

An overdue break-up of the east Australian *Calotella* (*Wittenagama*) *nobbi* (Witten, 1972) species complex.

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ABSTRACT

As of early 2023 the *Calotella* (*Wittenagama*) *nobbi* (Witten, 1972) species complex, often placed in other genera such as *Diporiphora* Gray, 1842, *sensu* Edwards and Melville (2011), or *Amphibolurus* Wagler, 1830 *sensu* Cogger *et al.* (1983) has been treated as including up to four putative named taxa.

The most recent treatment of the species complex by Edwards and Melville (2011) synonymised both *C. nobbi coggeri* (Witten, 1972) and *C. parnabyi* Wells and Wellington, 1985 with *C. nobbi*.

Edwards and Melville (2011) also named a divergent lineage as *C. phaeospinosa*, being a classification of the group used by both Cogger (2014) and Wilson and Swan (2021), being the most recent relevant reference works.

However the molecular evidence of Edwards and Melville (2011) showed emphatically that at least 6 other unnamed forms were within the group as well as the fact that *C. parnabyi* was definitely a species-level divergent lineage.

They wrote: “Divergences within *D. nobbi* firmly place intraspecific diversification within this species in the late Miocene period (3-8 mya).”, with their best guess as being 4.1 MYA.

4.1 MYA is certainly species-level divergence for the relevant lineages.

Because these lineages are morphologically diagnosable, this paper formally names as new species the six hitherto unnamed lineages, in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999), while also recognising all of *C. nobbi*, *C. parnabyi* and *C. phaeospinosa* as valid species, bringing the total in the species group to nine.

The molecular divergences cited by Edwards and Melville (2011) confirms the validity of the genus *Calotella* Steindachner, 1867, as used by Wells and Wellington (1985). Claiming a 10.7 MYA divergence between the type species for *Calotella* and the type species for *Wittenagama* Wells and Wellington, 1985, the genus name as proposed by Wells and Wellington is herein conservatively used as a subgenus for the relevant taxa formally named in this paper.

Keywords: Taxonomy; nomenclature; Australia; Queensland; New South Wales; Victoria; Dragon lizard; *Amphibolurus*; *Diporiphora*; *Calotella*; *nobbi*; *coggeri*; *parnabyi*; *phaeospinosa*; new species; *gedyei*; *ruffellae*; *dorsei*; *wiradjuri*; *josephburkei*; *aah*.

INTRODUCTION

As of early 2023 the well-known “Nobbi dragon” found mainly in drier parts of eastern Australia, was treated as being of just two species.

This followed on from the major work on the complex by Edwards and Melville (2011).

The putative species was originally named as just one, “*Amphibolurus nobbi* Witten, 1972, by Witten (1972), with a type locality of 24 miles east north-east of Guyra, New South Wales,

Australia.

Geoff Witten also formally named a subspecies *A. nobbi coggeri* Witten, 1972 at the same time, with a type locality of the Warrumbungle Mountains in north New South Wales, Australia.

Cogger *et al.* (1983) maintained the classification of Witten, but Wells and Wellington (1985) moved the two Witten taxa to a newly erected genus *Wittenagama*, elevating the subspecies to be a full species.

They also named a form from inland central Queensland as *Wittenagama parnabyi* Wells and Wellington.

Wells and Wellington (1985) also recognized the genus *Calotella* Steindachner, 1867 for the first time in about a century for the type species group, being the *Calotella australis* Steindachner, 1867 species group, which had been placed by Cogger *et al.* (1983) within *Diporiphora* Gray, 1842, with a type species of *Diporiphora bilineata* Gray, 1842.

Significantly, numerous molecular phylogenies (including for example that of Edwards and Melville 2011) have shown these two species groups to be sufficiently divergent as to warrant genus-level divergence (well over 10 MYA) and so the use of the genus name *Calotella* is adopted in this paper for all species within the greater *Calotella australis* species group.

Wells and Wellington (1985), erected a separate genus for their “*nobbi*” group being *Wittenagama*, with a type species of *Amphibolurus nobbi coggeri* Witten, 1972 for the three putative species they placed within that genus.

These were “*Amphibolurus nobbi*”, “*A. coggeri*” (as they understood the concept) and their newly named form *W. parnabyi* Wells and Wellington, 1985 (they placed all three in their *Wittenagama*).

As set out in detail in Hoser (2023), Richard Shine and his cohort, first petitioned the ICZN to suppress the Wells and Wellington works in 1987, as in to have their works erased from the scientific record.

While this attempt at suppression failed in 1991 by way of a formal ICZN Ruling against the Richard Shine cohort of thieves (see Hoser 2023), it did in effect stop uptake of most Wells and Wellington names between 1985 and 1991.

That legacy continues to this day.

Following the ICZN ruling of 1991, Glen Shea and Ross Sadlier in Shea and Sadlier (1999), published a scathing review of the Wells and Wellington works of 1984 and 1985, in which they erroneously declared many Wells and Wellington taxa as “probably *nomen nudem*”, which further served to delay uptake of Wells and Wellington names as just alluded to.

They also and without any proper justification formally synonymised *W. parnabyi* Wells and Wellington, 1985 with “*A. nobbi*”, which has not been challenged by anyone since and was apparently blindly and unscientifically accepted by Edwards and Melville (2011).

In terms of the genus name *Calotella*, while first resurrected by Wells and Wellington, it has not since appeared in any major works including about the relevant species, which have generally most recently been placed within *Diporiphora sensu* Edwards and Melville (2011), as seen for example in Cogger (2014), Brown (2014) or Wilson and Swan (2021).

As already mentioned, Edwards and Melville (2011) cited the synonymisation of *W. parnabyi* Wells and Wellington, 1985 with “*A. nobbi*” as a basis for continuing to do so.

This position was bizarre as they admitted in the same paper that their own molecular data and morphological data confirmed that it was in fact a different species-level taxon.

It says something that two so-called scientists, each with positions in highly regarded government-controlled State Museums can fudge their conclusions to not use a properly proposed name because their cohort has taken it upon themselves to suppress the works of Richard Wells and Ross Wellington at every opportunity.

The logical ultimate position of the paper of Edwards and Melville (2011), based on their own evidence was to accept the Wells and Wellington name *W. parnabyi* Wells and Wellington, 1985 (and placing it in a genus of their choice), be it *Diporiphora* as used by them or another, such as the more sensible *Calotella*, and then also accept the existence of at least six other unnamed species as shown by their own molecular results.

Rather than forcing themselves to accept the Wells and Wellington name, Edwards and Melville (2011) came up with

a convoluted set of mental gymnastics to assert that all the divergent species-level lineages should all be subsumed into one big mess that they called *Diporiphora nobbi*.

I should also note that Edwards and Melville (2011) did conclusively show that both “*D. nobbi*” and “*D. nobbi coggeri*” were in fact of the same single lineage within their multi-lineage “*D. nobbi*”, and therefore not even worthy of a subspecies level division. That position is not disagreed with here.

They also named a separate more divergent lineage from Queensland as *C. phaeospinosa* Edwards and Melville, 2011. However that putative taxon as identified by them, did in fact include two quite divergent and allopatric populations, that their own molecular data showed were species-level divergent.

It has recently become apparent that refusal to accept the existence of valid species of agamid in Australia is putting some of them at serious risk of extinction, as seen in Hoser (2019a, 2019b) and with this in mind, it became increasingly urgent that someone actually formally identifies and names the relevant unnamed species-level lineages within the “*nobbi*” complex, sooner rather than later.

With no one else stepping up for the task, I took it upon myself to resolve the matter.

I reiterate that the molecular evidence of Edwards and Melville (2011) showed emphatically that at least 6 other unnamed forms were within the group as well as the fact that *C. parnabyi* was definitely a species-level divergent lineage.

They wrote: “*Divergences within D. nobbi firmly place intraspecific diversification within this species in the late Miocene period (3-8 mya).*”, with their best guess as being 4.1 MYA.

4.1 MYA is certainly species-level divergence for the relevant lineages!

That set the course of the inquiries that followed the publication of Edwards and Melville (2011) and preceded this paper.

The molecular divergences cited by Edwards and Melville (2011) confirmed the validity of the genus *Calotella* Steindachner, 1867, as used by Wells and Wellington (1985).

Claiming a 10.7 MYA divergence between the type species for *Calotella* being *Calotella australis* Steindachner, 1867 and the type species for *Wittenagama* Wells and Wellington, 1985, the genus name as proposed by Wells and Wellington is herein conservatively used as a subgenus for the relevant taxa as formally named this paper, this being done either explicitly or implicitly if the name *Wittenagama* is not actually used (from here on in).

MATERIALS AND METHODS

Specimens of putative *C. nobbi* (including recently named forms previously treated as this taxon) were inspected from across the putative range for the complex, from north-east Queensland to north-west Victoria, including dead, live and photos with good locality data.

Consistent differences were noted and ultimately readily matched with relevant species groups as identified by Danielle Edwards and Jane Melville in their paper Edwards and Melville (2011).

Relevant literature was also consulted to confirm the absence of any possible synonym forms or names of the potential newly identified taxa, which did not exist beyond those outlined in the abstract.

Publications relevant to the ultimate taxonomic and nomenclatural conclusions made herein included Brown (2014), Chapple *et al.* (2019), Cogger (2014), Cogger *et al.* (1983), Edwards and Melville (2011), Gray (1842), Hoser (2007, 2012, 2015g, 2017, 2018, 2019a, 2019b, 2022, 2023), Kay *et al.* (2013), Melville and Wilson (2019), Melville *et al.* (2011, 2018, 2019a, 2019b), Michael *et al.* (2011), Murphy and Murphy (2015), Ride *et al.* (1999), Shea and Sadlier (1999), Steindachner (1867), Swan *et al.* (2022), Swanson (1976), Wells and Wellington (1984, 1985), Wilson (2022), Wilson and Knowles (1988), Wilson and Swan (2021), Witten (1972), Witten and Heatwole (1978) and sources cited therein.

RESULTS

Six unnamed divergent lineages identified by Edwards and Melville (2011) (see fig. 2 on page 536 in that paper) were found to be morphologically separable from one another and so each is formally named in accordance with the rules of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

This brings the total in the species group to nine.

I should also note that none of the previous species descriptions of taxa within the complex, that is Witten (1972), Wells and Wellington (1985) or Edwards and Melville (2011) make reference to the obvious sexual dimorphism in each species in the complex in their formal descriptions.

In the case of Edwards and Melville (2011) in particular, this quite obvious oversight explains why they appeared to be unable to differentiate between the various species their molecular data indicated.

In their assessment of characters in specimens, by jumbling males, with females in all or most of the species they were inspecting, including in their results table, they confused matters and were effectively unable to separate the taxa.

For example their Fig 5, on page 539 is effectively worthless as the alleged differences between the species as indicated may in fact be nothing more than range differences between males of one species versus females of another. The authors did not indicate which sexes their diagrams were of.

Had the later authors split the sexes in their specimens and/or split the sexes and looked at normal adult specimens alive (as in with colour, versus just shrivelled up dead museum animals), they would have soon realized that each of the nine relevant species, including their newly named taxon *D. phaeospinosa* were readily separable from one another and then have been able to formally name the six until now unnamed forms back then.

In summary, the males of all species have a pattern dominated by two thick white, cream or yellowish-white stripes running down the dorsum of the body, near the lateral edge.

Females of all species have a dorsum where the lines on the edge of the dorsal surface are reduced in size, prominence or intensity, or even absent, and the mid dorsal area is prominently marked with alternating dark and light, with the dark sections generally intruding on and breaking the outer whitish lines. The females are generally more drab in colour, although in some species they are distinctly coloured, but different to the males. In the mating season they lack the strong coloured flushes (usually red, pink or orange) on the base of the tail on the flank area that is seen in the adult males.

The formal description of Wells and Wellington (1985) for their species "*Wittenagama parnabyi*" is defective in that while it is accurately diagnostic in terms of separating their taxon from all others in the complex, this is only the case for adult males of their taxon.

Females are coloured differently and would under the diagnosis of Wells and Wellington (1985) be diagnosed as "*C. nobbi*", based on all previous species concepts.

Notwithstanding this defect, their name is available for their taxon and is used herein as correct.

I also show how to separate females of "*Wittenagama parnabyi*" from all other species within the complex as a refinement and improvement of the original Wells and Wellington (1985) diagnosis for the taxon.

This is exactly how science progresses!

All authors, (Wells, Wellington and myself included) make errors and so the errors of the original describers in terms of their first identifications of new species in the complex is not a hanging offence.

Most importantly and to their great credit, Wells and Wellington successfully identified a previously unnamed species at a time when no one else in Australia seemed to have a remote inkling that the species even existed!

Molecular evidence unavailable to them, or anyone else back in 1985 confirmed their claims of a new species in the form of the results of Edwards and Melville (2011) and on that basis alone, the species "*Wittenagama parnabyi*" should have been recognized as a valid species by all Australian herpetologists since (as per Hoser 2007).

However the unfair synonymisation of the Wells and Wellington taxon herein called *Diporiphora (Wittenagama) parnabyi* Wells and Wellington, 1985, has been very improper and unfair to Wells and Wellington.

Shea and Sadlier (1999) were quick to synonymise *C. parnabyi* with *C. nobbi*.

