

Article

Sequential Extraction Evaluation of Rock-Hosted Elements Using a pH Range Relevant to CO₂ Geo-Sequestration

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Abstract

Detailed geochemical modelling of the potential groundwater impacts of CO₂ geo-sequestration requires site-specific knowledge of how mobile elements are hosted within rocks. We present a simple sequential extraction procedure analogous to pH conditions produced by different partial pressures of carbon dioxide (CO₂) in contact with water. The procedure consists of three sequential steps: water at pH 7; acetic acid–ammonium acetate at pH 5 and then at pH 3, with the amounts of specific elements extracted by each step considered with respect to the whole rock total element abundance. Our purpose in developing this procedure is three-fold: (1) identify readily mobilized suites of elements for groundwater baseline and monitor bore studies; (2) provide insights regarding the mode/s of occurrence of easily extracted elements within rock samples; and (3) suggest possible mechanisms for the mobilization of rock-sourced elements into groundwater under neutral to moderately acidic pH that can inform the reactive transport modelling of carbon storage sites. In our case study, the second step extracted most of the main mobile elements of interest.

Keywords: element mobility; weak acid; sandstone; carbon storage reservoir

1. Introduction

The atmospheric emission of greenhouse gases can potentially have a profound effect on the global climate, and the geological storage of CO₂ emissions is one method of mitigating this [1–3]. CO₂ dissolved in groundwater initially forms carbonic acid, and the gradational pH reduction radiating out away from the CO₂ plume may induce element mobilization via desorption/cation exchange and mineral dissolution reactions. One way to explore such reactions is via benchtop experiments involving CO₂, water, and rock at in situ temperature and pressure conditions [4–8], with changes in water chemistry over time curve-fitted by modelling software such as The Geochemist’s Workbench® [4,5,7–10] that is then fed into reactive transport models such as TOUGHREACT [9–11]. However, this requires specialist equipment and is time consuming. Supplementing resource-intensive CO₂ batch reactor experiments with quicker and cheaper ‘test tube’ type extractions using an analogous weak acid is a way to increase the scale of the investigation of relevant fluid–rock interactions, as well as to help identify which mobile elements are likely worth labour-intensive computer modelling. Dilute acetic acid is a roughly analogous weak acid more suitable than carbonic acid for pH-controlled benchtop experiments. Being weak



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acids, both carbonic and acetic acids only partly dissociate rather than completely like strong acids such as nitric or hydrochloric, and, when buffered, acetic acid can have a similar pH range to that produced by different partial pressures of CO₂ in contact with water.

Sequential extraction experiments utilizing reagents with a progressively more acidic pH is one way of evaluating how mobile elements are hosted within reservoir rocks. Both single- and multiple-step extractions are commonly used to investigate the bio- or environmental-availability of elements and their modes of occurrence within substrates such as soils, sediments, and mine wastes [12,13]. Experiments using powdered and homogenized substrate materials produce more consistent and comparable results than extractions of 'as received' samples, and multiple-step 'sequential extractions' provide more useful element behaviour/occurrence data than single-step extractions.

The pH range of the initial steps of several sequential extraction procedures (neutral to moderately acidic) is applicable to impacted groundwater during CO₂ geo-sequestration. For example, the first step of the Community Bureau of Reference (BCR) three-step sequential extraction procedure (and variants) reacts acetic acid with 1 g of soil or sediment [14,15], at an initial pH of 3 that is relevant to CO₂ sequestration. A similar common reagent for the extraction of metals from carbonates is the 1 M sodium acetate–acetic acid buffer at pH 5 [16,17], which also promotes the extraction of adsorbed elements [12]. The acetate anion may extract some metals via complexation [17], or at least help to keep them in solution once extracted from host materials, as do exchangeable cations of reagents that may limit the sorption of metals to 'active' sites that may be present within sedimentary materials [18].

The broad range of potential hosts from which buffered weak acids may extract elements present in substrates can make the interpretation of extraction results challenging. Elements hosted in water-soluble chemical species, adsorption and exchange sites, weak acid reactive minerals (including carbonates and some aluminosilicates), as well as some amorphous compounds of manganese and iron (that may also have provided adsorption sites for other elements/compounds) are all dilute acetic acid-extractable [16–20]. Thus, whilst broadly following the initial step of BCR-style procedures and utilizing acetic acid buffered with ammonium acetate, we have added an additional two steps: a water-soluble and weakly exchangeable fraction at pH 7, and weak acid extraction at pH 5 prior to extraction at pH 3, to further discriminate element behaviour under neutral to moderately acidic conditions.

The later steps of other sequential extraction procedures such as BCR that employ harsher reagents at a lower pH than would be experienced during geo-sequestration are not considered by our work. Instead, fractions of the same powders used for sequential extractions have undergone separate fusion, loss on ignition, and multi-acid total digestion procedures to obtain quantitative total rock concentration data for up to 52 elements plus the adsorbed moisture content of the samples. This enables a more accurate assessment of the proportions of elements extracted during each sequential step than could be obtained by attempting to recover and assay the solid residues that remain after this sequential extraction procedure.

The current work considers data from curated Precipice Sandstone core samples ($n = 36$) from five wells drilled in the Surat Basin, Queensland, Australia (Figure 1): Chin-chilla 4, Tipton 153, West Moonie 1, West Wandoan 1, and Woleebee Creek GW4 [21–25]. Most of the samples are sandstones but six are siltstone with varying proportions and thicknesses of sandstone interbeds. The Precipice Sandstone was chosen as a target for the potential demonstration of CO₂ injection for a variety of reasons [23,24]. It is the deepest unit of the Surat Basin (Figure 1), has good porosity and permeability, and is isolated from both shallower coal seam gas units and aquifers more commonly accessed by farmers and

industry. Additionally, the Moonie Oil Field adjacent to the West Moonie 1 site extracts oil from both the Precipice Sandstone and a unit called the Boxvale Sandstone within the overlying Evergreen Formation.

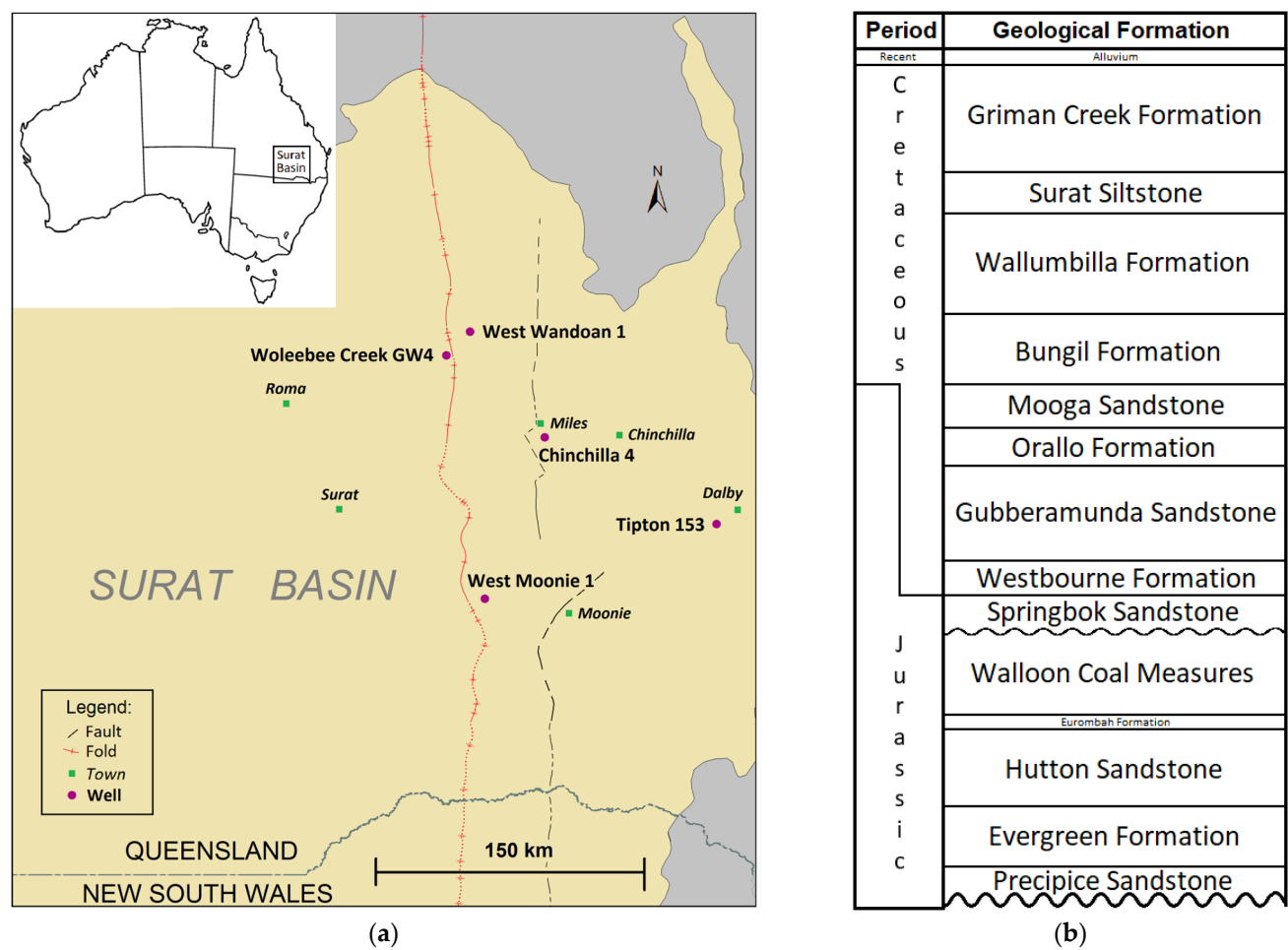


Figure 1. (a) The locations of the five sampled cored wells in the Surat Basin, Queensland, Australia: Chinchilla 4, Tipton 153, West Moonie 1, West Wandoan 1, and Woleebee Creek GW4 [21–25]. NB: Only approximate positions of major structures are shown. Inset map modified after [26]. (b) Stratigraphic column of common geological formations of the Surat Basin. The vertical scale of the geological formations is representative of the approximate relative thickness [23] rather than age which is more uncertain [27,28], and not all formations are present at the site of each well that has been drilled.

2. Materials and Methods

Several samples (n = 22) had thin sections prepared for SEM–EDS element analyses utilized by automated mineral assay tools such as MLA ([29] JKMRC/FEI Company, Brisbane, QLD, Australia) and QEMSCAN ([30] CSIRO/FEI Company, Brisbane, QLD, Australia). Representative rock powders of all core samples were prepared via clean crushing techniques using agate to limit contamination and reduce element concentration backgrounds. Splits of the same homogenized rock powders of given samples were utilized in parallel for XRD mineralogy, total element assays, and sequential extractions via a combination of methods.

Semi-quantitative XRD analysis of all rock powders (n = 36) was performed utilizing a Bruker D8 Advance powder XRD (Bruker, Karlsruhe, Germany) at the UQ Centre for Microscopy and Microanalysis (CMM). The copper radiation source was set to 40 kV and 40 mA, with 15 rpm rotation continuous scanning using a 0.06°/sec step size from 2° to

70° (2 θ) scanning angle. The raw data were manually processed using DIFFRAC.EVA V5.1 with the ICDD PDF-2 2025 reference database.

Standard gravimetric analytical techniques (Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS)) were utilized at the Centre for Geoanalytical Mass Spectrometry (CGMS) within the UQ School of the Environment. Concentration data were obtained for fifty-two elements including rare earth elements (REEs) within splits of the rock sample powders. Lithium metaborate fusion 5% *v/v* nitric acid digest ICP-OES, coupled with weighing powdered rock samples before and after both oven drying and furnace ignition (loss on ignition—LOI), determined major elements, moisture, and other volatile contents of the samples. An in-house Teflon beaker acid digestion method involving sequential hydrofluoric acid, hydrochloric acid, aqua regia, and nitric acid reactions was used to determine predominately minor and trace elements via ICP-OES and ICP-MS assays of aliquots diluted to 2% *v/v* nitric acid. Some major element assays were cross-comparable between the fusions and hotplate digestion techniques; however, silicon could only be assayed via fusions and elements such as sulfur are more accurately determined via capped Teflon beaker digests. Data QC involved checks of element recoveries for certified reference materials subjected to the same treatment and procedures as our samples, and for fusions the total mass of major and minor elements (as oxides) plus moisture and LOI needed to equal 100% *w/w*.

