 36.27; iii: RN51031, min.date 2001: SWL 23.69, max.date2010: SWL 29.66.

Biological values

The springs in the region have greatly reduced flow rates and many are extinct, suggesting that there may have been substantial local extinctions, including of specialised organisms that will never be known. Elizabeth and Reedy springs are the only two surviving wetlands that contain endemic species in the Springvale supergroup (Figure 9). Elizabeth Springs is the most important site for conservation in the Springvale Supergroup, and indeed one of the most important sites in the Great Artesian Basin and inland Australia. The open water pools are the habitat for the Elizabeth Springs goby (*Chlamydogobius micropterus*), a small fish known from no other locality. Two other species also occur nowhere else: the snail *Jardinella isolata* and *Isotoma* sp. (Elizabeth Springs R.J. Fensham 3676.), that we maintain as the non-endemic *Isotoma fluviatilis* until circumscription. *Isotoma* sp. (Elizabeth Springs R.J. Fensham 3676.) occurs at five springs spread over about 300m, with an estimated area of occupancy of 65m2 and population size of about 500 plants, and if recognised as a species should be listed as Endangered (Silcock et al., 2014).

Utricularia ameliae is only known from Elizabeth Springs, where a conservative population estimate is 500 plants. A *Utricularia* also occurs at Reedy Springs to the north that is probably this species, but it has not been recorded in flower. The robust perennial grass *Eragrostis fenshamii* is only known from Elizabeth and Reedy Springs, and Yowah Creek and Masseys Spring in the Eulo supergroup. Elizabeth and Reedy Springs also contain the only Queensland populations of the glabrous form of *Eriocaulon carsonii*, which is also known from GAB springs in South Australia. Reedy Springs contains a snail related but distinct from the *Jardinella* at Elizabeth Springs (*Jardinella* sp. AMS C.447677). Elizabeth Springs also contains disjunct arid-zone populations of widespread wetland grasses *Cenchrus purpurascens* and *Phragmites australis*.

Figure 9. Distinctive species from Elizabeth Springs (clockwise from top left: Elizabeth Springs Goby (*Chlamydogobius micropterus*), snail *Jardinella isolata*, *Utricularia ameliae* and *Isotoma* sp. (Elizabeth Springs R.J. Fensham 3676.).

Coorabulka Springs is the reference locality of groundwater scald indicator species *Trianthema* sp. (Coorabulka R.W. Purdie 1404) (Figure 10), and both Coorabulka and Pigeongah Springs to the north contain disjunct populations of *Cyperus laevigatus*. There are active and inactive bilby burrows and feed scrapes at Coorabulka Spring, although this is related to the calcrete substrate being preferred for burrows rather than the presence of springs (McRae, 2004).

Figure 10. Large pink hummocks of *Trianthema sp*. (Coorabulka R.W. Purdie 1404), reaching its zenith amongst *Cyperus laevigatus* at its type locality, Coorabulka Springs.

References

Habermehl, M.A. (1982) Springs in the Great Artesian Basin, Australia - their origin and nature. Bureau of Mineral Resources, Geology and Geophysics, Canberra, Report 235.

McRae, P.D. (2004) Ecology of the Greater Bilby, *Macrotis lagotis*, in western Queensland. University of Sydney.

Silcock, J.L., Healy, A.J. & Fensham, R.J. (2014) Lost in time and space: re-assessment of conservation status in an arid-zone flora through targeted field survey. Australian Journal of Botany, 62**,** 674-688.