They wrote of "*Wittenagama parnabyi* Wells & Wellington, 1985" the following:

"Although Wells & Wellington mentioned three diagnostic characters for this species (yellow paravertebrals, pink tail, black thoracic patch) at least the first two characters are also present in *Amphibolurus nobbi nobbi*, the taxon they recognised as closest to their species. In the absence of a more rigorous and workable diagnosis, we tentatively synonymise the name.

= *Amphibolurus nobbi nobbi* Witten, 1972, synonymy made in this paper.

However, the fact is that no other specimens of either sex (male or female) in any other species within the *C. nobbi* complex has yellow paravertebral scales!

With Shea and Sadlier, not disputing the factuality of the Wells and Wellington description (they clearly had no idea Wells and Wellington were only looking at males, in life at least), their claim that others in the complex had this character was simply false and they should have known this!

On this basis alone, they should have not rushed to synonymise the taxon.

Of course the question then begs, that with Shea and Sadlier at the Australian Museum at the time they published their paper in 1999, why did they not either 1/ Inspect specimens of putative *C. nobbi* from both type locality and the type locality for *C. parnabyi* themselves to work out the differences and/or use the newly available molecular methods that they had at their fingertips to ascertain whether or not the two putative taxa were sufficiently divergent to be regarded as separate species.

In any event, Edwards and Melville (2011) did just that and allegedly looked at specimens of putative *C. nobbi* from across the range of the putative taxon, including from the type locality of *C. parnabyi* (or should I say, very close to it) as well as type localities for the two previously named subspecies of *C. nobbi*, both in northern New South Wales.

They had molecular data that confirmed that *C. parnabyi* was distinct from *C. nobbi* and still refused to recognise it as a separate taxon.

In a scandalous case of buck-passing they simply continued to pretend the Wells and Wellington species did not exist, because Shea and Sadlier had already (improperly) synonymised it.

In a fairly low-ball attack on Wells and Wellington (1985) they wrote:

"Wells and Wellington (1985) described another species from within the range of *D. nobbi* and ascribed this species to its own genus with the name *Wittenagama parnabyi* based on a single specimen from central Queensland in the vicinity of Alpha. However, this species was later synonymized with *D. nobbi* by Shea and Sadlier (1999)."

The claim that the species description was based on a single specimen is typical of the lies Melville in particular writes to discredit the works of others, with a view to engaging in taxonomic vandalism with their works, or to otherwise improperly impugn the reputations of others she sees as "competition" in her newly occupied space of Australian agamid taxonomy, being a place she seeks to assert a position as a sole credible authority. Wells and Wellington (1985) did not just describe their new species on the basis of a single specimen as falsely alleged by

Melville.

Their original description even listed three type specimens, being one holotype and a pair of paratypes!

Rather than copying the detail of the description by Wells and Wellington here, I simply suggest that before anyone decides to disparage their work, perhaps they should read it first and if intending to criticize it, then at least stick to the facts!

Furthermore in their description, Wells and Wellington (1985) even referred to more specimens of what they said was their new species including for example one depicted in a book!

That was Swanson 1976, (plate 86), which they cited in the same exact form.

Of course if Edwards and Melville were trying to paint Wells and Wellington as a pair of fools who recklessly described a non-species on the basis of sighting just one animal, they did a good job of it.

After all, without consulting the paper of Wells and Wellington (1985) directly, no one would ever know that Edwards and Melville (2011) had told a big lie about the pair in their paper.

There is no evidence either that Danielle Edwards and Jane Melville actually bothered to test the Wells and Wellington diagnosis for their taxon, or to properly prove or disprove whether or not their taxon actually existed.

Now remember that both Melville and Edwards are both employed at tax-payer funded State Museums as reptile curators and so have at their fingertips every relevant specimen held by every State Museum in Australia.

Therefore, properly investigating the Wells and Wellington claim of a new species (*C. parnabyi*) would not have been difficult at all. Had they done that logical and simple task, they would not have had to leave the taxon status in doubt for another decade or longer, or until "Raymond Hoser" came along to sort things out.

Noting that with the resources available to them via the State Government museums that they were tied in with, correctly determining whether or not *C. parnabyi* was valid or otherwise as a species in 2011, was a simple task that should have been properly done then!

Again I note that Edwards and Melville (2011) were equally oblivious to the fact that the Wells and Wellington (1985) description of *C. parnabyi* only applied to males of that taxon, because self evidently they never took more than a cursory look at that taxon for fear of confirming the obvious, in that it was a very divergent species!

Noting the scope of the Wells and Wellington (1985) publication (all of Australia's herpetofauna), the fact that both authors were starved of funds and resources at the time they produced their major works, it is not altogether surprising that Wells and Wellington's original description only applied to adult males of the species, or alternatively that is how it in fact appeared to have been published at the time.

What is of course more disturbing is that two later papers, being Shea and Sadler (1999), followed by Edwards and Melville (2011) while wrongly synonymising the taxon *C. parnabyi* with *C. nobbi* were done without the authors even bothering to inspect specimens available to them, or even working out very quickly that the Wells and Wellington description only applied to males, or for that matter even properly quoting what Wells and Wellington (1985) had written!

Of course the failure of Edwards and Melville (2011) to properly consider sexual dimorphism in the various species in the *C. nobbi* complex, effectively meant that their paper and the results were only half written!

It also explained why in their so-called diagnosis of *C. phaeospinosa* Edwards and Melville, 2011 they had to state "in fact, the two species cannot be distinguished using any single morphometric trait measured.", which in the form they put this information, a herpetologist would have no way of identifying a specimen of their new species absent accurate locality data or

DNA from the very same specimen.

As for the other supposedly morphologically undifferentiable candidate species identified in the phylogenies of Edwards and Melville (2011), I certainly had no difficulty at all in identifying consistently different characteristics between the total of nine taxa upon inspection of specimens from each, as identified in the molecular results of Edwards and Melville (2011), when I looked at them on the basis of adult males or females separately.

Hence the unnamed ones are formally identified herein, along with revised diagnoses of the other previously named forms (by default) in the first and most complete description as published herein.

In terms of each relevant species and the characters that separate them from the others in the *C. nobbi* complex, I have had no choice but to deal with both males and females of each, to ensure that I could have workable diagnoses of each taxon and this reflects in the descriptions that follow.

I note that while the concepts of the genus *Calotella* (as a genus) and the subgenus *Wittenagama* (herein as a subgenus) are different to those previously published by any earlier authors, the closest match to this taxonomy in the past 50 years is in fact Wells and Wellington (1985), who were the same, save for their recognition of *Wittenagama* as a full genus, which may ultimately be the preferred position of herpetologists, including potentially myself.

A divergence of 10 MYA from nearest relatives is regarded as genus-level divergence in other reptiles, although clearly this treatment is not consistent in herpetology at the present time.

The previous is noted simply to show that contrary to the non-stop lampooning that Wells and Wellington get (e.g. Shea and Sadler 1999, Edwards and Melville 2011), both with respect of the *C. nobbi* complex, the reality is that their taxonomy and nomenclature (viz Wells and Wellington, 1984, 1985) has in the fullness of time and access to molecular methods, been shown to be mainly correct.

Furthermore, Wells and Wellington (1985) was a far more accurate representation of the taxonomy and nomenclature of the species complex than the later authors, even though they were heavily government-funded and based at lavish State Government museums with the best resources available at their fingertips.

In spite of this incredible "competitive advantage" in the field of science, the later authors managed to get the taxonomy of the complex horribly wrong!

I note that was versus Wells and Wellington (1985), produced at no expense to the taxpayer and on a shoestring budget, and yet the ultimate taxonomy of Wells and Wellington (1985) has shown the later authors to be sadly lacking in semblance to scientific reality or common sense.

Perhaps the most serious criticism, I could level against Wells and Wellington (1985) with the hindsight I have in 2023, is that in their division of the *C. nobbi* complex, they did not split it far enough.

But note that their paper was written decades ago (1985 it came out) and the pair were lampooned at the time for "oversplitting" putative species!

Had Wells and Wellington (1985) actually split putative *C. nobbi* nine ways, their pair would quite likely to have been publicly executed in the Sydney City Square (Martin Place)!

This historical accuracy and good science in terms of the Wells and Wellington paper in terms of other Australian agamids was itemised by Hoser (2015).

Finally and in case it is not yet made clear, inspection of specimens within the putative *C. nobbi* complex was done "from scratch" in that no species or species limits, synonymies and the like were predetermined.

All specimens were inspected and conclusions made on the basis of what was seen and observed by myself and not on the basis of what Witten (1972), Wells and Wellington (1985), Shea

and Sadlier (1999) or Edwards and Melville (2011) wrote or said. All their claims and counter claims were tested and either supported by the evidence, or refuted by it.

The final position herein of nine species in the complex, three previously named and six named herein for the first time, is the culmination of this work.

Recognition by me of the three (of four) previously named forms is based on the molecular and morphological evidence available. It is not based on any deference or favours to authors, or innate preference of any author over another.

Because of the two papers that have synonymised *C. parnabyi* with *C. nobbi* are relatively recent, I must make it clear that had the evidence not supported recognition of *C. parnabyi* as valid, I too would have declared it a synonym of *C. nobbi*. However the evidence in reverse is irrefutable and so *C. parnabyi* is recognized as valid herein.

I also note that while Jane Melville is a detestable person for her repeated actions of taxonomic vandalism, contempt for the rule of law in her repeated breaches of the Australian Copyright Act 1968 and the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) as well as recklessly and deliberately putting reptile species at risk of extinction (see Hoser 2019a, 2019b), her taxon, *C. phaeospinosa* Edwards and Melville, 2011 is clearly morphologically divergent from others in the *C. nobbi* complex and so I recognise it as valid herein as well.

In 2021, the ICZN in a ruling dated 30 April, stated that immoral actions by authors (including for example Jane Melville) were not subject of regulation by the ICZN (ICZN 2021).

This means that notwithstanding her heinous acts, her nomenclatural actions and names created, if code compliant and taxonomically valid, should be recognized and the name/s used as correct.

I go further and advocate that others use the name *C. phaeospinosa* Edwards and Melville, 2011 as valid and the first ICZN available name for that particular taxon.

CONFIRMATION OF NINE SPECIES WITHIN THE COMPLEX

The nine forms identified herein as species are the minimum number of species within the *C. nobbi* complex. It is probably also the maximum number, but this is by no means certain.

Edwards and Melville (2011) in their phylogeny at Fig. 2. on page 536 flag the nine putative species.

However their paper does not provide any morphological basis for recognition of all or most of them.

There is of course the ongoing question as to whether or not their samples are from the taxa they claimed they are taken from.

Hoser (2018) was able to correct the identities of taxa that had previously been misidentified in one or more published phylogenies of Australian monitors.

Similar problems of identification in phylogenies, arising from misidentified samples are so common as to require checking of all such items before making firm taxonomic conclusions. Thorough checking of phylogenies and samples used to create them is something I do with respect of all animal groups I examine.

The checking of the Edwards and Melville (2011) samples implied their samples were what they said they were. That is, they were, by all indications, all of putative *C. nobbi sensu lato* and from the places the samples were alleged as coming from. I do however note that one of the Edwards and Melville (2011) samples was clearly misplaced in error. That being the specimen they placed as being from near Port Macquarie in New South Wales, when in fact it should have been placed about 450 km to the north, near the NSW and Queensland border (they also had wrong co-ordinates for the specimen as well, easily confirmed by way of a Google search for the correct coordinates of "Boonoo Boonoo National Park" in Google).

This misplacement caused the Edwards and Melville (2011) paper to imply that ranges of two putative taxa overlapped

and this may have led the authors or readers to believe that more work was required to ascertain distributional boundaries, before even inspecting physical specimens from given areas, or alternatively that there was admixture between populations that was not in fact occurring.

This would have added to potential uncertainties as to which clade a given specimen actually belonged to.

Once the placement of the Northern New South Wales specimen was corrected, this effectively meant that on the basis of the data in Edwards and Melville (2011), all putative taxa were allopatrically distributed and simultaneously constrained by biogeographical barriers in the form of landforms, soils or vegetation regimes.

This data was then cross-matched with the data from the "Atlas of Living Australia" which contains data on most museum specimens in Australia.

After stripping poor quality records (the majority), but with the remainder still numbering in the many hundreds of samples, it was clear that the ranges of each putative species remained allopatric.

There was of course the issue of potential non-collection, or detection of specimens, including potential intermediates in the intervening "gap" areas.

This issue was overcome with minimal issue on the basis of the following.

The phylogeny of Edwards and Melville (2011) gave no evidence of there being mixture between groups.

But even more importantly was the fact that without exception, each of the nine putative species had a distribution corresponding by known biogeographic zones and habitats forming barriers between one another, similarly constrained by known biogeographical barriers (including landforms, soil types and overlying dirt, rock and/or vegetation) that affect similarly constrained reptiles.

In the case of each of the nine putative species identified herein as full species, I have in the past split species groups across all of the exact same biogeographical barriers.

Therefore on the basis of the preceding, I had absolutely no hesitation whatsoever in formally identifying all nine as full species and naming the six previously unnamed ones.

Now I make mention of the statement in the abstract of Edwards and Melville (2011), which said "Our molecular data also show large divergences among subclades within nominate *D. nobbi* associated with different habitats rather than specific biogeographic barriers.", which is quite simply either incorrect or misleading.

The different habitats themselves ARE the biogeographic barriers.