We have attempted to separate the fractions of elements that are as follows: (1) water-soluble (e.g., salts), weakly adsorbed, and exchangeable at pH 7; (2) strongly adsorbed or bound to minerals that dissolve at pH 5; and (3) bound to or hosted in minerals that continue (or begin) to react with weak acids at pH 3. To do this, we have generally followed the overall methodology of a modified BCR procedure [15] in terms of sample powder mass, extraction fluid volume and hence fluid–rock ratio, reaction time, tube rotation rate, laboratory temperature, centrifugation/filtering, and inter-step cleaning procedures. Each of the sequential extraction steps utilized generally the same methodology with only the extraction solution composition varying. Sediment resuspension following centrifugation compaction is essential at the commencement of each subsequent extraction step, to ensure comparable reactive surface areas [31]. Washing of well-shaken sample powders within tubes with 20 mL of pure water took place between each sequential extraction step, with this being discarded via pipetting following centrifugation.

In detail, experiments extracting elements from 1 g of rock sample powder took place in 50 mL falcon tubes. Each tube (plus powder) had 40 mL of reagent solution added to it. In sequence, these were water with trace ammonium acetate (0.11 M) at pH 7, acetic acid (1 M) buffered with ammonium acetate at pH 5 and again at pH 3. For the acid steps (2 and 3), tubes were initially left uncapped for about 30 min. This was to allow for escape of any CO₂ gas generated by reaction with carbonate minerals that (if abundant) may otherwise cause over-pressure leakage from tube lid threads. Once any visible bubbling had ceased, tubes were tightly capped and then wrapped with paraffin film to further limit the potential for leakage during experiments. Tubes were rotated end-over-end at 30 rpm for 16 h. After gentle internal washing and tapping to remove fine solids stuck to the sides or the inside of the lid, tubes underwent centrifugation at ~4000 rpm for 40 min to help settle fine solids floating in the fluid. Clean 5 mL pipette tips were then used to carefully remove as much fluid as practical (without disturbing solids) from each tube. Aliquots were immediately syringe filtered (0.11 μ m) and 10:1 diluted with 2% *v/v* nitric acid prior to analyses of major, minor, and trace elements via ICP-OES and ICP-MS.

3. Results

We have investigated the relationships between elements and their mobility at laboratory temperature and pressure and neutral to moderately acidic pH, with inferences made about the rock sample hosts of mobile elements. Because our intention is to demonstrate the utility of the procedure rather than focus on individual sample element behaviours, and for ease of reading, this section considers average rock mineralogy (Table 1) and median element data (Tables 2 and 3) for the total chosen sample set (n = 36). In Table 1, SEM refers to a combination of QEMSCAN and MLA of petrographic thin sections, whereas XRD assayed rock powders. Averaging the mineralogy (Table 1) causes the perception of some minerals, particularly carbonates, to be significantly less abundant than they were in some samples (Figure 2), and the different mineral assay techniques are complementary rather than directly comparable. Full data tables are available in Appendices A and B.

Table 1. Average mineralogy (%) of Precipice Sandstone samples.

			Tectosilicates				Phyllosilicates			Carbonates			Other
			Quartz	K-Feldspar	Plagioclase	Kaolinite	Micas/Illite	Smectite	I/S	Chlorite	Siderite	Ca-Bearing	
All	XRD	n = 36	82.0	1.2		7.7	6.8			0.8	1.1	0.3	0.1
	SEM	n = 22	79.3	0.6	0.5	11.1	3.7	2.4	0.8	0.1	0.9		0.6
Sandstones	XRD	n = 30	88.1	1.1		4.5	3.7			1.0	1.3	0.2	0.1
	SEM	n = 18	89.5	0.6	0.2	5.2	1.2	1.6	0.3	<0.1	1.0		0.4
Inter-bedded	XRD	n = 6	51.3	1.9		23.3	22.0			0.3	0.4	0.6	0.2
	SEM	n = 4	33.4	0.5	1.7	37.6	15.0	6.4	3.1	0.2	0.3		1.8

Table 2. Median whole rock and element extraction data (mg element per kg rock, n = 36).

Element *	Whole Rock	Step 1 (pH 7)	Step 2 (pH 5)	Step 3 (pH 3)	Sum of Acid Steps	Three Steps Summed
Al	13,009	<DL	31	22	53	55
As	1	0.01	0.2	0.02	0.2	0.2
Ba	52	2	1	0.1	1	4
Be	0.2	<DL	0.009	0.006	0.01	0.01
Bi	0.06	<DL	0.01	<DL	0.01	0.01
Ca	122	13	4	<DL	5	18
Co	3	0.2	0.6	0.1	0.8	1
Cr	9	<DL	0.05	0.04	0.1	0.1
Cs	0.4	0.02	0.005	<DL	0.01	0.03
Cu	13	0.3	4	0.3	6	6
Fe	644	<DL	28	26	59	59
Ga	3	0.001	0.006	0.005	0.01	0.01
Ge	0.4	<DL	0.004	0.002	0.005	0.006
Hf	1	<DL	<DL	<DL	<DL	<DL
K	2473	181	<DL	<DL	<DL	181
Li	4	<DL	<DL	<DL	<DL	<DL
Mg	148	4	2	1	4	7
Mn	10	<DL	<DL	<DL	<DL	<DL
Mo	0.2	0.003	0.001	<DL	0.001	0.01
Na	316	24	<DL	<DL	<DL	24
Ni	5	0.2	0.9	0.2	1	2
P	34	<DL	<DL	<DL	<DL	<DL
Pb	7	0.01	2	0.2	2	2
Rb	6	0.2	0.02	0.01	0.03	0.2

Table 2. Cont.

Element *	Whole Rock	Step 1 (pH 7)	Step 2 (pH 5)	Step 3 (pH 3)	Sum of Acid Steps	Three Steps Summed
REE	33	0.001	0.1	0.05	0.2	0.2
S	205	16	<DL	<DL	<DL	19
Sb	0.2	0.008	0.01	0.003	0.02	0.02
Sc	1	<DL	0.04	0.008	0.05	0.05
Si	437,088	<DL	<DL	<DL	<DL	<DL
Sn	3	<DL	0.09	0.009	0.1	0.1
Sr	16	0.8	0.2	0.04	0.3	1
Th	3	<DL	0.02	0.006	0.03	0.03
Ti	834	<DL	<DL	<DL	<DL	<DL
Tl	0.06	0.007	0.0006	<DL	0.0006	0.01
U	0.7	<DL	0.01	0.004	0.02	0.02
V	10	0.01	0.06	0.09	0.2	0.2
Y	4	<DL	0.04	0.01	0.06	0.06
Zn	15	0.4	2	0.4	2	4
Zr	40	<DL	0.006	<DL	0.006	0.02

* Shading indicates median extraction greater than 1 mg of element per kg of rock (ppm).

Table 3. Median element extraction (%) relative to whole rock element abundance, n = 36.

Element *	Step 1 (pH 7)	Step 2 (pH 5)	Step 3 (pH 3)	Sum of Acid Steps	Three Steps Summed
Al	<DL	0.2	<0.01	0.2	0.4
As	0.4	16	2	18	20
Ba	3	2	0.1	3	6
Be	<DL	5	2	7	7
Bi	<DL	19	<DL	19	19
Ca	6	2	<DL	3	11
Co	10	25	3	31	41
Cr	<DL	0.3	0.2	0.5	0.8
Cs	4	1	<DL	2	5
Cu	4	40	3	44	53
Fe	<DL	1	2	3	3.2
Ga	<0.01	0.1	0.1	0.2	0.4
Ge	<DL	0.6	0.3	1.2	1.3
Hf	<DL	<DL	<DL	<DL	<DL
K	1	<DL	<DL	<DL	1
Li	<DL	<DL	<DL	<DL	<DL
Mg	3	1	0.1	2	5
Mn	<DL	<DL	<DL	<DL	<DL
Mo	1	0.2	<DL	0.2	4
Na	6	<DL	<DL	<DL	6
Ni	6	18	3	21	28
P	<DL	<DL	<DL	<DL	<DL
Pb	0.1	31	2	35	36
Rb	2	0.2	0.1	0.5	3
REE	<0.01	0.2	<0.01	0.4	0.5
S	10	<DL	<DL	<DL	11
Sb	3	6	1	7	10
Sc	<DL	2	0.4	3	3

Table 3. Cont.

Element *	Step 1 (pH 7)	Step 2 (pH 5)	Step 3 (pH 3)	Sum of Acid Steps	Three Steps Summed
Si	<DL	<DL	<DL	<DL	<DL
Sn	<DL	3	0.3	3	3
Sr	6	1	0.1	2	8
Th	<DL	0.3	<0.01	0.3	0.5
Ti	<DL	<DL	<DL	<DL	<DL
Tl	5	0.4	<DL	0.4	7
U	<DL	1	0.4	2	2
V	0.1	0.6	0.7	1	2
Y	<DL	0.5	0.2	0.8	0.8
Zn	3	9	2	13	20
Zr	<DL	<0.01	<DL	<0.01	<0.01

* Shading indicates > 5% median element extraction from rock.

The amounts of elements mobilized from samples have been normalized to the mass of powder used for the extractions, with median element extraction expressed as mass of element (mg) per mass of powder (kg) in Table 2, which also lists the whole rock total element concentrations in the same units of measurement (rock ppm) for ease of reference. Dividing the mass of element extracted per total mass of element in the rock and multiplying $\times 100$ gives the percentage element extraction from samples; the median proportions of elements extracted are presented in Table 3. Please note that the entire sample set (Appendices B.1 and B.2) was used to calculate the data in Table 3 rather than just the medians of Table 2. Elements with median extraction greater than 1 mg per kg of rock or exceeding 5% of the median total originally present within the homogenized rock powders are highlighted, as well as summarized in Table 4, which details the most significantly extracted elements in terms of mass extracted (>1 mg element per kg rock) and/or proportion mobilized (>5%).

Table 4. Median most significantly extracted elements from all samples (n = 36).

Extraction Step		Step 1 (pH 7)													Step 2 (pH 5)										Step 3 (pH 3)			
Element		Co	Ni	Sr	Tl	Ca	Na	S	Ba	K	Mg	As	Be	Bi	Co	Ni	Sb	Cu	Pb	Zn	Al	Ba	Ca	Fe	Mg	Al	Fe	Mg
% of total	>5	10	6	6	5	6	6	10	3	1	3	16	5	19	25	18	6	40	31	9	0.2	2	2	1	1	<0.01	2	0.1
Rock ppm	>1	0.2	0.2	0.2	0.007	13	24	16	2	181	4	0.2	0.009	0.01	0.6	0.9	0.01	4	2	2	31	1	4	28	2	22	26	1

Alkali and alkaline earth metals, mainly potassium, sodium, calcium, and magnesium, plus sulfur contribute most to the bulk water chemistry changes during the Step 1 ‘water leach’ at pH 7. What is extracted during Step 1 is most likely water-soluble salts plus some weakly adsorbed and potentially cation exchangeable ions. Most of the potassium and sulfur water extracted from West Wandoan 1 sandstones (Figure 3) was probably drilling salt contamination, given that a substantial amount of potassium sulfate was added to the drilling mud whilst penetrating parts of the Precipice Sandstone at that site [24] and there is a near-perfect linear correlation ($R^2 = 0.99$) for both water extracted sulfur versus potassium and the whole rock elemental abundances of them. At least some of the extracted barium, calcium, magnesium, sodium, and strontium could have come from cation exchange sites within trace smectite (Table 1, Figure 2) [32]. The cobalt, nickel, and thallium may have been desorbed from clay surfaces, with thallium known to be mobile at neutral pH [33–35].

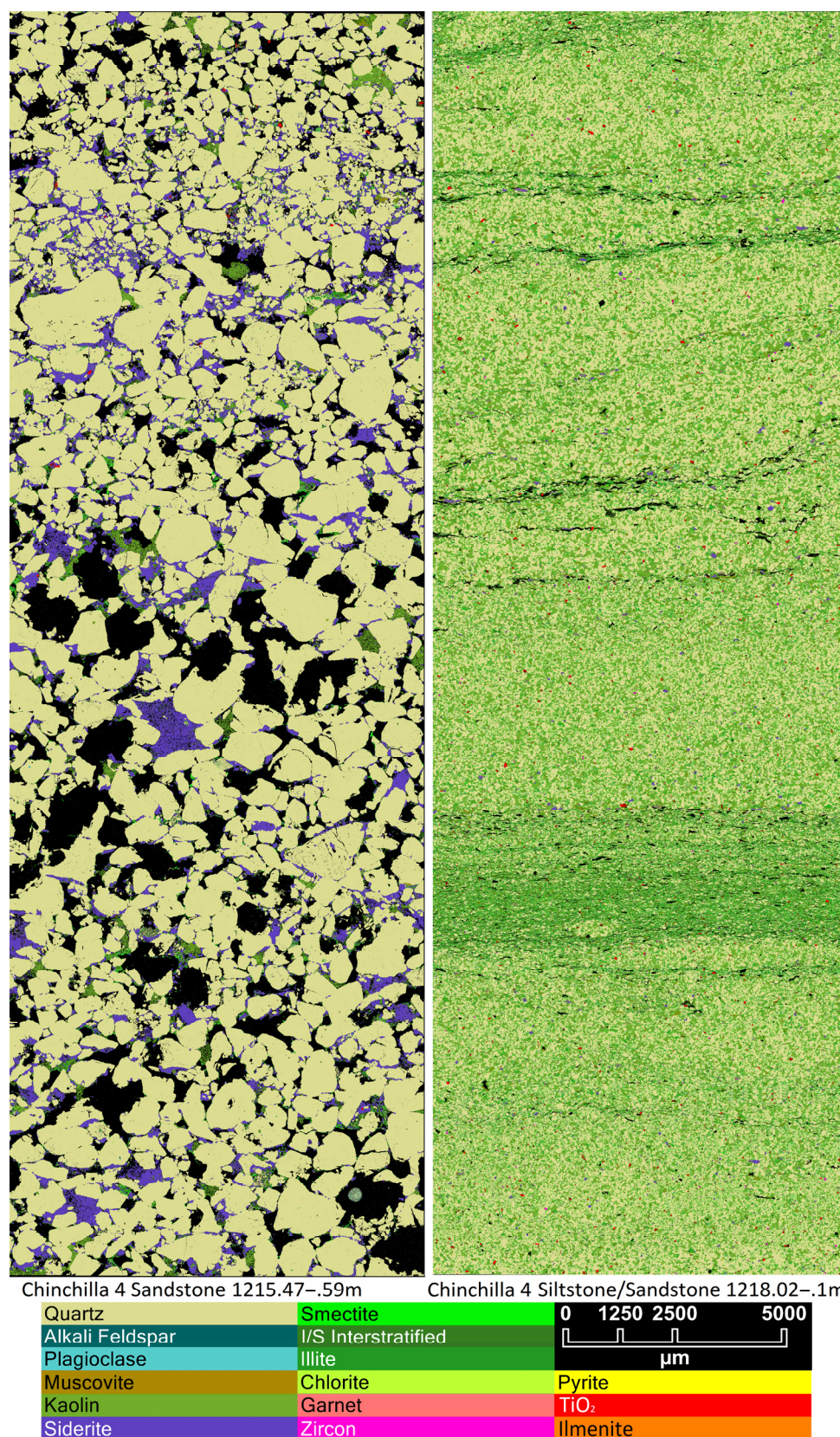


Figure 2. Examples of QEMSCAN false color mineral maps of thin sections of core from Chinchilla 4: sandstone interval 1215.47–1215.59 m (**left**) and interbedded siltstone/sandstone interval 1218.02–1218.10 m (**right**). The black areas in 1215.47–1215.59 m are intergranular porosity, whereas the dark linear areas in 1218.02–1218.10 m are coalified organic matter. The legend details which map colors correspond with minerals detected in one or both thin sections.

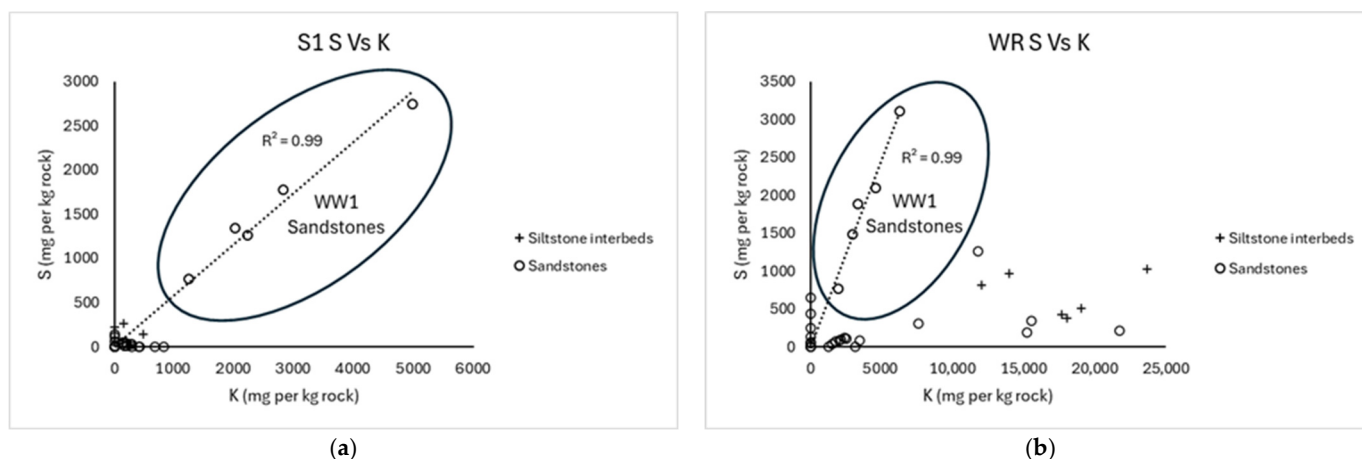


Figure 3. (a) The linear relationship ($R^2 = 0.99$) between water extracted sulfur (S) and potassium (K) for West Wandoan 1 (WW1) sandstones during the first step (S1) likely indicates contamination from concentrated drilling salts such as potassium sulfate used during coring in that well [24]; (b) whole rock (WR) sulfur and potassium data also show a linear trend ($R^2 = 0.99$) for WW1 sandstones but not for other samples.

Aluminum, iron, and magnesium had the highest median extraction during the pH 5 acid step (Table 1), with silicon extraction tracking these for individual samples (Appendix B.1). The below detection median silicon extraction is likely an artefact of the relatively high detection limits for silicon during ICP-OES analysis compared with most other assayed elements. The dissolution of an iron-rich chlorite is a likely major source of these elements, based on the SEM–EDS observations and geochemical model history matching of the incrementally sampled CO₂ batch reactor experiments with a subset of the same rocks used for this study as well as related rocks [5,8–10], although some of the iron and magnesium possibly came from trace carbonates that probably also reacted (Table 1, Figure 2). Additional elements with relatively high median extraction include barium, calcium, copper, lead, and zinc, with much of this likely associated with carbonate mineral dissolution given the related history-matched modelling for CO₂ batch reactor experiments [8–10]. Other mobile metals and metalloids include antimony, arsenic, beryllium, bismuth, cobalt, and nickel (Table 2). Whilst several of the extracted metals could have been hosted within carbonates [36,37], it is conceivable that at least some of the base metals and metalloids, particularly arsenic [38], may have been desorbed from mineral surfaces or been hosted within weak acid reactive sulfides and other minerals. Notably, the concentrations of acid extracted as well as whole rock cobalt and nickel appear correlated (Figure 4), with sampled intervals containing siltstone interbeds having the most abundant and mobile fractions of these elements.

Weak acid reactive aluminosilicate minerals probably continued to react at pH 3, and magnesian- and iron-rich trace carbonates, unlikely to have fully reacted (if at all) at pH 5, may have continued to slowly react during the third step (Table 1). However, no element experienced more than 3% median extraction relative to whole rock concentrations at pH 3. It is possible that trace amounts of potassium-bearing aluminosilicate/s did react given the linear relationship between thallium and rubidium [39] for both this step and the whole rock element data (Figure 5). This is despite acid extracted potassium generally being below detection which may have been an artefact of the very high detection limits for ICP-OES analysis of potassium relative to most assayed elements.

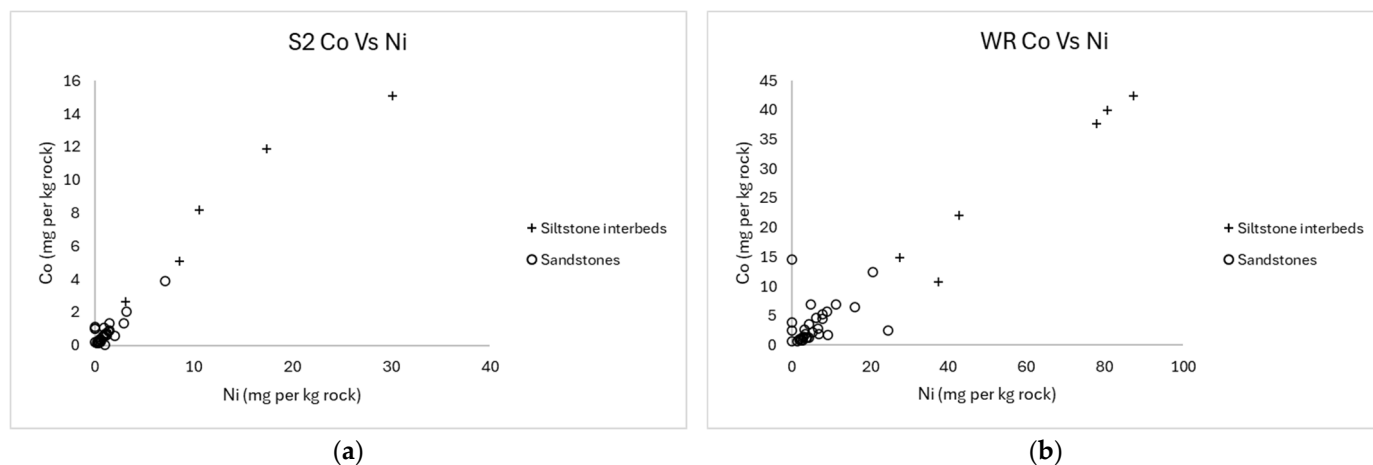


Figure 4. A linear trend between cobalt (Co) and nickel (Ni) for both (a) extraction at pH 5 during the second step (S2); (b) total abundance within Precipice Sandstone whole rock (WR) samples.

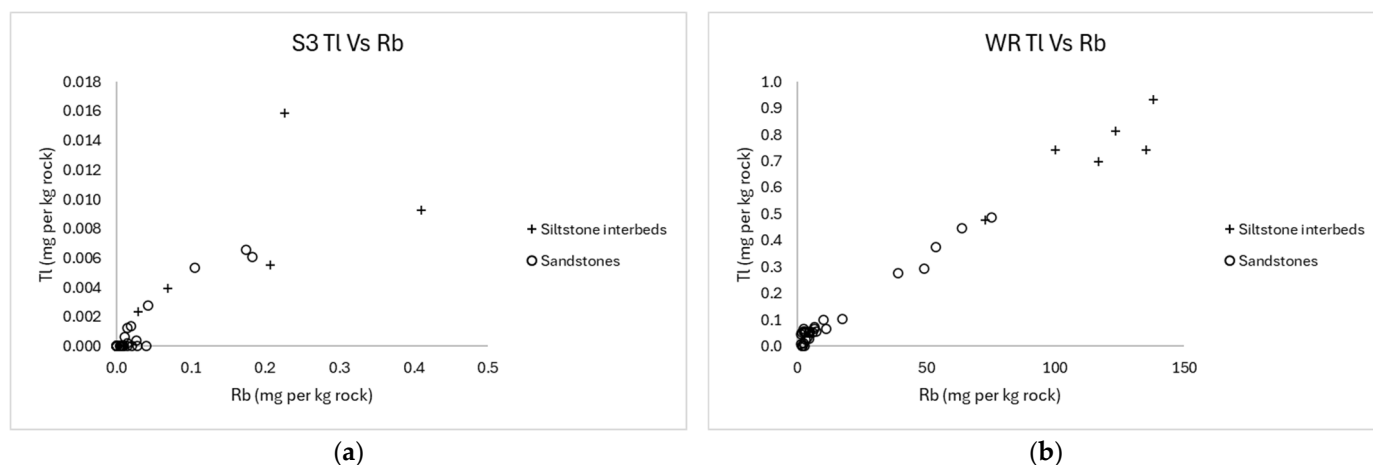


Figure 5. A linear trend between thallium (Tl) and rubidium (Rb) for (a) extraction at pH 3 during the third step (S3); (b) total abundance within Precipice Sandstone whole rock (WR) samples.

4. Discussion

The purpose for developing and utilizing this procedure was to identify which elements were readily mobilized over a pH range of 7 to 3 and use that data in combination with sample mineralogy to suggest the modes of occurrence of those elements within the rocks, and the mechanisms by which they may have been released from the rocks into the solution. The majority of the acid mobilization of elements occurred at pH 5 rather than pH 3, and the water step extracted significant amounts of some elements as well (Tables 2–4). This is significant, given that similar sequential extraction procedures tend to jump straight to pH 3 and may not include a water leach step at all [14,15]. The water step should always remain part of a sequential extraction procedure for soils and sediments, even if only to act as a baseline for the subsequent extraction step/s. Geochemical modelling of CO₂ geo-sequestration should focus upon potential water–rock interactions at pH 5 rather than pH 3 given the sequential extraction results of this study. This would also be more representative of CO₂ plume-impacted groundwater anyway, given that previous reaction transport modelling has shown that a low pH (<5) is only likely to occur close to the point of injection into the subsurface [9,10,40–42].