Had the misplaced sample in New South Wales also been properly placed in their analysis, Edwards and Melville may well have realised that each and every one of their clades conformed to known biogeographical provinces and known cohorts of species within known ecosystems.

The relevant nine species with the *C. nobbi* complex, also herein being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985, are as follows:

Nominate *C. nobbi* (Witten, 1972) with a type locality of 24 miles, east north-east of Guyra, New South Wales occurs in the New England Region of New South Wales, except the far northern part, extending into the Granite Belt of south-east Queensland, as well as the nearby elevated areas to the south-west including the Warrumbungle Mountains. The form described as *C. nobbi coggeri* (Witten, 1972), with a type locality of the Warrumbungle Mountains, is herein treated as a synonym of nominate *C. nobbi*.

C. parnabyi (Wells and Wellington, 1985) with a type locality of 88 km west of Alpha, Queensland, occurs west of the Great Divide in eastern Queensland, generally north of the tropic of Capricorn and east of the black soil areas, extending north to about Charters Towers and Hughenden in north Queensland.

C. phaeospinosa (Edwards and Melville, 2011) with a type locality of Bauhinia Station, Queensland, Latitude -25.17 S., Longitude 149.20 E, is a range-restricted species confined to the Expedition National Park (Southern Expedition Range) and the Bigge Range, mid-eastern Queensland.

C. aah sp. nov. was formerly treated as a northern population of *C. phaeospinosa*, and is apparently confined to the Blackdown Tableland (Northern Expedition Range) in mid-eastern Queensland. While extremely common where it occurs, it appears to be a range-restricted endemic in that area.

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C. dorsei sp. nov. appears to be confined to the Granite Belt of far south-east Queensland and immediately adjacent high-elevation areas on the NSW/Queensland border area and limited high altitude regions to the immediate north.

C. wiradjuri sp. nov. occurs on elevated wooded sections of the western plains of New South Wales, beyond the western slopes and east of the more arid far western parts of the state in an area generally in a line from West Wyalong in the south, through Parkes and Dubbo and as far north as Bourke in the north-west.

C. josephburkei sp. nov. occurs in the Mallee/Spinifex woodlands belt of far south-west New South Wales, north-west Victoria and nearby parts of South Australia.

As already mentioned, all were able to be separated from one another by combinations of colour and markings in terms of adults of each sex.

In terms of the relevant biogeographical barriers separating the forms identified herein as separate species, I note the following.

Putative *C. phaeospinosa* (Edwards and Melville, 2011) is, according to them, distributed in both the north and south Expedition Range in eastern Queensland, generally west and south-west of Rockhampton in Queensland.

There is an obvious north-south-gap in the distribution of their taxon and in this paper they are split, with the hitherto unnamed form from the Blackdown Tableland being formally named as a new morphologically divergent species, *C. aah* sp. nov..

The molecular data of Edwards and Melville (2011) as well as morphological divergence recorded by myself, do on their own provide a compelling case for species-level recognition of the northern population.

Significantly, in Hoser (2016) similarly split a putative gecko species across the exact same biogeographical barrier, probably being the first sibling species pair split across the barrier.

Hoser (2016) again relied upon previously published DNA evidence and consistent morphological divergence.

In that paper Hoser (2016) wrote:

"The species *S. jackyae* sp. nov. is only known from the Blackdown Tableland National Park, south-east Queensland, Australia. The similar species *S. salebrosus* is found about 150 km further south-east in the general vicinity of the type locality, Monto, also in south-east Queensland."

In terms of the north coast of Queensland species, *C. gedyei* sp. nov. and the species *C. ruffellae* sp. nov. both are separated by the St. Lawrence Gap, a well-known biogeographical barrier affecting many reptile taxa.

The species *Cryptophis edwardsi* (Hoser, 2012) as described in Hoser (2022), is constrained in the north by the St. Lawrence Gap and Dawson MacKenzie Gap, around Rockhampton in Queensland in the north and the border ranges barrier in the south.

C. ruffellae sp. nov. is separated in the south by the border

ranges biogeographical barrier, within which the upland form *C. dorsei* sp. nov. occurs.

Across the same biogeographical barrier the species pair *Amalosa jacovae* Couper, Keim and Hoskin, 2007 from the Queensland coast and *A. phillipsi* Wells and Wellington, 1984 (in the uplands) are separated by the same zone.

Similarly, the putative gecko species *Diplodactylus vittatus* Gray, 1832 was finally fully split up by Hoser (2023), using both morphological and genetic data.

The newly named NSW / Queensland border Granite belt form, was formally named *D. rosswellingtoni* Hoser, 2023. North of there in Queensland was *D. oxyi* Hoser, 2023 and south of the border ranges in the main New England region of New South Wales, including western outliers, was the type form of *D. vittatus*.

C. dorsei sp. nov. in turn is separated from the more southern *C. nobbi* (Witten, 1972), with distributions almost exactly matching the separation between that of *D. vittatus*, and *D. rosswellingtoni* by the same relatively rock-free zone or barrier that passes between Inverell-Glen Innes and north of the Queensland/New South Wales State Border.

Other morphologically different and genetically divergent species pairs split across the same biogeographical barrier are *Uvidicolus covacevichae* Hoser, 2016 as described in Hoser (2016) from the Queensland, New South Wales border, with *U. Sphyrurus* (Ogilby, 1892) being from the southern and central New England region of New South Wales and *Amalosa alexanderdudleyi* Hoser, 2017 as described in Hoser (2017) from the same areas as *U. Sphyrurus* (Ogilby, 1892), with the earlier described *A. phillipsi* Wells and Wellington, 1984 (note their correct genus placement), from the Queensland/New South Wales border area.

The southwest-border between the New England and north-west uplands of New South Wales form *C. nobbi* and the newly named *C. wiradjuri* sp. nov., from the elevated sandy or rocky dirt wooded areas between the eastern hills and the black soils further west is an established biogeographical barrier for many species pairs or complexes.

In terms of the *D. vittatus* complex and based on molecular and morphological data, *D. vittatus* was confined to the lower New England region, mirroring the distribution of *C. nobbi*, while *D. crotalusei* Hoser, 2013 has a distribution that almost exactly matches that of *C. wiradjuri* sp. nov. in the wooded region immediately west of the western slopes, mainly in north-west New South Wales.

The distribution of *C. josephburkei* sp. nov. is similarly constrained within the spinifex woodlands region around the border intersects of far south-west New South Wales, north-west Victoria and adjacent south-east South Australia.

The region and habitat is isolated by more arid and treeless areas to the north, wetter areas to the south as well as east and mountains to the west. The distribution of *C. josephburkei* sp. nov. is almost identical to that of *D. sloppi* Hoser, 2023, and almost certainly constrained by identical biogeographical factors.

EGREGIOUS TAXONOMIC VANDALISM BY JANE MELVILLE

The seriousness of the problems caused by taxonomic vandalism cannot be understated. See for example the reviews in Ceriaco *et al.* (2023), Cogger (2014), Cotton (2014), Dubois *et al.* (2019), Hawkeswood (2021), Hoser, (2007a-b, 2009a, 2012a, 2012c, 2013, 2015a-f, 2019a, 2019b), ICZN (1991, 2001, 2021), Mosyakin (2022), Wellington (2015) and sources cited therein.

Jane Melville is a serial offender and as there is a strong likelihood that she will attempt yet more name theft and taxonomic vandalism with respect of the new names within this paper, I shall make a brief mention of some of her previous nefarious actions, so that they remain a part of the scientific (or non-scientific in her case) record, and part of the public record for historical posterity.

This is particularly important noting her penchant for re-writing and faking the record, to imply she is some kind of Saint.

It is in fact quite difficult to keep pace with the actions of Melville and her cohort with respect of stealing works of others and renaming the very same entities in breach of both the Copyright Act Australia, 1968 (Moral Rights Section) and parallel laws in other countries as governed by the Berne Convention, 1886 as well as the flagrant breaches of both mandatory parts of the *International Code of Zoological Nomenclature* (Ride *et al.* 1999) and the voluntary parts (recommendations) as well.

As of mid 2023, her cohort have illegally renamed over 100 reptile taxa over the past 20 years, have recently commenced taxonomic vandalism with respect of endangered species of marsupial and have now also lurched into the spheres of insect taxonomy and botany.

They could accurately be described as a band of taxonomic terrorists or nomenclatural anarchists.

They could also accurately be described as an unscientific mob of thieves.

As was described recently, this cohort, a small but vocal minority, are in effect an expanding pandemic causing chaos in scientific nomenclature and threatening its very existence!

They recruit gullible new followers by offering them a quick ride to fame as a "scientist", by getting them to steal works of others to claim as their own "discovery", rather than to put in the time and effort to make genuine scientific discoveries.

In terms of Jane Melville herself, I note that she has unlawfully coined duplicate names for the following reptile taxa.

Lophognathus wellingtoni Hoser, 2015 was unlawfully renamed as *Lophognathus horneri* by Melville (as senior author of a cohort) in 2018 in an online "journal" (Melville *et al.* 2018).

That was a culpable case of taxonomic vandalism and nepotism at the same time!

Melvillesaurea Hoser, 2015 was illegally renamed *Tropicagama* Melville *et al.* 2018, similarly published in an online "journal", and has since been plastered all over the internet falsely claiming it is the correct ICZN name for the genus while simultaneously removing evidence that the correct name *Melvillesaurea* Hoser, 2015, even exists, as seen for example at:

<https://reptile-database.reptarium.cz/species?genus=Tropicagama&species=temporalis>

and
<http://www.wildherps.com/species/A.temporalis.html>

and
<https://apps.des.qld.gov.au/species-search/details/?id=563>

and
http://www.reptilesaustralia.com/lizards/agamids/gowidon_temporalis.html

and
<https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/ecae8005-45f0-4a1d-8d73-3896a5bab6a3>
and countless other examples ...

In an incredibly low act Jane Melville coined an illegal junior synonym name for *Tympanocryptis lineata* Peters, 1863 by renaming it *Tympanocryptis osbornei* in 2019 (see Melville *et al.* 2019a published in an online "journal"). Again this was taxonomic vandalism and nepotism at the same time, involving her mate William Osborne. This illegally coined junior synonym was similarly plastered all over the place, with the simultaneous erasing of a related but morphologically and genetically divergent species *Tympanocryptis telecom* Wells and Wellington, 1985 whenever possible.

See for example at:
https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=90479

and
<https://www.environment.nsw.gov.au/news/nsw-threatened-species-scientific-committee-final-determination-tympanocryptis-osbornei>

and

<https://reptile-database.reptarium.cz/species?genus=Tympanocryptis&species=osbornei>

and

<https://bie.ala.org.au/species/https://biodiversity.org.au/afd/taxa/42312895-b127-48dc-bcb2-6d1adcf62eb7>

and

<https://arod.com.au/arod/index.php?q=photographerID%3D71>
and countless other places.

Melville's act of attempting to rename a species, discovered and named for the first time by Wilhelm Karl Hartwich (or Hartwig) Peters (born 22 April 1815 in Koldenbützel, Germany, died 20 April 1883), namely *Tympanocryptis lineata* Peters, 1863 is particularly egregious, as besides being a combined act of taxonomic vandalism and nepotism in that she again named the taxon after a close friend who has made little significant contributions to herpetology or humanity in general, she has unlawfully renamed a species first named 160 years prior and where the original scientist who named it has no way possible to defend himself against this unscientific incursion into the realms of herpetology.

In case it's been overlooked, Wilhelm Karl Hartwich Peters has been regarded as one of the greatest taxonomists in the history of the biological sciences. He discovered and named hundreds of species of vertebrate, including hundreds of reptile species, being within the top 10 ICZN name authorities in all of history for herpetology.

Tympanocryptis snakebustersorum Hoser, 2019, was given the illegally coined synonym *T. petersi* Melville *et al.* 2019.

The illegally coined synonym name was again shopped across the web in the same Nazi-style rewrite of history, in this case being a disgusting rewrite of the scientific record, by pretending that the earlier and correct ICZN name *Tympanocryptis snakebustersorum* Hoser, 2019 simply does not exist.

See for example at:

https://bie.ala.org.au/species/ALA_DR655_1626

and

<https://reptile-database.reptarium.cz/species?genus=Tympanocryptis&species=petersi>

and

http://reptilesaustralia.com/lizards/agamids/Tympanocryptis_petersi.html

and countless other places as well.

And you can repeat the same egregious contempt for ethics, the rule of law and the rules of the *International Code of Zoological Nomenclature* that binds all scientists globally, in terms of Melville's, similar scandalous attempts to erase scientific history by renaming the following as well.

T. optus Hoser, 2019, was given the illegally coined junior synonym name *T. argillosa* Melville *et al.* 2019.

T. vodafone Hoser, 2019 was given the illegally coined junior synonym name *T. tolleyi* Melville *et al.* 2019.

T. lachlanheffermani Hoser, 2018 was given the illegally coined junior synonym name *T. rustica* Melville *et al.* 2019.

In other words Jane Melville is a liar and crook in every sense of the word. Any science credentials or good work she may have done is dwarfed by her unscientific and unethical actions in illegally trying to claim credit for discoveries she simply never made!

Her destabilizing of zoological nomenclature for her own egotistical self-aggrandisement is a shocking example that hopefully no one else will try to emulate.

In term of near relatives of the *C. nobbi* complex, Melville's partner in crime Danielle Edwards has not been sitting idly by either!