When considering the results, it is important to remember that powdered samples have a significantly greater mineral surface area exposed to fluid than would generally occur in nature, and the fluid–rock ratios of the experiments are very high, which results in the faster

and more complete mass transfer of susceptible elements into the fluid phase. Nonetheless, the modelling of potential Precipice Sandstone groundwater impacts should focus upon the potential sources and mobility of copper, lead, and zinc. This is due to their relatively high median extraction both in terms of proportions and absolute amounts at pH 5 (Table 4), particularly copper and lead which had 40% and 31% median extraction from the rocks, respectively, during the second step. The history-matched modelling of these for CO₂ batch reactor experiments with related rock samples suggests carbonate minerals as being a major source of these [8–10]. Other elements with appreciable proportions mobilized included the potentially problematic arsenic, cobalt, and nickel, so although the median extracted mass of these elements was significantly less than that of copper and lead, they should be considered by geochemical modellers too. In this context, the water chemistry during batch reactor experiments with Precipice Sandstone core at in situ temperature and pressure conditions demonstrated that metals and metalloids were released [5,6,9,10], which confirms the value of sequential extraction experiments for identifying elements likely readily mobilized by the water–CO₂–rock interaction in carbon storage reservoirs.

Potentially, the reaction time of the third extraction step (pH 3) may need to be significantly extended to allow for a more complete dissolution of slowly reacting minerals to occur and thus be detectable. Minerals that may gradually yet completely react at pH 5 over long timescales could conceivably react much faster at pH 3, but perhaps still not significantly during the present 16 h of tube rotation. An assessment of the minerals present within a specific sample set coupled with published reaction rate constants and likely powdered mineral surface areas could inform how long to extend the final step of the experiment (if warranted).

Sequential extractions, whilst useful, do not replace the need for CO₂ batch reactor experiments with representative intact rock samples and simulated groundwater chemistry, at in situ pressure and temperature conditions, that can be iteratively history-matched by geochemical modelling software such as The Geochemist's Workbench [4,5,7–10]. They do, however, help to provide context such as which mobile elements are most representative of overall rock formation behaviour under CO₂ geo-sequestration conditions, provided that sufficient rock samples have been taken from throughout the vertical extent of the target formation. Sequential extraction data should not be used for standalone assessments of the potential environmental impacts upon groundwater quality, particularly given the high surface areas of rock powders and high fluid–rock ratio involved in the experiments which were designed to accelerate mass transfer. Therefore, the sequential extractions probably show the maximum possible mobilization of metals, whereas the CO₂ batch reaction experiments at in situ temperatures and pressures take account of the geochemical processes that may immobilize the metals in precipitates or by adsorption to the Fe-oxide surfaces [6]. Thus, the sequential extraction data act as a useful screening tool for assessing the potential longer-term groundwater impacts of geologic carbon storage as well as the input to geochemical models with realistic rock and fluid properties [9,10].

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Abbreviations

The following abbreviations are used in this manuscript:

ANLEC R&D	Australian National Low Emissions Coal Research and Development
BCR	Community Bureau of Reference
CGMS	Centre for Geoanalytical Mass Spectrometry
CO ₂	Carbon Dioxide
ICP-MS	Inductively Coupled Plasma Mass Spectrometry
ICDD	International Centre for Diffraction Data
ICP-OES	Inductively Coupled Plasma Optical Emission Spectroscopy
LOI	Loss on Ignition
MLA	Mineral Liberation Analysis
PDF	Powder Diffraction File TM
QC	Quality Control
QEMSCAN	Quantitative Evaluation of Materials by Scanning Electron Microscopy
REE	Rare Earth Element
SEM-EDS	Scanning Electron Microscope Energy Dispersive Spectrometry
UQ	The University of Queensland
WR	Whole Rock
WW1	West Wandoan 1
XRD	X-ray Diffraction

Appendix A

Appendix A.1. Rock Samples Lithology

Table A1. Geological descriptions of sampled rock core intervals.

Well	Depth (mRT)	Description
Chinchilla 4	1215.47–1215.59	Reddish brown moderately sorted coarse- to very coarse-grained quartzose SANDSTONE with minor siderite cement.
	1218.02–1218.10	Interlaminated very fine-grained argillaceous SANDSTONE and micaceous dark grey SILTSTONE with coalified plant(?) fragments.
Tipton 153	1032.35–1032.48	Thinly cross bedded well sorted coarse- and very coarse-grained quartzose SANDSTONE layers.
	1033.88–1034.00	Very fine-grained SANDSTONE with frequent wavy grey micaceous silty mud drapes (possibly bioturbated too — intertidal?).
	1066.00–1066.24	Grey micaceous SILTSTONE with coalified plant fragments and minor very fine-grained argillaceous SANDSTONE.
	1067.92–1068.00	Thinly cross bedded moderately sorted fine- to coarse-grained SANDSTONE layers with micaceous laminations and moderate siderite cement.
	1093.00–1093.19	Cross bedded granular to pebbly moderately sorted coarse- and very coarse-grained quartzose SANDSTONE layers.
West Moonie 1	2263.61–2263.77	Thinly interbedded moderately sorted medium- to very coarse-grained SANDSTONE and GRAINSTONE layers with trace calcite cement and micaceous laminations.
	2267.05–2267.23	Poorly to moderately sorted medium- to very-coarse grained SANDSTONE.
	2267.71–2267.84	Interlaminated argillaceous very fine- to fine-grained SANDSTONE and dark grey micaceous SILTSTONE with coalified plant fossils.
	2274.10–2274.18	Interbedded moderately sorted coarse- to very coarse-grained and minor and medium-grained SANDSTONE with micaceous laminations and minor pebbles.
	2281.82–2281.92	Thinly interbedded moderately sorted medium- to coarse-grained and pebbly coarse- to very-coarse grained argillaceous SANDSTONE layers with micaceous laminations.
	2284.13–2284.24	Thinly interbedded medium- to very coarse-grained SANDSTONE and poorly sorted pebbly GRAINSTONE layers with micaceous laminations.
	2288.49–2288.61	Moderately sorted medium- to very coarse-grained SANDSTONE with minor micaceous laminations.
	2294.83–2294.98	Well sorted fine- to medium-grained quartzose SANDSTONE.
	2297.19–2297.37	Micaceous dark grey SILTSTONE interlaminated with argillaceous very fine-grained SANDSTONE.
	2298.73–2298.82	Well sorted fine-grained quartzose SANDSTONE with minor coarse-grained sandstone at base and trace micaceous laminations.
	2303.99–2304.14	Thinly cross bedded well sorted medium- and coarse-grained SANDSTONE layers.
	2311.19–2311.25	Moderately poorly sorted medium- to very coarse-grained quartzose SANDSTONE.
	2314.05–2314.17	Thinly cross bedded well sorted coarse- and very coarse-grained SANDSTONE layers.
	2319.26–2319.37	Thinly cross bedded well sorted very coarse-grained SANDSTONE with minor coarse-grained sandstone layers.
	2322.61–2322.73	Thinly cross bedded moderately well sorted medium- and coarse-grained SANDSTONE layers.
	2323.76–2323.95	Moderately well sorted fine- to medium-grained SANDSTONE.
	2325.88–2326.00	Thinly cross bedded poorly sorted fine- to very coarse-grained SANDSTONE and GRAINSTONE.

Table A1. *Cont.*

Well	Depth (mRT)	Description
West Moonie 1	2328.54–2328.59	Thinly interlaminated (tuffaceous?) grey micaceous SILTSTONE and very fine-grained argillaceous SANDSTONE.
	2330.41–2330.55	Thinly interbedded well sorted fine- and coarse-grained SANDSTONE layers.
	2333.23–2333.30	Well sorted coarse-grained SANDSTONE with minor medium-grained sandstone.
	2338.75–2338.85	Interbedded poorly sorted fine- to very coarse-grained SANDSTONE and GRAINSTONE layers with trace micaceous laminations.
West Wandoan 1	1165.57–1165.65	Thinly cross bedded medium- to coarse-grained quartzose SANDSTONE layers with micaceous silty mud drapes.
	1174.24–1174.33	Well sorted medium-grained quartzose SANDSTONE with trace micaceous laminations.
	1197.76–1197.84	Well sorted coarse-grained quartzose SANDSTONE with minor micaceous silty mud drapes.
	1207.61–1207.68	Interlaminated dark grey micaceous SILTSTONE and very fine-grained argillaceous SANDSTONE.
	1225.70–1225.80	Well sorted medium-grained quartzose SANDSTONE.
Woleebie Creek GWB 4	1229.43–1229.50	Cross bedded moderately well sorted coarse- to very coarse-grained quartzose SANDSTONE.
	1552.63–1553.00	Thinly cross bedded well to very well sorted medium- and coarse-grained quartzose SANDSTONE layers.
	1570.46–1570.52	Interbedded moderately sorted coarse- to very coarse-grained SANDSTONE and GRAINSTONE layers with trace micaceous laminations.

*Appendix A.2. Rock Samples Mineralogy***Table A2.** Semi-quantitative XRD mineral content (%) of sampled rock core intervals.

Well	Depth (mRT)	Lithology	Tectosilicates		Phyllosilicates			Carbonates			Oxide	Sulfide	
			Quartz	K-Feldspar	Kaolin	Muscovite *	Chlorite	Siderite	Ankerite	Dolomite	Calcite	Rutile	Pyrite
Chinchilla 4	1215.47–1215.59	Sandstone	88.4		1.0	2.9	2.2	5.5					
	1218.02–1218.10	Sandstone and Siltstone	64.1	2.1	17.8	13.8	1.6	0.20		0.40			
Tipton 153	1032.35–1032.48	Sandstone	95.4		2.8		1.9						
	1033.88–1034.00	Sandstone	82.5		7.2	7.9	0.9	1.5			0.13		
	1066.00–1066.24	Siltstone and Sandstone	49.9		24.8	23.6		0.65		0.64	0.53		
	1067.92–1068.00	Sandstone	63.1		6.9	7.9	1.4	19.9	0.74				
	1093.00–1093.19	Sandstone	93.7		2.7	1.9	1.7						
West Moonie 1	2263.61–2263.77	Sandstone and Grainstone	81.9	6.1	6.1	3.4	1.7	0.70					
	2267.05–2267.23	Sandstone	81.8	3.0	7.5	3.4		3.7			0.70		
	2267.71–2267.84	Sandstone and Siltstone	57.3	9.4	20.7	12.6							
	2274.10–2274.18	Sandstone	64.6	8.9	8.5	13.1	1.5	0.70	2.1			0.50	
	2281.82–2281.92	Sandstone	64.0	4.0	16.0	13.5	1.3	0.70				0.50	
	2284.13–2284.24	Sandstone and Grainstone	75.9		9.8	11.8	1.5	0.80			0.20		

Table A2. Cont.

Well	Depth (mRT)	Lithology	Tectosilicates		Phyllosilicates			Carbonates			Oxide	Sulfide	
			Quartz	K-Feldspar	Kaolin	Muscovite *	Chlorite	Siderite	Ankerite	Dolomite	Calcite	Rutile	Pyrite
West Moonie 1	2288.49–2288.61	Sandstone	86.1	0.9	6.0	6.6		0.30				0.10	
	2294.83–2294.98	Sandstone	94.2		5.2		0.50						
	2297.19–2297.37	Siltstone and Sandstone	40.3		24.5	35.2							
	2298.73–2298.82	Sandstone	92.5		4.5	3.0							
	2303.99–2304.14	Sandstone	88.5		6.2		1.4	3.7			0.20		
	2311.19–2311.25	Sandstone	96.9		3.1								
	2314.05–2314.17	Sandstone	97.5		2.5								
	2319.26–2319.37	Sandstone	97.8		2.2								
	2322.61–2322.73	Sandstone	93.7	0.70	1.7	2.5	0.80	0.20				0.20	0.20
	2323.76–2323.95	Sandstone	95.9		4.1								
	2325.88–2326.00	Sandstone and Grainstone	91.8		8.2								
	2328.54–2328.59	Siltstone and Sandstone	37.1		26.2	34.6				1.1		1.0	
	2330.41–2330.55	Sandstone	92.6	1.5	2.1	2.1	0.80	0.20			0.30	0.30	
	2333.23–2333.30	Sandstone	98.9		1.1								
	2338.75–2338.85	Sandstone and Grainstone	89.2		5.7	3.4	1.0	0.40				0.40	
	1165.57–1165.65	Sandstone	86.3		1.9	9.7	1.7			0.50			
	1174.24–1174.33	Sandstone	91.1		1.8	4.4	2.1	0.40	0.30				
	1197.76–1197.84	Sandstone	86.9		2.5	7.5	2.6	0.40					
	1207.61–1207.68	Siltstone and Sandstone	59.4		26.0	12.3		1.4	0.90				
1225.70–1225.80	Sandstone	94.9	3.0	2.0							0.10		
1229.43–1229.50	Sandstone	94.6	4.1	0.60	0.50				0.10	0.10			
Woleebee Creek GWB 4	1552.63–1553.00	Sandstone	94.6		1.4	2.0	2.1						
	1570.46–1570.52	Sandstone and Grainstone	88.5		5.2	4.8	1.6						
Average		All (n = 36)	82.0	1.2	7.7	6.8	0.8	1.1	0.1	0.08	0.06	0.08	0.006
		Sandstones (n = 30)	88.1	1.1	4.5	3.7	1.0	1.3	0.1	0.02	0.06	0.07	0.007
		Interbedded (n = 6)	51.3	1.9	23.3	22.0	0.3	0.4	0.2	0.4	0.09	0.2	n/a
Standard Deviation		All (n = 36)	16.8	2.4	7.7	8.8	0.85	3.4	0.39	0.23	0.15	0.21	0.03
		Sandstones (n = 30)	9.7	2.1	3.3	4.1	0.84	3.7	0.40	0.09	0.14	0.15	0.04
		Interbedded (n = 6)	9.9	3.4	3.1	9.9	0.60	0.51	0.34	0.41	0.20	0.37	n/a

* Illite may also have been present but was masked by muscovite XRD peaks.