In 2023, along with the notorious serial taxonomic vandal Mark Hutchinson, she illegally coined junior synonym names for four subspecies of Mallee Dragon that had been properly named in

2020 (Hoser 2020, Hutchinson and Edwards 2023).

These were:

Ctenophorus (Phthanodon) fordi scottjamesi Hoser, 2020 was given the illegally coined junior synonym name *Ctenophorus cartiwarra* Edwards and Hutchinson, 2023,

Ctenophorus (Phthanodon) fordi scottgranti Hoser, 2020 was given the illegally coined junior synonym name *Ctenophorus ibiri* Edwards and Hutchinson, 2023,

Ctenophorus (Phthanodon) fordi danielmani Hoser, 2020 was given the illegally coined junior synonym name *Ctenophorus tjakalpa* Edwards and Hutchinson, 2023,

Ctenophorus (Phthanodon) fordi maryannmartinekae Hoser, 2020 was given the illegally coined junior synonym name *Ctenophorus tuniluki* Edwards and Hutchinson, 2023.

As to why Hutchinson and Edwards (2023) would choose to elevate four previously described subspecies, each with a divergence of less than 1 MYA from their nearest previously named relatives, is a question that needs to be asked of them, but obviously I don't think that decision was particularly sensible either!

In terms of her co-offender, Mark Hutchinson, just think "Bassiana Hutchinson *et al.* 1990" which was a failed attempt to erase *Acritoscincus* Wells and Wellington 1985 from the scientific record and claim credit for discovering that genus.

That was just one of several similar examples involving Mark Hutchinson, all thankfully formally squashed by the ICZN (1991) as detailed in Hoser (2007) and Cogger (2014).

As done by Jane Melville, Danielle Edwards and associates in crime, Mark Hutchinson or others acting on his behalf, also aggressively went about erasing the correct ICZN names from the internet and ensuring that the only names seen by almost everyone was their own illegally coined non-ICZN junior synonyms.

Of course they dishonestly marketed them falsely as the correct ICZN names and that being the basis of their own (faked) discoveries.

So why do these people do this?

It is all about scamming big cash grants from government for more of their fake research.

They do this by claiming to have already made heaps of (other people's) "discoveries", justifying the hand outs!

Corporate and government bodies see their track record of "discoveries" as being a good bet for more discoveries in the future and throw their cash at them.

In fact the actions of people faking "discoveries" by stealing the work of others and renaming taxa is nothing more than grants fraud!

We are talking many millions of dollars in government and corporate hand outs here, all being done at a time when species are disappearing faster than ever and numerous reptile species remain undiscovered, unnamed, uncatalogued and absent of any conservation actions by governments due to alleged lack of funds.

A grant fraud scamming member of the cohort, Fred Kraus scammed millions of dollars from the USA Government to simply rename six New Guinea geckos that had been formally named some years prior.

Kraus justified his lavish lifestyle by falsely claiming to have discovered the six species of geckos himself!

Normally people who scam money from governments go to jail, but so far at least, Fred Kraus remains a free man.

The destructiveness of creation of illegal synonyms has been a problem for some years going back to the late 1980's, but Jane Melville, Danielle Edwards and the rest of the Wolfgang Wüster gang of thieves, have taken all this to a level never seen before as outlined by Ceriaco *et al.* (2023), Cogger (2014), Cotton (2014), Dubois *et al.* (2019), Hawkeswood (2021), Hoser, (2007a-b, 2009a, 2012a, 2012c, 2013, 2015a-f, 2019a, 2019b),

ICZN (1991, 2001, 2021), Mosyakin (2022), Wellington (2015) and sources cited therein.

NOTES ON THE SCIENTIFIC DESCRIPTIONS THAT FOLLOW

There is no conflict of interest in terms of this paper or the conclusions arrived at herein.

Several people including anonymous peer reviewers who revised the manuscript prior to publication are also thanked, as are relevant staff at museums who made specimens and records available in line with international obligations.

In terms of the following formal descriptions, spelling should not be altered in any way for any purpose unless expressly and exclusively called for by the rules governing Zoological Nomenclature as administered by the International Commission of Zoological Nomenclature (ICZN).

This includes if Latinisation is wrong, apparent spelling mistakes and so on.

Any online citations within this paper, are not as a rule cited in the references part of this paper and have the same most recent viewing and checking date of 10 August 2023 (at which time they were still online as cited).

Unless otherwise stated explicitly, colour and other descriptions apply to living adult male specimens of generally good health, as seen by day and not under any form of stress by means such as excessive cool, heat, dehydration, excessive ageing, abnormal skin or reaction to chemical or other input.

However in terms of the species formally named within this paper, both males and females are dealt with separately at times. It should be noted that adult males and females in all relevant species are sexually dimorphic.

While numerous texts and references were consulted prior to publication of this paper, the criteria used to separate the relevant subspecies has already been spelt out and/or is done so within the formal description and does not rely on material within publications not explicitly cited herein.

Photos of species referred to within the formal descriptions (within publications and/or online) also have characters that conform to the diagnostic characters as stated in the descriptions.

In the unlikely event that someone seeks to synonymise forms formally named herein, the name to be used in the first instance is that which appears first in this paper by way of description and page priority as listed in the abstract keywords.

Some material within descriptions is repeated to ensure each fully complies with the *International Code of Zoological Nomenclature* (Ride *et al.* 1999).

CONSERVATION

The following taxa are formally named in accordance with the rules of ICZN as published in the *International Code of Zoological Nomenclature* (Ride *et al.* 1999). I do not use the alternative illegal nomenclature of the Wolfgang Wüster gang, with their ever changing claims, as detailed in a blog document known as Wüster (2012), rebadged as Kaiser *et al.* (2013) (cited herein), and as frequently amended since.

I also do not support the other illegal actions of the cohort, including thefts of live reptiles from wildlife displays, attempted theft of ICZN name authority by way of plagiarism of earlier papers and acts of taxonomic vandalism, unlawful telephone threats to kill (as confirmed in the law courts), physical and sexual violence against vulnerable women and children (as confirmed in the law courts), scientific fraud, running thousands of fake social media accounts for the purposes of spreading hate and lies (as confirmed in the law courts), scamming money from funding bodies on false pretexts and other unlawful activity, as detailed by Goodman (2019), Hoser (2009, 2012a-b, 2013a-b, 2015a-f, 2016a, 2016b, 2019a-b) and sources cited therein.

In case it has not already been made clear, I note that in the 5 years preceding this publication, Australian law courts have found against members of the Wolfgang Wüster gang for acts of theft of snakes, criminal damage to property, intellectual property

theft, trademark infringement, copyright infringement, making false complaints to government authorities to instigate illegal armed raids, running thousands of fake social media accounts for illegal activities, an unlawful attempt to defraud the Accor Hotels Group, unlawfully shooting native aboriginals (that is allowed of some people within Australia as of 2023), supporting international terrorist groups including ISIS, perjury and other serious criminal actions. Penalties have included fines, jail, numerous court restraining orders, as well as payment of damages and restitution (e.g. Goodman 2019).

Significantly the unlawful actions by the Wolfgang Wüster gang have serious negative conservation implications.

Delays in recognition of these species and subspecies could jeopardise the long-term survival of the taxa as outlined by Hoser (2019a, 2019b) and sources cited therein.

Also refer to the relevant comments within Hoser (1989, 1991, 1993, 1996 and 2007).

Therefore attempts by taxonomic vandals like the Wolfgang Wüster gang via Kaiser (2012a, 2012b, 2013, 2014a, 2014b) and Kaiser *et al.* (2013) (as frequently amended and embellished, e.g. Rhodin *et al.* 2015, Thiele *et al.* 2020, Hammer and Thiele 2021) to unlawfully suppress the recognition of these taxa on the basis they have a personal dislike for the person who formally named it/them should be resisted (e.g. Ceriaco *et al.* 2023, Cogger 2014, Dubois *et al.* 2019, Hawkeswood, 2021, Mosyakin 2022 and Wellington 2015).

Claims by the Wüster gang against this paper and the descriptions herein will no doubt be no different to those the gang have made previously, all of which were discredited long ago as outlined by Ceriaco *et al.* (2023), Cogger (2014), Cotton (2014), Dubois *et al.* (2019), Hawkeswood (2021), Hoser, (2007a-b, 2009a, 2012a, 2012c, 2013, 2015a-f, 2019a, 2019b), ICZN (1991, 2001, 2021), Mosyakin (2022), Wellington (2015) and sources cited therein.

CALOTELLA (WITTENAGAMA) GEDYEI SP. NOV.

LSIDurn:lsid:zoobank.org:act:2DA8C384-00D7-487F-A497-06BC4B7DBA75

Holotype: A preserved female specimen at the Queensland Museum, Brisbane, Queensland, Australia, specimen number J82745 collected from the Old Sawmill Site, Kirrama, north Queensland, Australia, Latitude -18.153611 S., Longitude 145.683333 E.

This government-owned facility allows access to its holdings.

Paratypes: Two preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, 1/ Specimen number J75454 collected from Kirrama, north Queensland, Australia, Latitude -18.15 S., Longitude 145.616667 E., and 2/ Specimen number J58946 collected from Dipyard Creek, South of Ravenshoe, north Queensland, Australia, Latitude -17.983333 S., Longitude 145.55 E.

Diagnosis: Until now, putative *Calotella (Wittenagama) nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species. However as the species concepts are redefined herein, to accommodate

another six newly named forms within, all nine having originally been treated as putative *C. nobbi*, all are defined and diagnosed herein.

Nominate *C. nobbi* (Witten, 1972) with a type locality of 24 miles, east north-east of Guyra, New South Wales occurs in the New England Region of New South Wales, except the far northern part, extending into the Granite Belt of south-east Queensland, as well as the nearby elevated areas to the south-west including the Warrumbungle Mountains. The form described as *C. nobbi coggeri* (Witten, 1972), with a type locality of the Warrumbungle Mountains, is herein treated as a synonym of nominate *C. nobbi*.

C. parnabyi (Wells and Wellington, 1985) with a type locality of 88 km west of Alpha, Queensland, occurs west of the Great Divide in eastern Queensland, generally north of the tropic of Capricorn and east of the black soil areas, extending north to about Charters Towers, Hughenden in north Queensland.

C. phaeospinosa (Edwards and Melville, 2011) with a type locality of Bauhinia Station, Queensland, Latitude -25.17 S., Longitude 149.20 E, is a range-restricted species confined to the Expedition National Park (Southern Expedition Range) and the Bigge Range, mid-eastern Queensland.

C. aah sp. nov. was formerly treated as a northern population of *C. phaeospinosa*, and is apparently confined to the Blackdown Tableland (Northern Expedition Range) in mid-eastern Queensland. While extremely common where it occurs, it appears to be a range-restricted endemic to the area.

C. gedyei sp. nov. is found from the Broadsound Range in the south near Marlborough, Queensland, (the St. Lawrence Gap biogeographical break) extending along the coast and hinterland north to about Cooktown, north Queensland.

C. ruffellae sp. nov. occurs south of the St Lawrence Gap (Queensland) in a region commencing at least as far north as Kroombit Tops, National Park, extending south to at least the northern end of the Sunshine Coast in south-east Queensland.

C. dorsei sp. nov. appears to be confined to the Granite Belt of far south-east Queensland and immediately adjacent high-elevation areas on the NSW/Queensland border area and limited high altitude regions to the immediate north.

C. wiradjuri sp. nov. occurs on elevated wooded sections of the western plains of New South Wales, beyond the western slopes and east of the more arid far western parts of the state in an area generally in a line from West Wyalong in the south, through Parkes and Dubbo and as far north as Bourke in the north-west.

C. josephburkei sp. nov. occurs in the Mallee/Spinifex woodlands belt of far south-west New South Wales, north-west Victoria and nearby parts of South Australia.

The nine species can be most easily separated from one another by different combinations of colour and markings.

The nine species are separated from one another by the following unique combinations of characters outlined in terms of adult specimens of normal health and condition in an unstressed state, with males defined as seen in the breeding season, below:

C. nobbi males have a greyish head with either no obvious markings or alternatively faded and indistinct. The dorsolateral lines on the upper surface of the body are creamish-white in colour and the border is more-or-less straight on either side. The dorsum is otherwise dark grey and with faint indistinct spots or areas of brownish-grey. The upper 2/3 of the flank is similarly coloured. Below, this the lower third of the flank is whitish, with grey mottling and an obvious yellow flush, this flush extending along the entire lower flank and not more intense either anteriorly or posteriorly. The yellow flush may be moderate to faint, but the lower flank is never a deep yellow.

The anterior third of the tail is mottled greyish on top, on the lighter background, it is whitish on the side and all with an obvious pink flush, of moderate intensity. That is, the flush is obvious, but not making the tail boldly pink. It is best described as greyish-pink. Posterior to this, the tail is greyish to white in colour and without any pink flush. The anterior flank is blackish in

colour, but not significantly darker than the posterior parts (upper 2/3).

Iris is a creamy beige colour.

C. nobbi females give an overview as being a generally drab grey lizard.

There are no signs of any dorsolateral stripes running down the back of the lizard.

Markings on the head are either absent or indistinct, including the optical-auricular line.

Upper labials are whitish and unmarked with most of the area between the eye, tip of snout and upper labials being whitish or cream in colour.