Table A3. Semi-quantitative QEMSCAN and MLA mineral content (%) of sampled rock core intervals.

Well	Depth (mRT)	Lithology	SEM Technique *	Tectosilicates				Phyllosilicates			Carbonate			Heavy Minerals				Other
				Quartz	K-Feldspar	Plagioclase	Kaolinite	Micas / Illite	Smectite	I/S	Chlorite	Siderite	Garnet	Ilmenite	Monazite	Pyrite	TiO ₂	
Chinchilla 4	1215.47–1215.59	Sandstone	QEMSCAN	81.7	0.05	0.08	2.1	0.4	0.8	0.1	0.2	14.0	0.2	0.3		0.02	0.07	0.01
	1218.02–1218.10	Sandstone and Siltstone	QEMSCAN	52.8	0.7	0.9	24.1	8.7	6.6	2.9	0.7	1.3	0.01	0.5		0.01	0.7	0.08
Tipton 153	1032.35–1032.48	Sandstone	QEMSCAN	91.9	0.2	0.3	4.7	1.1	1.1	0.5			0.03			0.01	0.2	0.03
	1033.88–1034.00	Sandstone	QEMSCAN	65.7	0.7	0.8	20.0	3.4	4.6	2.2	0.04	0.7	0.05	0.05	1.4		0.5	0.04
	1066.00–1066.24	Siltstone and Sandstone	QEMSCAN	28.4	1.0	1.3	36.9	9.5	10.1	9.5			0.01		2.7	0.01	0.5	0.05
	1067.92–1068.00	Sandstone	QEMSCAN	76.4	0.3	0.3	12.7	1.7	2.2	0.8	0.3	3.9		0.3	0.8		0.4	0.06
	1093.00–1093.19	Sandstone	QEMSCAN	93.9	0.1	0.2	3.8	0.6	0.8	0.5			0.01				0.06	0.01
West Moonie 1	2263.61–2263.77	Sandstone and Grainstone	MLA	80.7	6.7	0.3	6.2	2.7	3.3		0.03	0.05		0.001	0.0004	0.005	0.07	0.01
	2274.10–2274.18	Sandstone	MLA	87.6	2.8	0.1	4.4	2.1	2.6		0.02	0.2		0.002	0.001	0.2	0.02	0.005
	2284.13–2284.24	Sandstone and Grainstone	MLA	88.6	0.02	0.2	6.1	1.1	3.9		0.001	0.0004			0.0003	0.004	0.004	0.007
	2288.49–2288.61	Sandstone	MLA	84.8	0.02	0.2	8.7	3.0	3.1		0.008	0.0001		0.0003	0.0002	0.008	0.1	0.01
	2322.61–2322.73	Sandstone	MLA	95.9	0.008	0.2	1.6	0.9	1.1		0.01	0.02		0.0005	0.0005	0.002	0.1	0.02
	2328.54–2328.59	Siltstone and Sandstone	MLA	18.7	0.006	0.7	44.8	26.2	9.0		0.02			0.002	0.01	0.00007	0.4	0.09
	2330.41–2330.55	Sandstone	MLA	94.6	0.01	0.2	2.8	0.9	1.2		0.002	0.0002		0.0006	0.0003	0.0004	0.08	0.006
West Wandoan 1	1165.57–1165.65	Sandstone	QEMSCAN	94.8	0.1	0.1	3.4	0.7	0.7	0.2							0.09	0.02
	1174.24–1174.33	Sandstone	QEMSCAN	91.5	0.3	0.2	4.8	1.1	1.1	0.4			0.01				0.6	0.06
	1197.76–1197.84	Sandstone	QEMSCAN	97.7	0.07	0.05	1.8	0.2	0.2	0.04							0.05	0.01
	1207.61–1207.68	Siltstone and Sandstone	MLA	33.6	0.3	3.8	44.7	15.4			0.1						0.7	0.1
	1225.70–1225.80	Sandstone	QEMSCAN	97.0	0.05	0.06	2.1	0.3	0.4	0.1						0.03	0.05	0.01
	1229.43–1229.50	Sandstone	QEMSCAN	98.0	0.06	0.06	1.2	0.2	0.2	0.06						0.02	0.2	0.03
Woleebee Creek GWB 4	1552.63–1553.00	Sandstone	QEMSCAN	98.6	0.04	0.06	0.8	0.1	0.2	0.06							0.03	0.01
	1570.46–1570.52	Sandstone and Grainstone	QEMSCAN	91.0	0.06	0.08	7.5	0.3	0.6	0.3						0.03	0.07	0.01
Median	All		n = 22	79.3	0.6	0.5	11.1	3.7	2.4	0.8	0.06	0.9	0.01	0.05	0.2	0.01	0.2	0.03
	Sandstone (including Grainstone)		n = 18	89.5	0.6	0.2	5.2	1.2	1.6	0.3	0.03	1.0	0.02	0.03	0.1	0.02	0.1	0.02
	Interbedded Siltstone/Sandstone		n = 4	33.4	0.5	1.7	37.6	15.0	6.4	3.1	0.2	0.3	0.005	0.1	0.7	0.005	0.6	0.08
Standard Deviation	All		n = 22	23.6	1.4	0.8	13.7	6.2	2.8	2.0	0.2	3.0	0.04	0.1	0.6	0.04	0.2	0.03
	Sandstone (including Grainstone)		n = 18	8.5	1.6	0.2	4.6	1.0	1.3	0.5	0.07	3.3	0.05	0.09	0.4	0.04	0.2	0.02
	Interbedded Siltstone/Sandstone		n = 4	12.4	0.4	1.3	8.5	7.0	3.9	3.9	0.3	0.6	0.005	0.2	1.2	0.005	0.1	0.02

* MLA is like QEMSCAN in principle. Sample analyses were obtained at different times and for different research projects that utilized whichever was available.

Appendix B

Appendix B.1. Element Concentration Data

Table A4. Elements Al–Ni assayed concentrations within sampled rock core intervals (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	5785	4.4	33	<DL	0.01	743	15	8.2	0.24	13	41,020	1.7	0.43	0.98	<DL	2.3	225	1634	0.82	355	<DL
	1218.02–1218.10	89,778	15	239	1.6	0.36	383	15	74	9.9	22	14,208	26	2.2	6.6	12,036	42	1384	272	1.7	690	28
Tipton 153	1032.35–1032.48	9319	2.6	28	0.05	0.02	295	1.8	3.9	0.23	19	628	2.0	0.17	0.70	<DL	3.8	93	6.8	0.15	165	9.3
	1033.88–1034.00	58,865	7.0	122	0.58	0.20	266	6.5	40	4.3	9.5	8289	15	1.1	4.9	7588	16	843	63	0.51	658	16
	1066.00–1066.24	134,380	4.9	306	2.6	0.72	718	11	93	19	41	6631	39	2.7	7.4	17,652	86	1906	24	0.77	920	38
	1067.92–1068.00	29,765	1.3	71	0.26	0.09	323	2.5	16	1.5	6.7	42,326	9.1	0.77	2.6	3160	18	1171	909	0.15	366	25
	1093.00–1093.19	8490	0.39	29	<DL	0.01	206	0.73	3.1	0.19	16	472	1.9	0.22	0.78	<DL	2.2	102	7.3	0.20	<DL	<DL
	2263.61–2263.77	24,639	3.1	175	0.32	0.04	<DL	4.7	10	1.4	7.9	1264	4.8	0.38	1.9	15,204	6.6	214	13	0.22	529	6.1
West Moonie 1	2267.05–2267.23	33,269	4.6	214	0.56	0.12	344	5.7	12	2.1	7.5	20,424	6.3	0.74	1.6	21,778	8.2	912	652	<DL	332	9.0
	2267.71–2267.84	108,726	5.0	390	6.5	1.0	394	40	56	16	20	5360	30	2.6	6.0	19,036	84	1467	26	3.4	1113	81
	2274.10–2274.18	20,660	4.1	174	0.45	0.12	<DL	4.6	11	1.6	9.1	3207	4.4	0.49	1.0	11,785	7.4	180	81	0.50	397	7.8
	2281.82–2281.92	55,756	3.8	245	1.8	0.21	84	13	52	4.5	15	2479	15	1.5	4.9	15,560	20	680	10	0.81	686	21
	2284.13–2284.24	24,003	2.9	46	0.38	0.12	<DL	6.9	10	0.66	18	665	4.9	0.32	0.92	2158	8.4	162	5.3	0.59	191	11
	2288.49–2288.61	19,603	0.88	38	0.36	0.07	<DL	1.9	12	0.75	7.2	556	5.2	0.31	1.0	1995	7.5	209	5.2	0.13	<DL	6.9
	2294.83–2294.98	6500	0.93	47	0.19	0.06	<DL	1.3	5.8	0.34	6.2	<DL	2.6	0.57	1.6	2404	2.9	93	4.9	<DL	<DL	3.7
	2297.19–2297.37	146,610	14	369	8.9	0.73	281	38	113	27	44	7342	38	2.4	6.7	23,696	109	2110	23	2.8	924	78
	2298.73–2298.82	12,244	0.97	50	0.34	0.07	<DL	2.6	7.9	0.49	5.1	<DL	2.6	0.25	1.6	2542	4.0	115	3.9	<DL	<DL	3.2
	2303.99–2304.14	5709	0.59	36	0.16	0.05	<DL	1.2	2.9	0.31	12	3061	1.9	0.33	0.98	<DL	3.0	177	179	<DL	<DL	4.4
	2311.19–2311.25	5455	0.77	48	0.23	<DL	<DL	1.2	2.6	0.31	6.5	1229	1.7	0.32	1.2	<DL	2.9	77	61	<DL	<DL	2.2
	2314.05–2314.17	1878	1.2	41	0.17	<DL	251	6.9	1.8	0.26	21	<DL	0.93	0.14	0.63	<DL	2.2	44	7.5	<DL	<DL	4.8
	2319.26–2319.37	2526	0.34	40	0.15	<DL	<DL	1.2	1.9	0.30	13	<DL	1.1	0.20	0.84	<DL	2.7	61	9.5	<DL	<DL	3.9
	2322.61–2322.73	6283	0.47	57	0.11	0.06	<DL	0.76	8.2	0.46	14	613	2.0	0.23	1.9	1288	2.7	102	10	<DL	165	2.3
	2323.76–2323.95	13,302	0.49	62	0.23	0.07	<DL	0.87	7.4	0.38	4.2	1008	2.5	0.31	1.4	3436	3.6	112	15	<DL	<DL	2.8
	2325.88–2326.00	13,843	0.99	72	0.30	0.30	<DL	1.3	15	0.52	5.0	<DL	5.2	1.1	6.8	1753	4.9	124	19	0.99	<DL	2.8
	2328.54–2328.59	139,044	4.0	390	6.0	0.58	298	22	96	23	43	7017	41	2.9	11	18,034	84	1946	20	0.77	1073	43
	2330.41–2330.55	7717	0.41	66	0.17	0.06	180	0.98	4.3	0.38	19	403	1.8	0.20	0.97	<DL	3.2	51	2.8	<DL	234	1.8
	2333.23–2333.30	3453	0.41	57	0.17	<DL	<DL	0.68	5.9	0.31	5.3	<DL	0.78	0.14	0.42	<DL	3.1	56	2.1	<DL	<DL	1.3
	2338.75–2338.85	14,094	0.70	52	0.32	0.08	<DL	1.5	9.7	0.52	11	527	3.7	0.49	1.0	1521	5.1	147	3.2	0.10	192	3.1