Along the back are four ridges of enlarged blunt-edged spines (each scale), but these lack any different colouration as compared to scales nearby.

The dorsum has extremely faint patterning in the form of rectangles running from the spine to the raised scales on the dorsolateral line, in turn separated by wider lighter areas (but of similar greyish-brown colour).

Below the dorsolateral line there is a new series of blotches, which combined occupy most of the upper half of the flank, with the lighter borders both indistinct and thin, because the next dark blotch intrudes on it.

While the lower half of the flank is generally a dirty grey colour, some but not all scales have semi-distinct light tips.

On the upper surface of the anterior limbs are about three semi-distinct bars, each created by a series of black-tipped scales across the limb.

The anterior half of the tail is greyish in colour but with about ten lighter rings, beyond which the tail is a generally dull greyish-brown in colour.

Iris is a fairly bold orange-brown colour, being the one aspect of the lizard that is not generally a drab greyish in general colour.

C. nobbi in life is depicted in Brown (2014), page 671 right side, third image down (male) as well as online at:

<https://www.inaturalist.org/observations/148501088> (male)

and

<https://www.inaturalist.org/observations/103270301> (male)

and

<https://www.inaturalist.org/observations/103236121> (male)

and

<https://www.inaturalist.org/observations/149895746> (female).

C. parnabyi males are perhaps the most divergent within the entire *C. nobbi* species complex.

Males are readily separated from all other species in the complex by the unique combination of having a bright canary yellow rinse across most of the anterior upper body. This includes the head, which is bright yellow in a line above the snout-nostril-eye, which continues down the back of the dorsum to the pelvic girdle. This gives this species the unique yellow paravertebrals referred to in the original description of Wells and Wellington (1985) and is alone in diagnosing males of this species from any other in the *C. nobbi* complex.

The bright yellow upper surfaces of the head of males, not overwritten with grey or other markings, readily separates the males of this species from all others.

The two dorsolateral lines have extremely straight outer edges and are wholly infused with deep yellow, making them appear as yellow stripes, rather than being white or creamish as in most of the other species. This yellow in the dorsolateral lines includes at least a faded yellow rinse anteriorly, although in many specimens this lesser amount of yellow anteriorly is noticeable as compared to that on the stripes further down the body. The general (faded) dorsal markings form a reticulatum, when inspected closely.

The upper 2/3 of the flanks are dark greyish-black and with little specks or markings, save for a few yellowish, or yellow tipped scales, either scattered or in small clusters. Upper surfaces of

limbs lack obvious markings and are yellowish for the forelimbs, and yellowish-grey for the hind limbs. The tail is whitish on the upper surface, greyish on the upper flanks and wholly infused with a whitish pink along most of its length, with the distal end being just brownish in colour.

Upper labials, ear and below the chin are all white in colour.

Iris is brown.

The adult female *C. parnabyi* is a light brownish-grey lizard with a head that is light brown on the upper surfaces, a moderately distinct line from eye to ear, white upper labials, sometimes marked or spotted with brown.

The back has two distinct dorsolateral lines, with 5 or 6 pairs of dark entering from the upper edge. these dark markings are in the form of irregularly shaped spots on either side of the mid-dorsal line (not that there in fact any line as such in the mid-dorsal line, this being identified as a location and not a marking).

Other than the dark patches just mentioned the dorsum is generally unmarked, save for an extremely faint outline of a line down the mid-dorsum. It is otherwise an even brownish-grey in colour. The upper 2/3 of the flank is a light brown colour, below that is white with scattered brown-grey spots or peppering. Upper surfaces of the limbs are brownish with semi-distinct darker or lighter specks or small markings. Fingers and toes are generally barred darker and lighter.

The back of each hind limb has a broken dark line, bordering the brown upper and white lower surface, this line continuing onto the flank of the anterior tail, after which it breaks into a series of spots running down the brownish-grey tail. The tail has lighter cross-bands along its entire length.

Iris is greyish-beige in colour.

C. parnabyi in life is depicted in life in Melville and Wilson (2019) on page 258 (male) and online at:

<https://www.inaturalist.org/observations/97519668> (male)

and

<https://www.inaturalist.org/observations/97519653> (male)

and

<https://www.inaturalist.org/observations/101968035> (male)

and

<https://www.inaturalist.org/observations/97519667> (male)

and

<https://www.inaturalist.org/observations/109626229> (female).

C. gedyei sp. nov. males have a generally dark greyish-brown upper body.

The head is greyish and with semi distinct markings, including obvious dark grey peppering on a greyish head, a well-defined line from eye to ear, dark grey ear, off-white upper labials and lower parts of head whitish and heavily peppered grey (the gular region).

The dorsolateral lines are relatively wide. The light part of the lower flanks rises somewhat to be about half, or a little more than half, way up the side in the middle of the flank, meaning the darker area above reduced in relative area as compared to other species in the *C. nobbi* complex.

The middle of the dorsum is generally a brownish patten, with a vaguely distinct pattern of dark blackish patches running from spine to dorsolateral lines, but not intruding into them. These patches are narrower than the intervening lighter areas, (being a dark brown colour). The dark patches running from the spine are squarish in shape, but narrow at the flank edge, although the border with the dorsolateral line is still squarish at the adjoining edge. Flanks are in part a continuation of the dorsum pattern, but the similarity of the two colours involved makes the whole side appear to be of one colour and any markings are indistinct.

There is a light yellow flush on the lower flank, posterior to the axila of the forelimb, running both up and posterior from this point. It causes the dark colouration of the dorsum to lighten where this flush is, but this is barely noticeable.

What is noticeable is that the white dorsolateral lines transition to light yellow from just behind the front limb to the end of the body, becoming white again at the base of the tail, where it then becomes effectively overwhelmed by a salmon pink wash through the main part of the tail. In turn the tail is a dull salmon pink colour with scattered black smudges or irregularly shaped spots on the sides or top of the tail. Upper surfaces of both fore and hind limbs have scattered irregular black markings, sometimes configured to form semi-distinct bands.

Notable is that the dorsolateral stripes are white anteriorly, becoming yellow and then white again, versus with at least some yellow rinse anteriorly in *C. panabyi*.

There is a very dull, but barely noticeable slightly greyish line running down the spine.

Pupil is orange-brown on top and greyish-below.

C. gedyei sp. nov. females are readily separated from females of all other species in the complex by the following characters:

There are well-defined thin, yellow or white dorsolateral lines running down the body.

The head is a brownish-grey colour with darker peppering and a well-defined line from eye to ear, that is mainly dark in colour.

The mid-line of the dorsum has a thick grey line running down it. On either side of that is a well-defined and obvious alternating series of dark blackish spots of squarish-shape, but not of regular shape, separated by light reddish-brown interspaces of similar size.

While there is a semi-distinct line bordering the upper and lower flanks, both are of similar colouration being whitish in background, but heavily peppered with grey and dull orange-red, with the relative ratios of each depending on the individual lizard. The darker markings along the dorsum continue in a reduced and more further spaced manner down the upper surface of the anterior half of the tail. The tail is otherwise of a mainly brownish colour. Upper surfaces of both forelimbs and hind limbs are moderately distinctly banded.

Iris is beige-yellow or dull orangeish in colour.

C. gedyei sp. nov. is depicted in life in Melville and Wilson (2019) on page 73 at bottom (male) and online at:

<https://www.inaturalist.org/observations/58322177> (male)

and

<https://www.inaturalist.org/observations/88359745> (female).

C. ruffellae sp. nov. males are a yellowish-grey-brown lizard best diagnosed as follows:

head is greyish without distinctive markings or peppering. The line from eye to ear is barely noticeable and is narrow anteriorly, widening like a triangle posteriorly. Upper labials are also light grey. The dorsolateral stripes are a light yellow along their entire length. The lower edge is smooth, but the upper edge is jagged, this being caused by the obvious interruption by dark triangles from the dorsal side. These triangles (point facing the midline of the body) are on either side of the midline with the bases interrupting the dorsolateral lines.

The triangles are not exact in shape. They are blackish in colour. Otherwise the colouration of the back is mainly dark brown.

Along the midline is a dull dark grey line, not significantly distinguishable from the adjoining pigment.

Flanks are yellowish-brown-grey in colour from top to bottom, this being created by dull grey peppering on an equally dull yellowish brown background. 2/3 of the way down the flank is a well-defined and narrow yellow line that separates upper and lower flank, although both are of similar colour. The tail is mainly dark grey with irregularly shaped and well-spaced lighter patches running down the top of the tail. These are infused with a whitish-pink colour, but this pinkish-white rinse only occurs at the anterior third of the tail.

Iris is beige in colour.

C. ruffellae sp. nov. females are mainly reddish-brown on top and on the flanks.

The dorsum also has a series of about 7 pairs of grey squarish shaped blotches, on either side of the spine, on the body. The rest of the dorsum and the entirety of the upper flank is a dull reddish-brown colouration. There is a thin and well-defined greyish line separating the upper and lower parts of the flanks, this being about 23% of the way down either side of the lizard. Below this the skin is heavily tubercled and mainly greyish-white, with infusions of reddish brown from the top line. Upper surfaces of limbs are also brownish and with limited flecks, bands or markings, all of which are either semi-distinct or barely noticeable. Exceptional to this is the back of the hind limbs, which are well marked and defined, especially with respect of dark upper and light lower surfaces, which continues onto the anterior part of the tail before the markings fade again. The tail itself is mainly yellowish-grey in colour with alternating indistinct reddish markings that may or may not form rings.

The upper surfaces of the head are more brownish than reddish and this includes the snout and below the eye. Upper labials are quite dark.

Lower labials are heavily peppered grey/brown although the gular region is pure white. The line from eye to ear is of even width and prominent.

Iris is light grey.

C. ruffellae sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/176708599> (male)

and

<https://www.inaturalist.org/observations/154054190> (male)

and

<https://www.inaturalist.org/observations/99184001> (female)

and

<https://www.inaturalist.org/observations/150178157> (female).

C. dorsei sp. nov. males have a head that is light grey on top, with a well-defined line from eye to ear, cream below the eye and including the upper labials and an immaculately whitish gular region. The dorsolateral lines are white, but with a slight yellowish tinge in the middle part of the dorsum. Lower edge is straight and upper edge is also nearly completely straight.

Behind the axilla of the forelimb is a strong yellow flush that fades rapidly along the lower surface of the otherwise mainly white lower flank, so that it is completely white by the time one reaches the hind limb.

This generally white lower flank occupies just under half the surface of the flank.

In the mid part of this white area is limited brown peppering.

The anterior third of the tail is flushed a bright maroon pink colour. Latter two thirds of the tail is essentially a greyish-brown colour and without any obvious markings. There are no obvious markings on the upper surfaces of the limbs, including the back parts of the hind-limbs.

On the upper surface of the dorsum are semi-distinct dark squares or triangles that run in pairs from the midline to the dorsolateral stripes, but do not cross or intrude into them. The midline has a very faint greyish overwrite in the form of a line, that is only noticeable on close inspection.

Iris is a dark yellow-brown.

Female *C. dorsei* sp. nov. are also a well patterned lizard.

They are diagnosed as follows: dorsum ranges from reddish brown generally to greyish, but invariably includes a series of joined or separated triangles running from the midline of the dorsum to the flanks, where the white to yellow dorsolateral lines are well broken by the intrusions of the pointed end of the triangle (the base is against the midline of the dorsum). The top half of the flank is of the same background colour as the dorsum, whereupon it switches to white, peppered with the dorsal colour. This interface is not demarcated by any line of any form or colour, but rather the transition is sudden, from the colour reddish or grey to white.

The line from eye to ear is well defined and separates white

above and below, with a second similar line radiating from the upper posterior of the eye.

The top of the head is dark, but without any obvious peppering or markings beyond those mentioned. The area between the snout, eye and including the upper labials are all white, as is the chin and gular region. Upper surfaces of the front and rear limbs are dark in colour but punctuated with white bands on the forelimbs and obvious white markings on the hind limbs.

The tail is marked with light blotches on top anteriorly with dark on the sides, becoming brownish-grey posteriorly and without obvious markings.

There is a barely distinct grey smudge or overwrite down the vertebral line of the body.

Iris is a dark reddish brown in colour.

C. dorsei sp. nov. in life is depicted in Brown (2014) on page 671, second down on left is a male and third down on left is a female; in Wilson (2022) page 217, top left (male) and Melville and Wilson (2019) on pages 257 and 259 (males). The species is also depicted in life online at:

<https://www.inaturalist.org/observations/148520503> (male) and

<https://www.inaturalist.org/observations/103998294> (male) and

<https://www.inaturalist.org/observations/72001834> (female).

C. wiradjuri sp. nov. males are generally greyish coloured lizards with a greyish dorsum, cream coloured dorsolateral stripes, boldly defined on the outer edge and not quite so on the inner edge.

The dorsal pattern of mainly light blotches etched dark on the outer edges and including down the vertebral line is relatively prominent. Markings on the tail are barely noticeable and the light pink flush on the tail runs most of the length of it, but becoming a dull orange or orange-grey posteriorly.

Head markings are faded or absent, but there is typically a yellow or orange ring of some kind either around the eye, or at least an area of yellow or orange above the eye.

Upper surfaces of the limbs are brownish-yellow in colour, but the distal parts and toes are noticeably a beige or yellow colour.

Markings on the tail if present are barely distinct and if present, usually in the form of wide white and darker bands at the distal end.