Table A4. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Wandoan 1	1165.57–1165.65	9274	<DL	35	<DL	<DL	205	3.7	3.8	0.23	21	368	2.5	0.18	1.5	3319	<DL	<DL	5.4	0.27	717	4.4
	1174.24–1174.33	12,717	<DL	40	<DL	<DL	69	2.9	12	0.32	13	532	3.9	0.54	3.5	4583	<DL	150	3.3	0.42	1102	6.6
	1197.76–1197.84	7715	<DL	51	<DL	<DL	98	5.3	3.8	0.15	24	415	1.9	0.17	0.85	6243	<DL	213	11	0.54	936	7.8
	1207.61–1207.68	131,104	13	332	1.8	0.40	567	42	111	15	36	6519	36	3.2	7.4	13,992	71	1900	27	3.1	963	87
	1225.70–1225.80	5570	<DL	23	<DL	<DL	104	2.1	4.0	0.11	16	419	1.4	0.19	0.84	1975	<DL	<DL	8.9	0.39	636	5.4
	1229.43–1229.50	4963	<DL	19	<DL	<DL	1074	1.9	2.1	0.14	22	661	1.3	0.17	0.61	2930	<DL	<DL	5.0	0.22	773	3.4
Woleebee Creek GWB 4	1552.63–1553.00	2752	0.15	33	<DL	0.02	140	2.5	2.4	0.14	21	244	1.1	0.09	0.74	<DL	2.3	25	3.2	<DL	296	<DL
	1570.46–1570.52	15,602	2.0	33	<DL	0.09	144	3.9	9.2	0.27	9.3	548	4.0	0.41	1.2	<DL	5.2	71	4.7	0.21	301	<DL
Median	All (n = 36)	13,009	1.0	52	0.23	0.06	122	2.7	8.7	0.42	13	644	3.2	0.35	1.3	2473	3.9	148	10	0.21	316	5.1
	Sandstones (n = 30)	9296	0.82	48	0.17	0.05	77	2.3	7.6	0.33	12	552	2.5	0.32	1.0	1985	3.2	114	8.2	0.15	213	4.1
	Interbedded (n = 6)	132,742	9.2	350	4.3	0.6	389	30	95	18	38	6824	37	2.7	7.0	17,843	84	1903	25	2.3	943	60
Standard Deviation	All (n = 36)	43,728	3.9	115	2.0	0.24	248	11	33	7.0	11	9902	12	0.90	2.6	7239	29	650	315	0.85	379	23
	Sandstones (n = 30)	13,911	1.7	57	0.34	0.07	235	3.3	11	1.1	5.9	10,675	3.5	0.32	1.5	5369	4.9	285	342	0.28	314	5.7
	Interbedded (n = 6)	19,557	4.8	54	2.7	0.23	155	13	20	5.5	10	2911	5.3	0.31	1.6	3723	20	265	92	1.1	136	24

Table A5. Elements P–Zr assayed concentrations, plus adsorbed water and LOI of sampled rock core intervals (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr	H ₂ O	LOI
Chinchilla 4	1215.47–1215.59	25	4.2	2.5	26	645	0.25	1.1	423,339	2.5	13	2.2	822	0.07	0.59	8.6	3.4	24	32	3135	18,326
	1218.02–1218.10	151	25	73	229	806	0.75	14	328,350	4.6	84	20	6235	0.48	4.4	98	29	130	226	4611	71,455
Tipton 153	1032.35–1032.48	80	4.9	3.2	20	50	0.17	0.76	451,433	4.0	14	1.9	574	0.06	0.46	5.3	2.5	5.0	23	1248	7485
	1033.88–1034.00	91	15	39	125	305	0.41	6.9	379,421	2.9	49	11	4008	0.28	2.5	49	16	68	157	3908	46,151
	1066.00–1066.24	163	48	124	309	429	0.87	21	282,306	6.4	72	29	7118	0.81	7.3	145	33	108	245	7826	86,047
	1067.92–1068.00	47	9.9	17	71	<DL	0.12	9.0	388,006	1.6	21	6.8	1940	0.10	1.4	40	8.9	30	91	1329	41,965
	1093.00–1093.19	54	3.2	2.5	25	<DL	0.12	0.67	454,053	2.8	11	1.8	382	0.01	0.40	5.7	2.8	6.1	24	1775	9425
	2263.61–2263.77	132	9.1	49	26	192	0.38	2.0	432,686	2.6	22	2.4	846	0.29	0.73	10	6.7	15	60	1882	10,824
West Moonie 1	2267.05–2267.23	<DL	15	64	51	217	0.58	3.5	397,813	3.3	35	3.9	1299	0.45	1.0	18	7.7	45	48	2036	24,781
	2267.71–2267.84	184	34	117	199	510	0.73	16	300,851	7.2	63	19	5968	0.70	4.7	112	34	108	203	13,029	93,145
	2274.10–2274.18	123	10	54	27	1257	0.45	1.3	430,308	2.3	28	2.4	503	0.38	0.63	12	5.9	20	29	<DL	12,097
	2281.82–2281.92	232	15	75	143	336	0.61	8.3	384,448	3.6	53	9.2	3683	0.49	2.6	64	34	54	170	2713	33,721
	2284.13–2284.24	127	7.8	10	30	89	0.45	1.6	450,279	3.5	23	1.9	923	0.10	0.54	14	6.1	21	25	1783	16,488
	2288.49–2288.61	111	7.7	11	32	81	0.22	1.8	404,376	2.0	14	3.0	736	0.07	0.81	12	4.5	9.5	33	1422	16,121
	2294.83–2294.98	<DL	5.4	4.4	74	119	0.16	1.2	468,513	2.4	21	7.9	1800	0.05	0.85	7.5	6.4	13	54	2640	6404
	2297.19–2297.37	495	47	138	337	1020	2.4	22	267,978	6.8	121	29	7971	0.93	6.9	152	28	318	235	7911	124,443
	2298.73–2298.82	<DL	6.1	6.5	29	111	0.17	1.3	445,707	1.8	14	2.8	1574	0.07	0.76	8.8	3.5	17	55	1966	8755

Table A5. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr	H ₂ O	LOI
West Moonie 1	2303.99–2304.14	<DL	3.8	3.1	38	60	0.10	1.1	452,839	3.3	10	3.4	322	0.03	0.45	4.6	2.4	8.7	30	1196	8425
	2311.19–2311.25	<DL	4.3	2.8	37	<DL	0.10	0.87	441,524	1.8	12	4.5	392	<DL	0.57	3.8	2.5	10	39	1269	7175
	2314.05–2314.17	<DL	3.6	1.8	18	135	0.12	0.34	456,999	4.9	8.9	1.1	170	<DL	0.35	2.2	1.6	11	19	1228	4404
	2319.26–2319.37	<DL	3.7	2.3	25	<DL	<DL	0.45	486,254	1.2	9.1	2.0	156	0.06	0.36	2.0	2.0	11	20	940	4072
	2322.61–2322.73	<DL	3.9	4.4	28	<DL	0.12	1.2	438,658	3.0	13	2.6	789	0.03	0.68	6.0	3.9	6.5	63	1493	5473
	2323.76–2323.95	<DL	5.4	5.0	35	86	0.15	1.3	475,340	1.7	16	3.4	2182	0.06	0.74	8.4	2.7	13	40	2049	8803
	2325.88–2326.00	<DL	42	6.1	153	66	0.21	3.2	469,270	4.2	21	19	3080	0.05	2.3	15	10	20	243	983	10,172
	2328.54–2328.59	430	32	135	290	374	0.80	19	277,078	7.5	130	35	8528	0.74	7.1	112	35	29	382	5501	87,459
	2330.41–2330.55	84	5.1	3.9	21	48	0.13	0.95	435,519	3.9	9.9	2.0	626	0.03	0.53	6.1	2.7	6.5	31	900	6751
	2333.23–2333.30	<DL	2.0	2.0	14	<DL	0.11	0.42	482,148	1.8	8.2	1.2	612	<DL	0.36	2.8	1.2	11	13	1913	5597
	2338.75–2338.85	37	5.4	6.6	42	31	0.19	1.5	439,557	2.2	17	2.8	1113	0.07	0.56	12	3.9	8.6	33	<DL	8929
	1165.57–1165.65	<DL	7.3	4.4	27	1877	0.20	1.0	431,683	4.0	12	2.1	607	0.05	0.54	5.7	3.5	14	48	2334	12,723
	1174.24–1174.33	<DL	8.7	7.3	65	2095	0.24	2.3	421,080	3.3	19	7.0	2521	0.06	1.2	14	7.2	27	128	2454	13,937
	1197.76–1197.84	<DL	6.1	2.5	25	3104	0.21	0.64	424,087	5.1	11	2.4	371	0.05	0.51	5.3	2.4	15	28	1577	13,961
	1207.61–1207.68	846	41	100	361	970	1.3	19	270,009	6.6	131	29	7810	0.74	6.1	153	31	211	257	8425	120,904
	1225.70–1225.80	<DL	4.1	1.9	25	769	1.3	0.74	442,271	3.0	11	2.1	732	0.05	0.49	4.7	4.2	15	31	677	7418
	1229.43–1229.50	<DL	3.4	1.4	25	1480	0.17	0.42	455,836	3.4	9.2	1.9	353	0.05	1.1	3.4	2.0	8.7	20	241	7814
Woleebee Creek GWB 4	1552.63–1553.00	31	2.7	1.3	15	251	0.18	0.47	462,756	3.4	7.0	1.3	218	0.01	0.38	3.6	2.1	5.2	24	350	2842
	1570.46–1570.52	58	7.5	3.1	49	434	0.20	1.7	444,834	2.6	18	4.1	627	0.05	0.63	17	4.1	24	35	231	11,332
Median	All (n = 36)	34	6.7	5.5	33	205	0.20	1.3	437,088	3.3	16	2.9	834	0.06	0.70	10	4.1	15	40	1779	11,078
	Sandstones (n = 30)	<DL	5.4	4.4	28	115	0.18	1.2	441,897	3.0	14	2.5	734	0.06	0.61	7.9	3.7	14	33	1458	9177
	Interbedded (n = 6)	307	38	120	300	658	0.83	19	279,692	6.7	102	29	7464	0.74	6.5	129	32	119	240	7868	90,302
Standard Deviation	All (n = 36)	170	13	43	99	691	0.47	6.6	62,193	1.6	34	9.4	2498	0.27	2.1	46	11	63	92	2741	33,687

Table A6. Step 1: pH 7 extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	<DL	0.003	2		<DL	74	0.07	<DL	0.03	<DL	<DL	<DL	<DL	<DL		0.2	39	5	<DL	<DL	
	1218.02–1218.10	<DL	0.006	6	0.0004	<DL	136	0.05	<DL	0.2	<DL	<DL	<DL	<DL	<DL	<DL	0.2	70	3	<DL	<DL	0.1
Tipton 153	1032.35–1032.48	<DL	0.004	0.8	<DL	<DL	45	0.006	<DL	0.02	<DL	<DL	0.002	<DL	<DL		<DL	7	<DL	0.004	<DL	<DL
	1033.88–1034.00	<DL	0.02	2	<DL	<DL	46	0.06	<DL	0.2	<DL	<DL	<DL	<DL	<DL	275	0.2	27	<DL	0.003	659	0.1
	1066.00–1066.24	<DL	0.01	4	<DL	<DL	167	0.3	<DL	0.3	<DL	<DL	<DL	<DL	<DL	198	0.4	29	<DL	0.04	332	0.3
	1067.92–1068.00	<DL	<DL	0.8	<DL	<DL	27	0.001	<DL	0.04	<DL	<DL	<DL	<DL	<DL	<DL	<DL	33	<DL	<DL	<DL	0.08
	1093.00–1093.19	<DL	0.008	5		<DL	53	0.002	<DL	0.01	<DL	<DL	<DL	<DL	<DL		<DL	11	<DL	0.002		

Table A6. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2263.61–2263.77	<DL	0.01	2	<DL	<DL		1	<DL	0.02	0.8	<DL	0.0005	0.0004	<DL	193	0.03	4	1	0.005	63	2
	2267.05–2267.23	<DL	<DL	2	<DL	<DL	19	0.5	<DL	0.03	0.2	<DL	<DL	<DL	<DL	285	<DL	8	<DL		<DL	0.7
	2267.71–2267.84	<DL	0.02	11	<DL	<DL	120	2	<DL	0.3	<DL	<DL	<DL	0.004	0.001	345	0.6	19	<DL	0.4	679	4
	2274.10–2274.18	<DL	0.01	2	0.002	<DL		1	<DL	0.02	0.8	<DL	0.0004	0.0005	<DL	152	0.03	4	3	0.002	<DL	2
	2281.82–2281.92	<DL	0.02	7	0.002	<DL	47	2	0.0008	0.1	0.05	<DL	0.0005	0.001	<DL	139	0.1	7	<DL	0.1	158	2
	2284.13–2284.24	<DL	0.04	3	0.0008	<DL		0.8	<DL	0.02	0.1	<DL	0.0006	0.0006	<DL	169	0.06	2	<DL	0.04	61	0.8
	2288.49–2288.61	<DL	0.01	2	<DL	<DL		0.2	<DL	0.02	0.4	<DL	0.0006	0.0004	<DL	167	0.04	0.9	<DL	0.01		0.6
	2294.83–2294.98	20	0.05	0.9	<DL	<DL		0.2	0.05	0.02	1		0.01	<DL	<DL	821	<DL	5	<DL			0.3
	2297.19–2297.37	<DL	0.06	7	<DL	<DL	123	5	0.01	0.4	0.02	<DL	0.002	0.005	<DL	487	3	28	<DL	0.2	493	5
	2298.73–2298.82	17	0.04	0.8	<DL	<DL		0.2	0.02	0.02	0.4		0.007	<DL	<DL	411	<DL	3	<DL			0.1
	2303.99–2304.14	8	<DL	1	0.0002	<DL		0.09	0.006	0.02	2	<DL	0.001	<DL	<DL		<DL	4	<DL			0.3
	2311.19–2311.25	4	0.03	1	<DL			0.1	<DL	0.02	0.8	<DL	0.001	<DL	<DL		<DL	4	<DL			0.1
	2314.05–2314.17	3	0.07	1	<DL		53	0.4	0.007	0.01	4		<DL	<DL	<DL		<DL	4	<DL			0.3
	2319.26–2319.37	<DL	0.02	2	<DL			0.06	<DL	0.01	1		0.0003	<DL	<DL		<DL	3	<DL			0.1
	2322.61–2322.73	<DL	0.02	3	<DL	<DL		0.2	0.02	0.01	2	<DL	0.004	0.001	<DL	417	0.03	3	0.3		106	0.1
	2323.76–2323.95	26	0.03	1	<DL	<DL		0.07	0.04	0.02	0.4	<DL	0.009	<DL	<DL	678	<DL	5	<DL			0.2
	2325.88–2326.00	13	0.02	2	<DL	<DL		0.2	0.03	0.02	0.3		0.005	<DL	<DL	286	<DL	3	<DL	0.2		0.2
	2328.54–2328.59	<DL	0.04	11	0.001	<DL	99	0.1	<DL	0.3	0.04	<DL	0.001	0.002	<DL	270	0.4	22	<DL	0.07	375	0.4
	2330.41–2330.55	<DL	0.02	3	<DL	<DL	16	0.2	0.004	0.007	4	<DL	0.002	0.0005	<DL		0.02	1	<DL		48	0.1
	2333.23–2333.30	11	0.02	2	<DL			0.07	0.02	0.01	2		0.005	<DL	<DL		<DL	5	<DL			0.1
	2338.75–2338.85	<DL	0.005	3	0.0008	<DL		0.1	0.0002	0.02	1	<DL	0.0006	0.001	<DL	207	0.04	2	<DL	0.02	79	0.09
West Wandoan 1	1165.57–1165.65	<DL		1			12	0.8	<DL	0.02	0.9	<DL	0.002	<DL	<DL	2226			<DL	0.05	581	0.5
	1174.24–1174.33	<DL		0.9			15	0.08	<DL	0.03	0.09	<DL	0.002	<DL	<DL	2811		13	<DL	0.07	641	0.2
	1197.76–1197.84	<DL		0.5			44	0.8	<DL	0.01	1	<DL	0.002	<DL	<DL	4978		13	<DL	0.2	732	0.6
	1207.61–1207.68	<DL	0.01	4	<DL	<DL	201	17	<DL	0.2	<DL	<DL	<DL	<DL	<DL	157	0.3	72	3	0.05	351	18
	1225.70–1225.80	<DL		0.5			6	0.2	<DL	0.007	2	<DL	0.002	<DL	<DL	1236			<DL	0.1	323	0.4
	1229.43–1229.50	4		0.4			20	0.2	0.008	0.007	3	<DL	0.003	<DL	0.001	2018			<DL	0.05	439	0.5
Woleebec Creek GWB 4	1552.63–1553.00	<DL	0.009	3		<DL	10	0.2	<DL	0.01	0.2	<DL	0.003	<DL	<DL		<DL	4	<DL		291	
	1570.46–1570.52	<DL	0.02	3		<DL	9	0.8	<DL	0.01	0.08	<DL	0.002	<DL	<DL		<DL	3	<DL	0.04	<DL	
Median	All (n = 36)	<DL	0.01	2	<DL	<DL	13	0.2	<DL	0.02	0.3	<DL	0.001	<DL	<DL	181	<DL	4	<DL	0.003	24	0.2
	Sandstones (n = 30)	<DL	0.01	2	<DL	<DL	8	0.2	<DL	0.02	0.6	<DL	0.002	<DL	<DL	168	<DL	4	<DL	0.002	<DL	0.2
	Interbedded (n = 6)	<DL	0.01	7	<DL	<DL	130	1	<DL	0.3	<DL	<DL	<DL	0.001	<DL	234	0.4	29	<DL	0.06	363	2
Standard Deviation	All (n = 36)	6	0.02	3	0.0005	<DL	52	3	0.01	0.1	1	<DL	0.002	0.001	0.0003	995	0.4	17	1	0.08	241	3
	Sandstones (n = 30)	7	0.02	1	0.0005	<DL	21	0.4	0.01	0.04	1	<DL	0.003	0.0004	0.0002	1080	0.05	9	1	0.05	229	0.6
	Interbedded (n = 6)	<DL	0.02	3	0.0004	<DL	33	6	0.004	0.06	0.01	<DL	0.0007	0.002	0.0004	152	0.8	22	1	0.1	204	6

Shading indicates element was below detection limit in given rock samples.

Table A7. Step 1: pH 7 extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.001	0.3	<DL	137	<DL	<DL	<DL	<DL	2	<DL	<DL	0.02	<DL	<DL	<DL	0.05	<DL
	1218.02–1218.10	<DL	0.002	0.7	0.001	219	<DL	<DL	<DL	0.006	5	<DL	<DL	0.03	<DL	<DL	<DL	0.3	<DL
Tipton 153	1032.35–1032.48	<DL	0.004	0.2	0.002	<DL	0.009	<DL	<DL	<DL	2	<DL	<DL	0.007	<DL	0.006	<DL	<DL	<DL
	1033.88–1034.00	<DL	0.002	1	<DL	27	0.003	<DL	<DL	<DL	3	<DL	<DL	0.02	<DL	0.003	<DL	0.3	<DL
	1066.00–1066.24	<DL	0.01	2	0.0007	47	0.01	<DL	<DL	<DL	7	<DL	<DL	0.03	<DL	0.02	<DL	0.4	<DL
	1067.92–1068.00	<DL	<DL	0.2	<DL		<DL	<DL	<DL	<DL	0.8	<DL	<DL	0.003	<DL	<DL	<DL	<DL	<DL
	1093.00–1093.19	<DL	0.001	0.2	0.0009		0.001	<DL	<DL	<DL	2	<DL	<DL	0.003	<DL	0.006	<DL	0.02	<DL
	2263.61–2263.77	<DL	0.06	0.2	0.001	44	0.005	0.0008	<DL	<DL	0.7	<DL	<DL	0.02	<DL	0.0003	0.0001	3	<DL
West Moonie 1	2267.05–2267.23		<DL	0.2	<DL	31	0.008	<DL	<DL	<DL	0.7	<DL	<DL	0.02	<DL	<DL	0.0004	2	0.004
	2267.71–2267.84	<DL	<DL	2	0.003	<DL	0.02	<DL	<DL	<DL	12	0.0002	<DL	0.02	<DL	0.01	0.0001	<DL	0.0004
	2274.10–2274.18	<DL	0.02	0.1	0.0008	42	0.01	0.0008	<DL	<DL	0.5	<DL	<DL	0.01	<DL	<DL	<DL	3	<DL
	2281.82–2281.92	<DL	0.01	0.6	0.002	46	0.02	0.002	15	<DL	4	<DL	<DL	0.02	<DL	0.004	<DL	3	<DL
	2284.13–2284.24	<DL	0.1	0.1	0.001	10	0.02	0.001	8	<DL	0.6	<DL	<DL	0.01	<DL	0.004	<DL	2	<DL
	2288.49–2288.61	<DL	0.08	0.1	0.0006	7	0.008	0.0008	<DL	<DL	0.4	<DL	<DL	0.003	<DL	0.003	<DL	0.6	<DL
	2294.83–2294.98		0.09	0.2	0.1	<DL	0.01	<DL	<DL	0.03	1	0.02	<DL	0.0003	0.01	0.08	0.006	0.2	0.03
	2297.19–2297.37	<DL	0.006	3	0.0005	145	0.09	<DL	<DL	<DL	8	<DL	<DL	0.06	0.0007	0.02	0.02	3	<DL
	2298.73–2298.82		0.07	0.09	0.05	<DL	0.007	<DL	<DL	<DL	0.5	0.007	<DL	0.0007	0.004	0.06	0.004	0.4	0.02
	2303.99–2304.14		0.02	0.07	0.02	<DL	<DL	<DL	<DL	0.01	0.7	0.003	<DL	<DL	0.0007	0.01	0.002	0.3	0.009
	2311.19–2311.25		0.02	0.09	0.02		<DL	<DL	<DL	<DL	0.7	<DL	<DL		0.001	0.02	0.001	0.2	0.007
	2314.05–2314.17		0.03	0.08	0.01	<DL	0.006	<DL	<DL	0.01	0.7	<DL	<DL		0.0007	0.01	0.0008	2	0.01
	2319.26–2319.37		0.005	0.05	0.005			<DL	<DL	<DL	0.6	<DL	<DL	<DL	0.0004	0.008	<DL	0.7	<DL
	2322.61–2322.73		0.05	0.1	0.07		0.005	0.004	15	0.02	0.9	0.009	0.8	0.001	0.002	0.03	0.004	0.4	0.03
	2323.76–2323.95		0.06	0.1	0.05	<DL	0.006	<DL	<DL	0.01	0.8	0.008	<DL	<DL	0.003	0.09	0.005	0.6	0.05
	2325.88–2326.00		0.2	0.09	0.04	<DL	0.02	<DL	<DL	0.02	0.5	0.01	<DL	0.005	0.002	0.07	0.003	0.6	0.03
	2328.54–2328.59	<DL	0.0007	2	0.003	22	0.06	0.007	45	<DL	8	<DL	<DL	0.02	<DL	0.02	0.0001	<DL	<DL
	2330.41–2330.55	<DL	0.04	0.06	0.02	5	0.004	0.002	8	0.007	0.4	0.002	<DL	0.001	0.0006	0.02	0.001	0.2	0.01
	2333.23–2333.30		0.05	0.1	0.03		<DL	<DL	<DL	0.02	0.9	0.005	<DL		0.002	0.05	0.002	0.5	0.02
	2338.75–2338.85	<DL	0.009	0.1	0.001	8	0.007	0.001	<DL	<DL	0.4	<DL	<DL	0.004	<DL	0.006	<DL	2	<DL
West Wandoan 1	1165.57–1165.65		0.02	0.5	0.02	1262	0.008	<DL	<DL	0.002	0.6	<DL	<DL	0.008	0.0006	0.02	<DL	0.5	<DL
	1174.24–1174.33		0.009	1	0.05	1780	0.007	<DL	<DL	<DL	0.9	<DL	<DL	0.006	0.003	0.03	0.002	0.05	<DL
	1197.76–1197.84		0.001	0.7	0.001	2746	0.02	<DL	<DL	<DL	1	<DL	<DL	0.02	<DL	0.01	<DL	0.7	0.001
	1207.61–1207.68	<DL	<DL	1	0.0008	260	0.01	<DL	<DL	<DL	7	<DL	<DL	0.07	<DL	0.01	<DL	17	<DL
	1225.70–1225.80		0.001	0.2	<DL	763	0.2	<DL	<DL	<DL	0.6	<DL	<DL	0.02	<DL	0.01	<DL	0.3	<DL
	1229.43–1229.50		0.02	0.3	0.05	1342	0.02	<DL	<DL	0.009	0.5	0.005	<DL	0.01	0.001	0.02	0.002	0.3	0.01

Table A7. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Woleebee Creek GWB 4	1552.63–1553.00	<DL	0.002	0.1	<DL	55	0.01	0.002	<DL	0.003	0.9	<DL	<DL	0.003	<DL	0.04	<DL	0.2	<DL
	1570.46–1570.52	<DL	0.003	0.09	<DL	111	0.009	<DL	<DL	<DL	0.6	<DL	<DL	0.009	<DL	0.01	<DL	3	<DL
Median	All (n = 36)	<DL	0.01	0.2	0.001	16	0.008	<DL	<DL	<DL	0.8	<DL	<DL	0.007	<DL	0.01	<DL	0.4	<DL
	Sandstones (n = 30)	<DL	0.02	0.1	0.002	8	0.007	<DL	<DL	<DL	0.7	<DL	<DL	0.004	<DL	0.01	<DL	0.4	<DL
	Interbedded (n = 6)	<DL	0.001	2	0.0009	96	0.01	<DL	<DL	<DL	8	<DL	<DL	0.03	<DL	0.01	0.00005	0.4	<DL
Standard Deviation	All (n = 36)	<DL	0.05	0.7	0.03	591	0.03	0.001	8	0.007	3	0.004	0.1	0.02	0.002	0.02	0.003	3	0.01
	Sandstones (n = 30)	<DL	0.05	0.3	0.03	642	0.03	0.001	4	0.008	0.8	0.004	0.1	0.007	0.002	0.02	0.002	1	0.01
	Interbedded (n = 6)	<DL	0.004	0.7	0.001	99	0.03	0.002	17	0.002	2	0.00006	<DL	0.02	0.0003	0.006	0.007	6	0.0002

Shading indicates element was below detection limit in given rock samples.