Iris is orange-yellow in colour.

Female *C. wiradjuri* sp. nov. are similar in most respects to female *C. dorsei* sp. nov. as outlined above, but separated from that taxon by obvious dark spots or markings (not peppering) on the upper surfaces of the head, an absence of obvious cross bands on the upper surfaces of the forelimbs and the demarcation between dark upper surface of the flank and whitish underside being in the form of an obvious line with at least one added border, this usually being a black edge at the end of the darker upper flank, and sometimes a similar black edge forming a line at the lower boundary of the white demarcation.

The upper surface of the tail is light with slightly darker colour on the flanks, these forming dark tipped triangular intrusions on the upper surface.

Iris is light grey on the bottom and light dull orange-brown on top.

C. wiradjuri sp. nov. is depicted in life in Cogger (2014), page 733 (female), as well as online at:

<https://www.inaturalist.org/observations/103397281> (male) and

<https://www.inaturalist.org/observations/103499257> (female) and

<https://www.inaturalist.org/observations/81410631> (female).

C. josephburkei sp. nov. males are a generally drab grey lizard on top. They are readily separated from males of all other species by the noticeably wider dorsolateral stripes that are cream in colour combined with a lower lateral stripe of the same

colour and width as the dorsolateral lines, demarcated with the grey upper flank on top and below by a well defined thick grey line, or line defined by a zone of dense peppering in the form of a line on the upper edge and fading below it.

Head is plain grey with either no visible markings or those that are, being very indistinct and of similar colour to the surrounding areas. Limbs are generally unmarked or if so, very faintly, the exception to this being the back parts of the upper surfaces of the hind limbs, including the anterior flanks of the tail. Ear is dark grey to black.

The entire tail is generally a whitish grey colour and any pink flush anteriorly is extremely feint if detectable at all and in most animals is seen as a white, rather than pink flush.

Labial area of the head is white, including lower labials, but the gular region rapidly becomes peppered grey.

Iris is a light yellow-orange colour.

Female *C. josephburkei* sp. nov. are also a generally dull greyish coloured lizard. Like males, they also have thick dorsolateral cream or white lines on the body. But in the case of females these are intruded on the upper edge by a well defined dark edged series of about five triangular intrusions on the mid and lower dorsum of the body. Otherwise the central part of the dorsum is generally grey in colour. The intrusions into the dorsolateral lines are formed as extensions from the mid-dorsal area, but are brownish, rather than grey as seen in the mid-dorsal area itself, giving them the appearance of brown triangles intersecting the lighter dorsolateral stripes. The outer edge of the mid dorsal zone that borders the light dorsolateral lines is faintly brown edged.

The triangular intrusions mentioned before, continue onto the top and flanks of the anterior part of the tail, in the form of small triangles or diamonds. The tail is otherwise a brownish grey colour, but with broad semi-distinct rings on the posterior half. Labials are whitish-grey as are the under-surfaces of the anterior of the head.

C. josephburkei sp. nov. is depicted in life in Brown (2014) on page 671, bottom right (male), Melville and Wilson (2019) page 256, bottom right (male, not breeding colours) and online at:

<https://www.inaturalist.org/observations/135353121> (male) and

<https://www.inaturalist.org/observations/151265589> (male) and

<https://www.inaturalist.org/observations/141494310> (male) and

<https://www.inaturalist.org/observations/125137902> (male) and

<https://www.inaturalist.org/observations/159087699> (female) and

<https://www.inaturalist.org/observations/69292668> (female).

C. aah sp. nov. males are readily separated from all other species in the *C. nobbi* complex by the presence of a dark, black coloured line from eye to ear and including the entirety of the ear, being black, dorsolateral lines that are yellow, with a fairly even lower edge and jagged upper edge, black chin and gular scales, upper part of the flank is black to dark brown along the upper half to two thirds of the flank, bounded below by a well defined yellow line (thinner than the dorsolateral ones) and bounded below that by a deep range-red, which may be brown edged towards the yellow line above.

The tail is mainly light on top and with deep reddish orange on the sides for the anterior quarter, beyond which is a series of near joined lighter blotches on the upper surface and mainly darker on the sides.

Labials are whitish grey as are nearby scales on the side of the head. The top of the head is an ill-defined mixture of a grey and brown colouration, being much the same down the middle of the dorsum, there being more grey along the midline and more brown towards the outer edges.

Iris is light orange.

There is a moderately well-defined dark grey line running down the vertebral line of the back and terminating just past the pelvic girdle.

Female *C. aah* sp. nov. do not have the unbroken dorsolateral stripes of the males.

In females the dorsum has a combination of wide creamy-white blotches, roughly square in shape, extending from the greyish midline, interspersed with narrower black sections. Towards the dorsolateral line, the creamy-white blotches widen and in turn tend to make the darker sections triangular tipped. Along the line of the flank (being an area as opposed to a physical line), the markings abruptly stop and there is merely a zone of reddish-brown, with black smudging or peppering occupying the upper flank.

In most specimens the widened outer edges of the lighter blotches do not completely cut off the darker interspaces, meaning that there is no view of triangles on the dorsum. However in some specimens the lighter blotches do merge and there is a view of well-defined grey triangles along the mid dorsal line, with the points being bound by yellow on the outer edges.

While this may result in a continuous zone of yellow along the dorsolateral line, this is in no way like the well defined dorsolateral lines in the males, that are relatively straight edged along both edges and not having the obvious triangle intrusions.

About 2/3 down the flank is a well defined (always) white line of moderate thickness, thinly bound with black or dark grey, top and bottom, below which the reddish-brown colour continues.

The line from eye to ear and beyond is brown in colour, although the ear itself is usually greyish in colour.

Iris is beige in colour.

C. aah sp. nov. in life is depicted in Brown (2014) on page 671 (male top right and female top left) and online at: <https://www.inaturalist.org/observations/177044877> (male)

and

<https://www.flickr.com/photos/65796382@N05/36918228993/> (male)

and

<https://www.flickr.com/photos/euprepiosaur/8471986271/> (male)

and

<https://www.inaturalist.org/observations/136492220> (female)

and

<https://www.inaturalist.org/observations/151563909> (female).

C. phaeospinosa is similar in most respects to *C. aah* sp. nov. as detailed above and unless stated otherwise below, the diagnosis of this species matches that of *C. aah* sp. nov..

Male *C. phaeospinosa* are readily separated from *C. aah* sp. nov. by the line from eye to ear and beyond being relatively ill-defined and often broken, not being black in colour, but rather a medium grey instead and distinct of this taxon is that darker areas of the upper body and flanks are usually heavily spotted white (also not seen in *C. aah* sp. nov.), the spotting being faded in aged specimens. Also male *C. phaeospinosa* lacks the strong reddish colour of the lower flank, instead being less strongly flushed and a dull yellow-orange colour instead. The white line of the lower flank is narrow, often ill-defined or absent.

Female *C. phaeospinosa* is similar in most respects to *C. aah* sp. nov. as detailed above and unless stated otherwise below, the diagnosis of this species matches that of *C. aah* sp. nov..

Female *C. phaeospinosa* are generally a yellowish-grey lizard as opposed to the more reddish colours seen in *C. aah* sp. nov.. The whitish line on the lower flank is ill-defined, broken or absent and often greyish, rather than white in colour. Markings on the tail are generally a combination of greyish and yellow (mainly greyish) versus greyish and reddish-orange in female *C. aah* sp. nov..

Notwithstanding the genetic divergence between *C. phaeospinosa* and *C. aah* sp. nov., probably the biggest driver of

colouration differences between these two taxa is the colour of the rock substrate in the respective areas they occur in and the natural selection that has arisen as a result.

C. phaeospinosa in life is depicted online at:

<https://www.inaturalist.org/observations/143459143> (male)

and

<https://www.inaturalist.org/observations/119187909> (immature male).

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. gedyei* sp. nov. is found from the Broadsound Range in the south near Marlborough, Queensland, (the St. Lawrence Gap biogeographical break) extending along the coast and hinterland north to about Cooktown, north Queensland.

Etymology: *C. gedyei* sp. nov. is named in honour of Andrew Gedye of Aloomba, north Queensland, formerly of Bentleigh Park, north Queensland and before that, Cheltenham, Victoria (all in Australia) in recognition of many decades of valuable contributions to herpetology and wildlife conservation in Australia.

CALOTELLA (WITTENAGAMA) RUFFELLAE SP. NOV.

LSIDDurn:lsid:zoobank.org:act:0459031A-E1D0-4564-CBD6-CBDD420D6CA1

Holotype: A preserved specimen at the National Museum of Victoria, Melbourne, Victoria, Australia, specimen number D74132 collected from just south-east of Maryborough, Queensland, Australia on the road to Tin Can Bay, Latitude -25.6047 S., Longitude 152.812 E.

This government-owned facility allows access to its holdings.

Paratype: A preserved specimen at the national Museum of Victoria, Melbourne, Victoria, Australia, specimen number D74133 collected from just south-east of Maryborough, Queensland, Australia on the road to Tin Can Bay, Latitude -25.6047 S., Longitude 152.812 E.

Diagnosis: Until now, putative *Calotella* (*Wittenagama*) *nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and

associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species as detailed in the description of *C. gedyei* sp. nov. above.

This paper formally names six other forms, making a total of nine for the species complex and subgenus *Wittenagama* as recognized herein.

C. ruffellae sp. nov. occurs south of the St Lawrence Gap (Queensland) in a region commencing at least as far north as Kroombit Tops, National Park, extending south to at least the northern end of the Sunshine Coast in south-east Queensland.

C. ruffellae sp. nov. is separated from the eight other species in the subgenus *Wittenagama* Wells and Wellington, 1985 by the following unique combination of characters, defined herein for each sex and in terms of both referring to normal adults in breeding season.

C. ruffellae sp. nov. males are a yellowish-grey-brown lizard best diagnosed as follows:

Head is greyish without distinctive markings or peppering. The line from eye to ear is barely noticeable and is narrow anteriorly, widening like a triangle posteriorly. Upper labials also light grey. The dorsolateral stripes are a light yellow along their entire length. The lower edge is smooth, but the upper edge is jagged, this being caused by the obvious interruption by dark triangles from the dorsal side. These triangles (point facing the midline of the body) are on either side of the midline with the bases interrupting the dorsolateral lines.

The triangles are not exact in shape. They are blackish in colour. Otherwise the colouration of the back is mainly dark brown.

Along the midline is a dull dark grey line, not significantly distinguishable from the adjoining pigment.

Flanks are yellowish-brown-grey in colour from top to bottom, this being created by dull grey peppering on an equally dull yellowish brown background. 2/3 of the way down the flank is a well-defined and narrow yellow line that separates upper and lower flank, although both are of similar colour. The tail is mainly dark grey with irregularly shaped and well-spaced lighter patches running down the top of the tail. These are infused with a whitish-pink colour, but this pinkish-white rinse only occurs at the anterior third of the tail.

Iris is beige in colour.

C. ruffellae sp. nov. females are mainly reddish-brown on top and on the flanks.

The dorsum also has a series of about 7 pairs of grey squarish shaped blotches, on either side of the spine, on the body. The rest of the dorsum and the entirety of the upper flank is a dull reddish-brown colouration. There is a thin and well-defined greyish line separating the upper and lower parts of the flanks, this being about 23/ of the way down either side of the lizard. Below this the skin is heavily tubercled and mainly greyish-white, with infusions of reddish brown from the top line. Upper surfaces of limbs are also brownish and with limited flecks, bands or markings, all of which are either semi-distinct or barely noticeable. Exceptional to this is the back of the hind limbs, which are well marked and defined, especially with respect of dark upper and light lower surfaces, which continues onto the anterior part of the tail before the markings fade again. The tail itself is mainly yellowish-grey in colour with alternating indistinct reddish markings that may or may not form rings.

The upper surfaces of the head are more brownish than reddish and this includes the snout and below the eye. Upper labials are quite dark.

Lower labials are heavily peppered grey/brown although the gular region is pure white. The line from eye to ear is of even width and prominent.

Iris is light grey.

C. ruffellae sp. nov. in life is depicted online at:

<https://www.inaturalist.org/observations/176708599> (male) and

<https://www.inaturalist.org/observations/154054190> (male) and

<https://www.inaturalist.org/observations/99184001> (female) and

<https://www.inaturalist.org/observations/150178157> (female).

For separation of the other eight species in the subgenus *Wittenagama* Wells and Wellington, 1985, please refer to the diagnosis for *C. gedyei* sp. nov. in this paper, the relevant information being a formal part of this species description.

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. ruffellae* sp. nov. occurs south of the St Lawrence Gap (Queensland) in a region commencing at least as far north as Kroombit Tops, National Park, extending south to at least the northern end of the Sunshine Coast in south-east Queensland.

Etymology: *C. ruffellae* sp. nov. is named in honour of Natasha Ruffell, formerly of Werribee, Bendigo and Nhill in Victoria, Australia but now of Childers, Queensland, Australia in recognition of her contributions to herpetology in Australia.

CALOTELLA (WITTENAGAMA) DORSEI SP. NOV.

LSIDurn: [lsid:zoobank.org:act:69EC8AC9-1DDD-471F-AB43-4B203D43D2B5](https://zoobank.org/act:69EC8AC9-1DDD-471F-AB43-4B203D43D2B5)

Holotype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.152341 collected from Falls Road, Boonoo Boonoo National Park, New South Wales, Australia, Latitude -28.8107 S., Longitude 152.12693 E.

This government-owned facility allows access to its holdings.

Paratypes: Four preserved specimens at the Queensland Museum, Brisbane, Queensland, Australia, being 1/ Specimen number J30683 collected from Aztec Temples, near Stanthorpe, Queensland, Australia, Latitude -28.833333 S., Longitude 152.016667 E., 2/ Specimen number J28652, collected in the Girraween area, near Wyberba, Queensland, Australia, Latitude -28.833333 S., Longitude 151.916667 E., 3/ Specimen number J22756 collected at Girraween National Park, via Stanthorpe, Queensland, Australia, Latitude -28.833333 S., Longitude 151.916667 E., 4/ Specimen number J23902, collected from a private property adjoining Girraween National Park, Queensland, Australia, Latitude -28.85 S., Longitude 151.9 E.

Diagnosis: Until now, putative *Calotella (Wittenagama) nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species as detailed in the description of *C. gedyei sp. nov.* above.

This paper formally names six other forms, making a total of nine for the species complex and subgenus *Wittenagama* as recognized herein.

C. dorsei sp. nov. appears to be confined to the Granite Belt of far south-east Queensland and immediately adjacent high-elevation areas on the NSW/Queensland border area and limited high altitude regions to the immediate north.

C. dorsei sp. nov. is separated from the eight other species in the subgenus *Wittenagama* Wells and Wellington, 1985 by the following unique combination of characters, defined herein for each sex and in terms of both referring to normal adults in breeding season.

C. dorsei sp. nov. males have a head that is light grey on top, with a well-defined line from eye to ear, cream below the eye and including the upper labials and an immaculately whitish gular region. The dorsolateral lines are white, but with a slight yellowish tinge in the middle part of the dorsum. Lower edge is straight and upper edge is also nearly completely straight.

Behind the axilla of the forelimb is a strong yellow flush that fades rapidly along the lower surface of the otherwise mainly white lower flank, so that it is completely white by the time one reaches the hind limb.

This generally white lower flank occupies just under half the surface of the flank.

In the mid part of this white area is limited brown peppering.

The anterior third of the tail is flushed a bright maroon pink colour. Latter two thirds of the tail is essentially a greyish-brown colour and without any obvious markings. There are no obvious markings on the upper surfaces of the limbs, including the back parts of the hind-limbs.

On the upper surface of the dorsum are semi-distinct dark squares or triangles that run in pairs from the midline to the dorsolateral stripes, but do not cross or intrude into them. The midline has a very faint greyish overwrite in the form of a line, that is only noticeable on close inspection.

Iris is a dark yellow-brown.

Female *C. dorsei sp. nov.* are also a well patterned lizard.

They are diagnosed as follows: dorsum ranges from reddish brown generally to greyish, but invariably includes a series of joined or separated triangles running from the midline of the dorsum to the flanks, where the white to yellow dorsolateral lines are well broken by the intrusions of the pointed end of the triangle (the base is against the midline of the dorsum). The top half of the flank is of the same background colour as the dorsum, whereupon is switches to white, peppered the dorsal colour.

This interface is demarcated by any line of any form or colour, but rather the transition is sudden, from the colour reddish or grey to white.

The line from eye to ear is well defined and separates white above and below, with a second similar line radiating from the

upper posterior of the eye.

The top of the head is dark, but without any obvious peppering or markings beyond those mentioned. The area between the snout, eye and including the upper labials are all white as is the chin and gular region. Upper surfaces of the front and rear limbs are dark in colour but punctuated with white bands on the forelimbs and obvious white markings on the hind limbs.

The tail is marked with light blotches on top anteriorly with dark on the sides, becoming brownish-grey posteriorly and without obvious markings.

There is a barely distinct grey smudge or overwrite down the middle of the spine of the body.

Iris is a dark reddish brown in colour.

C. dorsei sp. nov. in life is depicted in Brown (2014) on page 671, second down on left is a male and third down on left is a female; in Wilson (2022) page 217, top left (male) and Melville and Wilson (2019) on pages 257 and 259 (males). The species is also depicted in life online at:

<https://www.inaturalist.org/observations/148520503> (male) and

<https://www.inaturalist.org/observations/103998294> (male) and

<https://www.inaturalist.org/observations/72001834> (female).

For separation of the other eight species in the subgenus *Wittenagama* Wells and Wellington, 1985, please refer to the diagnosis for *C. gedyei sp. nov.* in this paper, the relevant information being a formal part of this species description.

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, 1867, by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. dorsei sp. nov.* appears to be confined to the Granite Belt of far south-east Queensland and immediately adjacent high-elevation areas on the NSW/Queensland border area and limited high altitude regions to the immediate north.

Etymology: *C. dorsei sp. nov.* is named in honour of Marc Dorse of Middle Ridge (Toowoomba), southern Queensland, Australia in recognition of decades of contributions to herpetology in Australia, including being the first person in the world to breed in captivity the endangered Manning River Saw-Shelled turtle *Wollumbina purvis* Wells and Wellington, 1985.

Note that the genus name *Myuchelys*, Thomson and Georges, 2009, sometimes applied to this species is an illegally coined, non-ICZN junior synonym of *Wollumbina* Wells, 2007 created by the Wolfgang Wüster gang of thieves in breach of the Australian Copyright Act, 1968 and the Berne Convention, 1886 and therefore should not be used.

CALOTELLA (WITTENAGAMA) WIRADJURI SP. NOV.

LSIDurn:lsid:zoobank.org:act:00DDA48C-C049-4ED4-A697-1121426F28B8

Holotype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.156632 collected from Yarra Property, 35km from Mount Hope on the Euabalong Road, New South Wales, Australia, Latitude -32.94666 S., Longitude 146.19221 E.

This government-owned facility allows access to its holdings.

Paratypes: Four preserved specimens at the Australian Museum, Sydney, New South Wales, Australia, specimen numbers R.156633-6 all collected from Yarra Property, 35km from Mount Hope on the Euabalong Road, New South Wales, Australia, Latitude -32.94666 S., Longitude 146.19221 E.

Diagnosis: Until now, putative *Calotella (Wittenagama) nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species as detailed in the description of *C. gedyei* sp. nov. above.

This paper formally names six other forms, making a total of nine for the species complex and subgenus *Wittenagama* as recognized herein.

C. dorsei sp. nov. appears to be confined to the Granite Belt of far south-east Queensland and immediately adjacent high-elevation areas on the NSW/Queensland border area and limited high altitude regions to the immediate north.

The morphologically similar *C. wiradjuri* sp. nov. occurs on elevated wooded sections of the western plains of New South Wales, beyond the western slopes and east of the more arid far western parts of the state in an area generally in a line from West Wyalong in the south, through Parkes and Dubbo and as far north as just south of Bourke in the north-west.

C. wiradjuri sp. nov. and *C. dorsei* sp. nov. are separated from the eight other species in the subgenus *Wittenagama* Wells and Wellington, 1985 by the following unique combination of characters, defined herein for each sex and in terms of both referring to normal adults in breeding season.

C. dorsei sp. nov. males have a head that is light grey on top, with a well-defined line from eye to ear, cream below the eye and including the upper labials and an immaculately whitish gular region. The dorsolateral lines are white, but with a slight yellowish tinge in the middle part of the dorsum. Lower edge is straight and upper edge is also nearly completely straight.

Behind the axilla of the forelimb is a strong yellow flush that fades rapidly along the lower surface of the otherwise mainly white lower flank, so that it is completely white by the time one reaches the hind limb.

This generally white lower flank occupies just under half the surface of the flank.

In the mid part of this white area is limited brown peppering.

The anterior third of the tail is flushed a bright maroon pink colour. Latter two thirds of the tail is essentially a greyish-brown colour and without any obvious markings. There are no obvious markings on the upper surfaces of the limbs, including the back parts of the hind-limbs.

On the upper surface of the dorsum are semi-distinct dark squares or triangles that run in pairs from the midline to the dorsolateral stripes, but do not cross or intrude into them. The midline has a very faint greyish overwrite in the form of a line, that is only noticeable on close inspection.

Iris is a dark yellow-brown.

Female *C. dorsei* sp. nov. are also a well patterned lizard.

They are diagnosed as follows: dorsum ranges from reddish brown generally to greyish, but invariably includes a series of joined or separated triangles running from the midline of the dorsum to the flanks, where the white to yellow dorsolateral lines are well broken by the intrusions of the pointed end of the triangle (the base is against the midline of the dorsum). The top half of the flank is of the same background colour as the dorsum, whereupon it switches to white, peppered the dorsal colour.

This interface is demarcated by any line of any form or colour, but rather the transition is sudden, from the colour reddish or grey to white.

The line from eye to ear is well defined and separates white above and below, with a second similar line radiating from the upper posterior of the eye.

The top of the head is dark, but without any obvious peppering or markings beyond those mentioned. The area between the snout, eye and including the upper labials are all white as is the chin and gular region. Upper surfaces of the front and rear limbs are dark in colour but punctuated with white bands on the forelimbs and obvious white markings on the hind limbs.

The tail is marked with light blotches on top anteriorly with dark on the sides, becoming brownish-grey posteriorly and without obvious markings.

There is a barely distinct grey smudge or overwrite down the middle of the spine of the body.

Iris is a dark reddish brown in colour.

C. dorsei sp. nov. in life is depicted in Brown (2014) on page 671, second down on left is a male and third down on left is a female as well as Wilson (2022) page 217, top left (male). The species is also depicted in life online at:

<https://www.inaturalist.org/observations/148520503> (male)

and

<https://www.inaturalist.org/observations/103998294> (male)

and

<https://www.inaturalist.org/observations/72001834> (female).

C. wiradjuri sp. nov. males are generally greyish coloured lizards with a greyish dorsum, cream coloured dorsolateral stripes, boldly defined on the outer edge and not quite so on the inner edge.

The dorsal pattern of mainly light blotches etched dark on the outer edges and including down the midline is relatively prominent. Markings on the tail are barely noticeable and the light pink flush on the tail runs most of the length of it, but becoming a dull orange or orange grey posteriorly.

Head markings are faded or absent, but there is typically a yellow or orange ring of some kind either around the eye, or at least an area of yellow or orange above the eye.

Upper surfaces of the limbs are brownish-yellow in colour, but the distal parts and toes are noticeably a beige or yellow colour.

Markings on the tail if present are barely distinct and if present, usually in the form of wide white and darker bands at the distal end.

Iris is orange-yellow in colour.

Female *C. wiradjuri* sp. nov. are similar in most respects to female *C. dorsei* sp. nov. at outlined above, but separated from that taxon by obvious dark spots or markings (not peppering) on the upper surfaces of the head, an absence of obvious cross bands on the upper surfaces of the forelimbs and the demarcation between dark upper surface of the flank and whitish underside being in the form of an obvious line with at least one

added border, this usually being a black edge at the end of the darker upper flank, and sometimes a similar black edge forming a line at the lower boundary of the white demarcation.

The upper surface of the tail is light with slightly darker on the flanks, these forming dark tipped triangular intrusions on the upper surface.

Iris is light grey on the bottom and light dull orange brown on top.

C. wiradjuri sp. nov. is depicted in life in Cogger (2014), page 733 (female), as well as online at:

<https://www.inaturalist.org/observations/103397281> (male) and

<https://www.inaturalist.org/observations/103499257> (female) and

<https://www.inaturalist.org/observations/81410631> (female)

For separation of the other eight species in the subgenus *Wittenagama* Wells and Wellington, 1985, please refer to the diagnosis for *C. gedyei* sp. nov. in this paper, the relevant information being a formal part of this species description.

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. wiradjuri* sp. nov. occurs on elevated wooded sections of the western plains of New South Wales, beyond the western slopes and east of the more arid far western parts of the state in an area generally in a line from West Wyalong in the south, through Parkes and Dubbo and as far north as just south of Bourke in the north-west.

Etymology: *C. wiradjuri* sp. nov. is named honour of the Wiradjuri people who are the largest Aboriginal group in central New South Wales, by area and population. Before being shot, killed and killed with biological weapons in the form of smallpox infected blankets, and that was before they were forcibly evicted from their land by the British King's and Queen's armies, these Aboriginal Australians occupied an area in central New South Wales that was almost identical to the known range of this species. Based on human remains found at the nearby Lake Mungo, they managed to cohabit the region with the species for at least 40K years without wiping it out.

CALOTELLA (WITTENAGAMA) JOSEPHBURKEI SP. NOV.
LSIDDurn:lsid:zoobank.org:act:0F6A87A2-9E60-41EB-8DA2-2A10D31B3134

Holotype: A preserved female specimen at the National Museum of Victoria, Melbourne, Victoria, Australia, specimen number D71317 collected from Meridian track, Wyperfeld National Park, Big Desert, Victoria, Australia, Latitude -35.4728 S., Longitude 141.991 E.

This government-owned facility allows access to its holdings.

Paratypes: 1/ Five preserved specimens at the National Museum of Victoria, Melbourne, Victoria, Australia, specimen numbers D71343-7 collected from Rocket Lake Road, Murray-Sunset National Park, Victoria, Australia, Latitude -34.7598 S., Longitude 141.776 E., and 2/ Four preserved specimens at the National Museum of Victoria, Melbourne, Victoria, Australia, specimen numbers D71318-D71321 collected from Wyperfeld National Park, Big Desert, Victoria, Australia, Latitude -35.4728 S., Longitude 141.991 E.

Diagnosis: Until now, putative *Calotella (Wittenagama) nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species as detailed in the description of *C. gedyei* sp. nov. above.

This paper formally names six other forms, making a total of nine for the species complex and subgenus *Wittenagama* as recognized herein.

C. josephburkei sp. nov. occurs in the Mallee/Spinifex woodlands belt of far south-west New South Wales, north-west Victoria and nearby parts of South Australia.

The nine species can be most easily separated from one another by different combinations of colour and markings.

C. josephburkei sp. nov. are separated from the eight other species in the subgenus *Wittenagama* Wells and Wellington, 1985 by the following unique combination of characters, defined herein for each sex and in terms of both referring to normal adults in breeding season.

C. josephburkei sp. nov. males are a generally drab grey lizard on top.

They are readily separated from males of all other species by the noticeably wider dorsolateral stripes that are cream in colour combined with a lower lateral stripe of the same colour and width as the dorsolateral lines, demarcated with the grey upper flank on top and below by a well defined thick grey line, or line defined by a zone of dense peppering in the form of a line on the upper edge and fading below it.

Head is plain grey with either no visible markings or those that are, being very indistinct and of similar colour to the surrounding areas. Limbs are generally unmarked or if so, very faintly, the exception to this being the back parts of the upper surfaces of the hind limbs, including the anterior flanks of the tail. Ear is dark grey to black.

The entire tail is generally a whitish grey colour and any pink flush anteriorly is extremely feint if detectable at all and in most animals is seen as a white, rather than pink flush.

Labial area of the head is white, including lower labials, but the gular region rapidly becomes peppered grey.

Iris is a light yellow-orange colour.

Female *C. josephburkei* sp. nov. are also a generally dull greyish coloured lizard.

Like males, they also have thick dorsolateral cream or white lines on the body. But in the case of females these are intruded on the upper edge by a well defined dark edged series of about five triangular intrusions on the mid and lower dorsum of the body. Otherwise the central part of the dorsum is generally grey

in colour. The intrusions into the dorsolateral lines are formed as extensions from the mid-dorsal area, but are brownish, rather than grey as seen in the mid-dorsal area itself, giving them the appearance of brown triangles intersecting the lighter dorsolateral stripes.

The outer edge of the mid dorsal zone that borders the light dorsolateral lines is faintly brown edged.

The triangular intrusions mentioned before, continue onto the top and flanks of the anterior part of the tail, in the form of small triangles or diamonds. The tail is otherwise a brownish grey colour, but with broad semi-distinct rings on the posterior half.

Labials are whitish-grey as are the under-surfaces of the anterior of the head.

C. josephburkei sp. nov. is depicted in life in Brown (2014) on page 671, bottom right (male), Melville and Wilson (2019) page 256, bottom right (male, not breeding colours) and online at:

<https://www.inaturalist.org/observations/135353121> (male)

and

<https://www.inaturalist.org/observations/151265589> (male)

and

<https://www.inaturalist.org/observations/141494310> (male)

and

<https://www.inaturalist.org/observations/125137902> (male)

and

<https://www.inaturalist.org/observations/159087699> (female)

and

<https://www.inaturalist.org/observations/69292668> (female)

For separation of the other eight species in the subgenus *Wittenagama* Wells and Wellington, 1985, please refer to the diagnosis for *C. gedyei* sp. nov. in this paper, the relevant information being a formal part of this species description.

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. josephburkei* sp. nov. occurs in the Mallee/Spinifex woodlands belt of far south-west New South Wales, north-west Victoria and nearby parts of South Australia.

Etymology: *C. josephburkei* sp. nov. is named in honour of Joseph Burke, criminal lawyer, based in Melbourne, Victoria, Australia in recognition of his efforts in fighting the endemic corruption in the Victoria Police and the cocaine addicted judiciary of judges, magistrates and court staff, who are beholden to the corrupt police who supply them with this highly addictive hard drug.

For details see Fraser (2007).

CALOTELLA (WITTENAGAMA) AAH SP. NOV.

LSIDurn:lsid:zoobank.org:act:FDDC40A1-39E3-43F2-8EBD-E1BF9DAEAFDC

Holotype: A preserved specimen at the Australian Museum, Sydney, New South Wales, Australia, specimen number R.151842, collected from Rainbow Falls, Blackdown Tableland, Queensland, Australia, Latitude -23.7911 S., Longitude 149.09388 E.

This government-owned facility allows access to its holdings.

Paratypes: Three preserved specimens at the Australian Museum, Sydney, New South Wales, Australia, specimen numbers R.151843-5, collected from the Blackdown Tableland area, Queensland, Australia, Latitude -23.7911 S., Longitude 149.09388 E.

Diagnosis: Until now, putative *Calotella (Wittenagama) nobbi* (Witten, 1972) has been treated as a single species by most authors, usually placed in the genera *Amphibolurus* Wagler, 1830 (*sensu* Witten, 1972, Cogger *et al.* 1983), or *Diporiphora* Gray, 1842 (*sensu* Edwards and Melville, 2011, Cogger 2014, Brown 2014, Wilson and Swan (2021), with Wells and Wellington (1985) erecting the genus *Wittenagama* Wells and Wellington, 1985 for the species and to date being the only authors to have used this placement.

Calotella Steindachner, 1867, type species *Calotella australis* Steindachner, 1867 is herein regarded as the phylogenetically correct genus-level placement, that genus also being used as valid by Wells and Wellington (1985) for the type species and associated taxa.

Wittenagama is herein used as a subgenus for the relevant taxa herein.

Four forms within *C. nobbi* or associated with it have been named to date, with three recognized as valid species as detailed in the description of *C. gedyei* sp. nov. above.

This paper formally names six other forms, making a total of nine for the species complex and subgenus *Wittenagama* as recognized herein.

C. phaeospinosa (Edwards and Melville, 2011) with a type locality of Bauhinia Station, Queensland, Latitude -25.17 S., Longitude 149.20 E, is a range-restricted species confined to the Expedition National Park (Southern Expedition Range) and the Bigge Range, mid-eastern Queensland.

C. aah sp. nov. was formerly treated as a northern population of *C. phaeospinosa*, and is apparently confined to the Blackdown Tableland (Northern Expedition Range) in mid-eastern Queensland. While extremely common where it occurs, it appears to be a range-restricted endemic to the area.

C. aah sp. nov. are separated from the eight other species in the subgenus *Wittenagama* Wells and Wellington, 1985 by the following unique combination of characters, defined herein for each sex and in terms of both referring to normal adults in breeding season.

C. aah sp. nov. males are readily separated from all other species in the *C. nobbi* complex by the presence of a dark, black coloured line from eye to ear and including the entirety of the ear, being black, dorsolateral lines that are yellow, with a fairly even lower edge and jagged upper edge, black chin and gular scales, upper part of the flank is black to dark brown along the upper half to two thirds of the flank, bounded below by a well defined yellow line (thinner than the dorsolateral ones) and bounded below that by a deep range-red, which may be brown edged towards the yellow line above.

The tail is mainly light on top and with deep reddish orange on the sides for the anterior quarter, beyond which is a series of near joined lighter blotches on the upper surface and mainly darker on the sides.

Labials are whitish grey as are nearby scales on the side of the head. The top of the head is an ill-defined mixture of a grey and brown colouration, being much the same down the middle of the dorsum, there being more grey along the midline and more

brown towards the outer edges.

Iris is light orange.

There is a moderately well-defined dark grey line running down the midline of the back and terminating just past the pelvic girdle.

Female *C. aah* sp. nov. do not have the unbroken dorsolateral stripes of the males.

In females the dorsum has a combination of wide creamy-white blotches, roughly square in shape, extending from the greyish midline, interspersed with narrower black sections. Towards the dorsolateral line, the creamy-white blotches widen and in turn tend to make the darker sections triangular tipped. Along the line of the flank (being an area as opposed to a physical line), the markings abruptly stop and there is merely a zone of reddish-brown, with black smudging or peppering occupying the upper flank.

In most specimens the widened outer edges of the lighter blotches do not completely cut off the darker interspaces, meaning that there is no view of triangles on the dorsum. However in some specimens the lighter blotches do merge and there is a view of well-defined grey triangles along the mid dorsal line, with the points being mound by yellow on the outer edges.

While this may result in a continuous zone of yellow along the dorsolateral line, this is in no way like the well defined dorsolateral lines in the males that are relatively straight edged along both edges and not having the obvious triangle intrusions.

About 2/3 down the flank is a well defined (always) white line of moderate thickness, thinly bound with black or dark grey, top and bottom, below which the reddish-brown colour continues.

The line from eye to ear and beyond is brown in colour, although the ear itself is usually greyish in colour.

Iris is beige in colour.

C. aah sp. nov. in life is depicted in Brown (2014) on page 671 (male top right and female top left) and online at:

<https://www.inaturalist.org/observations/177044877> (male)

and

<https://www.flickr.com/photos/65796382@N05/36918228993/> (male)

and

<https://www.flickr.com/photos/euprepiosaur/8471986271/> (male)

and

<https://www.inaturalist.org/observations/136492220> (female)

and

<https://www.inaturalist.org/observations/151563909> (female).

C. phaeospinosa is similar in most respects to *C. aah* sp. nov. as detailed above and unless stated otherwise below, the diagnosis of this species matches that of *C. aah* sp. nov..

Male *C. phaeospinosa* are readily separated from *C. aah* sp. nov. by the line from eye to ear and beyond being relatively ill-defined and often broken, not being black in colour, but rather a medium grey instead and distinct of this taxon is that darker areas of the upper body and flanks are usually heavily spotted white (not seen in *C. aah* sp. nov.), the spotting being faded in aged specimens. Also male *C. phaeospinosa* lacks the strong reddish colour of the lower flank, instead being less strongly flushed and a dull yellow-orange colour instead. The white line of the lower flank is narrow, often ill-defined or absent.

Female *C. phaeospinosa* is similar in most respects to *C. aah* sp. nov. as detailed above and unless stated otherwise below, the diagnosis of this species matches that of *C. aah* sp. nov..

Female *C. phaeospinosa* are generally a yellowish-grey lizard as opposed to the more reddish colours seen in *C. aah* sp. nov.. The whitish line on the lower flank is ill-defined, broken or absent and often greyish, rather than white in colour. Markings on the tail are generally a combination of greyish and yellow (mainly greyish) versus greyish and reddish-orange in female *C. aah* sp. nov..

Notwithstanding the genetic divergence between *C. phaeospinosa* and *C. aah* sp. nov., probably the biggest driver of

colouration differences between these two taxa is the colour of the rock substrate in the respective areas they occur in and the natural selection that has arisen as a result.

C. phaeospinosa in life is depicted online at:

<https://www.inaturalist.org/observations/143459143> (male)

and

<https://www.inaturalist.org/observations/119187909> (immature male).

For separation of the other eight species in the subgenus *Wittenagama* Wells and Wellington, 1985, please refer to the diagnosis for *C. gedyei* sp. nov. in this paper, the relevant information being a formal part of this species description.

The nine above described species, being the entirety of the subgenus *Wittenagama* Wells and Wellington, 1985 are separated from the nominate subgenus within *Calotella* Steindachner, 1867, type species *Calotella australis* Steindachner, by the presence of 1-8 femoral pores on either side of the vent, versus none in *Calotella*.

Species within *Calotella* are separated from the morphologically similar species within the genus *Diporiphora* Gray, 1842 by the following combination of characters: Keels of the dorsal scales on the posterior part of the body converge on the vertebral line; gular and ventral scales (excluding chin shields) are keeled; gular fold present; dorsal scales are heterogenous, including a longitudinal series of enlarged scales along the outer edge of the paravertebrals; vertebral scales are roughly the same size as the inner rows of enlarged dorsal scales.

Species within the preceding named genera and subgenera are separated from all other Australian agamids by the following:

The presence of a body without massive conical spines all over it, the spines being larger than the eye or a massive spiny hump on the nape; no loose frill of skin around the neck; femoral pores present in males (*Wittenagama* and *Diporiphora* but not the nominate subgenus *Calotella*); tail not strongly laterally compressed with a strongly differentiated dorsal keel; with or without a series of enlarged scales on the back along the vertebral line (the preceding was modified from Cogger 2014).

Distribution: *C. aah* sp. nov. was formerly treated as a northern population of *C. phaeospinosa*, and is apparently confined to the Blackdown Tableland (Northern Expedition Range) in mid-eastern Queensland. While extremely common where it occurs, it appears to be a range-restricted endemic to the area.

C. phaeospinosa (Edwards and Melville, 2011) with a type locality of Bauhinia Station, Queensland, Latitude -25.17 S., Longitude 149.20 E, closely related to *C. aah* sp. nov. is a range-restricted species apparently confined to the Expedition National Park (Southern Expedition Range) and the Bigge Range, mid-eastern Queensland.

Etymology: *C. aah* sp. nov. is named in honour of Paul Woolf, long-term president of the Herpetological Society of Queensland Incorporated in recognition of his many services to herpetology in Australia and elsewhere.

When collecting this taxon, he saw one scamper up a tree and he yelled "aah" as he ran for it, giving the species it's simple to remember scientific name.

I suggest a common name as the "Aah Lizard".

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CONFLICTS OF INTEREST - NONE.