Table A8. Step 2: pH 5 extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	346	0.04	6		<DL	48	1	1	0.009	4	756	0.02	0.02	<DL		<DL	15	58	0.001	<DL	
	1218.02–1218.10	55	0.2	6	0.07	0.04	62	0.3	0.1	0.3	2	15	0.01	0.004	0.001	<DL	<DL	24	6	0.002	<DL	0.6
Tipton 153	1032.35–1032.48	552	0.9	3	0.007	0.001	49	0.6	0.2	0.004	6	74	0.03	0.002	<DL		0.1	9	<DL	0.01	<DL	0.9
	1033.88–1034.00	564	1	7	0.08	0.05	39	0.9	0.7	0.2	2	50	0.03	0.007	<DL	<DL	0.4	17	<DL	0.009	<DL	1
	1066.00–1066.24	314	0.6	9	0.2	0.2	190	3	0.2	0.6	12	18	0.02	0.002	0.0006	<DL	0.8	26	<DL	0.03	<DL	3
	1067.92–1068.00	85	0.02	0.7	0.01	0.01	19	0.04	0.07	0.01	0.6	174	0.007	0.002	0.0007	<DL	<DL	24	12	0.0002	<DL	1
	1093.00–1093.19	1195	0.2	3		0.002	9	0.2	0.2	0.004	7	55	0.06	0.005	0.002		<DL	7	<DL	0.07		
West Moonie 1	2263.61–2263.77	15	0.8	1	0.02	0.01		0.7	0.02	0.005	4	29	0.006	0.003	<DL	<DL	0.02	<DL	<DL	<DL	<DL	1
	2267.05–2267.23	16	0.9	1	0.03	0.03	28	0.7	0.02	0.01	2	1139	0.004	0.005	<DL	<DL	<DL	29	30		<DL	1
	2267.71–2267.84	331	0.6	21	0.7	0.4	87	15	0.2	0.2	3	46	0.01	0.005	<DL	<DL	0.1	5	<DL	0.05	<DL	30
	2274.10–2274.18	15	0.9	1	0.02	0.06		0.5	0.02	0.005	4	57	0.006	0.002	<DL	<DL	0.003	<DL	<DL	<DL	<DL	0.8
	2281.82–2281.92	36	1	5	0.2	0.1	23	4	0.05	0.06	3	15	0.005	0.003	<DL	<DL	0.1	3	<DL	0.05	<DL	7
	2284.13–2284.24	21	1	1	0.04	0.03		1	0.02	0.005	2	7	0.003	0.002	<DL	<DL	0.03	<DL	<DL	0.05	<DL	3
	2288.49–2288.61	14	0.4	0.5	0.03	0.03		0.6	0.02	0.004	4	4	0.002	0.002	<DL	<DL	0.02	<DL	<DL	<DL		2
	2294.83–2294.98	10	0.1	0.4	0.01	0.01		0.3	0.01	<DL	2		0.002	<DL	<DL	<DL	<DL	<DL				0.6
	2297.19–2297.37	100	1	24	0.4	0.05	<DL	8	0.05	0.9	4	22	0.005	0.004	<DL	<DL	0.6	2	<DL	0.1	<DL	11
	2298.73–2298.82	10	0.2	0.5	0.008	0.01		0.4	0.01	0.01	2		0.003	<DL	<DL	<DL	<DL	<DL				0.5
	2303.99–2304.14	9	0.1	0.5	<DL	0.01		0.6	0.04	0.01	7	975	0.002	0.005	<DL		<DL	21	38			1
	2311.19–2311.25	9	0.07	0.2	0.003			0.1	0.01	<DL	1	339	0.0009	<DL	<DL		<DL	7	12			0.3
	2314.05–2314.17	10	0.3	0.7	0.003		<DL	1	0.02	<DL	11		0.002	<DL	<DL		<DL	1	<DL			1
	2319.26–2319.37	10	0.06	1	0.006			0.5	0.02	<DL	7		0.002	<DL	<DL		<DL	2	<DL			0.8
	2322.61–2322.73	8	0.06	2	0.008	0.01		0.1	0.03	0.002	8	47	0.003	0.003	<DL	<DL	0.02	2	<DL		<DL	0.2

Table A8. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2323.76–2323.95	9	0.09	0.6	0.009	0.01		0.2	0.02	0.01	2	85	0.002	<DL	<DL	<DL	<DL	2	<DL			0.5
	2325.88–2326.00	12	0.06	1	0.02	0.1		0.4	0.02	0.01	2		0.003	0.004	<DL	<DL	<DL	3	3	0.2		0.5
	2328.54–2328.59	185	0.5	29	0.6	0.3	108	5	0.2	0.8	11	33	0.01	0.007	<DL	<DL	1	22	<DL	0.007	<DL	9
	2330.41–2330.55	8	0.07	1	0.008	0.009	5	0.2	0.01	0.002	13	<DL	0.002	0.002	<DL		0.01	<DL	<DL		<DL	0.3
	2333.23–2333.30	11	0.03	0.5	0.002			0.2	<DL	<DL	3		0.002	<DL	<DL		<DL	<DL	<DL			0.3
	2338.75–2338.85	14	0.1	1	0.03	0.06		0.2	0.03	0.006	7	<DL	0.004	0.004	<DL	<DL	0.03	<DL	<DL	<DL	<DL	0.3
West Wandoan 1	1165.57–1165.65	527		2			4	1	0.2	0.005	11	26	0.04	0.009	<DL	<DL			<DL	0.03	<DL	0.9
	1174.24–1174.33	667		4			6	0.9	0.5	0.01	5	27	0.08	0.02	<DL	<DL		3	<DL	0.04	<DL	1
	1197.76–1197.84	299		2			9	2	0.2	0.002	15	58	0.04	0.01	<DL	<DL		2	<DL	0.08	<DL	3
	1207.61–1207.68	124	3	9	0.2	0.1	114	12	0.2	0.4	8	80	0.03	0.008	0.0006	<DL	0.1	30	<DL	0.1	<DL	17
	1225.70–1225.80	71		1			4	0.7	0.1	<DL	9	82	0.03	0.01	<DL	<DL			<DL	0.08	<DL	1
	1229.43–1229.50	27		1			6	0.6	0.08	<DL	9	94	0.01	0.007	<DL	<DL			<DL	0.03	<DL	0.8
Woleebee Creek GWB 4	1552.63–1553.00	206	0.09	5		0.007	6	1	0.2	0.002	9	27	0.02	0.005	<DL		<DL	2	<DL		<DL	
	1570.46–1570.52	65	0.7	2		0.04	4	1	0.1	0.003	2	25	0.01	0.003	<DL		<DL	<DL	<DL	0.03	<DL	
Median	All (n = 36)	31	0.2	1	0.009	0.01	4	0.6	0.05	0.005	4	28	0.006	0.004	<DL	<DL	<DL	2	<DL	0.001	<DL	0.9
	Sandstones (n = 30)	16	0.1	1	0.007	0.01	2	0.6	0.03	0.004	4	28	0.005	0.003	<DL	<DL	<DL	2	<DL	<DL	<DL	0.8
	Interbedded (n = 6)	154	0.6	15	0.3	0.2	97	7	0.2	0.5	6	28	0.01	0.004	0.0003	<DL	0.4	23	<DL	0.04	<DL	10
Standard Deviation	All (n = 36)	255	0.5	7	0.2	0.09	41	3	0.2	0.2	4	263	0.02	0.005	0.0004	<DL	0.2	10	12	0.05	<DL	6
	Sandstones (n = 30)	275	0.4	2	0.04	0.03	14	0.7	0.2	0.03	4	285	0.02	0.005	0.0003	<DL	0.07	8	13	0.04	<DL	1
	Interbedded (n = 6)	105	0.8	9	0.2	0.1	57	5	0.07	0.3	4	22	0.007	0.002	0.0005	<DL	0.4	11	2	0.05	<DL	10

Shading indicates element was below detection limit in given rock samples.

Table A9. Step 2: pH 5 extracted concentrations of elements P–Zr (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.4	0.04	0.8	48	0.006	0.07	242	0.02	1	0.08	<DL	0.01	0.04	0.06	0.1	3	0.02
	1218.02–1218.10	<DL	3	0.3	0.4	46	0.02	0.08	<DL	0.005	2	0.05	<DL	0.02	0.08	0.03	0.09	7	0.07
Tipton 153	1032.35–1032.48	<DL	2	0.02	0.3	<DL	0.02	0.04	171	0.09	1	0.03	<DL	0.005	0.01	0.3	0.05	2	0.02
	1033.88–1034.00	<DL	5	0.3	0.5	<DL	0.02	0.1	229	0.008	2	0.08	<DL	0.02	0.06	0.4	0.08	17	0.04
	1066.00–1066.24	<DL	19	0.8	0.3	<DL	0.05	0.2	142	0.006	7	0.2	<DL	0.02	0.08	0.4	0.06	19	0.04
	1067.92–1068.00	<DL	0.9	0.02	0.05		0.002	0.1	<DL	0.008	0.3	0.01	<DL	0.0005	0.01	0.1	0.01	1	0.03
	1093.00–1093.19	<DL	0.6	0.03	0.3		0.007	0.03	209	0.1	0.4	0.03	<DL	0.0007	0.01	0.4	0.05	1	0.05
West Moonie 1	2263.61–2263.77	<DL	3	0.03	0.2	<DL	0.03	0.02	<DL	0.09	0.2	0.06	<DL	0.001	0.009	0.02	0.06	1	<DL
	2267.05–2267.23		2	0.02	0.1	<DL	0.03	0.06	<DL	0.1	0.2	0.04	<DL	<DL	0.005	0.04	0.03	3	0.009

Table A9. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2267.71–2267.84	<DL	14	<DL	0.2	<DL	<DL	0.2	142	0.004	6	0.1	<DL	<DL	0.04	0.2	0.09	7	0.03
	2274.10–2274.18	<DL	2	0.02	0.1	45	0.06	<DL	<DL	0.07	0.1	0.01	<DL	0.0002	0.007	0.02	0.04	1	<DL
	2281.82–2281.92	<DL	6	0.1	0.1	<DL	0.07	0.03	<DL	<DL	2	0.01	<DL	0.005	0.03	0.08	0.04	10	<DL
	2284.13–2284.24	<DL	5	0.02	0.05	<DL	0.04	<DL	<DL	0.02	0.2	<DL	<DL	<DL	0.008	0.03	0.01	3	<DL
	2288.49–2288.61	<DL	3	0.02	0.05	<DL	0.01	<DL	<DL	0.06	0.1	<DL	<DL	<DL	0.008	0.03	0.008	0.7	<DL
	2294.83–2294.98		2	0.01	0.06	<DL	0.01	0.04	<DL	0.2	0.1	0.004	<DL	<DL	0.01	0.04	0.008	0.2	0.004
	2297.19–2297.37	<DL	10	1	0.1	<DL	0.1	0.06	<DL	<DL	9	0.02	<DL	0.05	0.04	0.04	0.05	27	<DL
	2298.73–2298.82		2	0.007	0.04	<DL	0.006	0.05	<DL	0.2	0.08	0.002	<DL	<DL	0.009	0.04	0.007	0.8	0.005
	2303.99–2304.14		1	<DL	0.07	<DL	0.007	0.08	<DL	0.8	0.09	0.004	<DL	<DL	0.002	0.07	0.01	0.5	0.004
	2311.19–2311.25		0.8	0.009	0.03		0.001	0.04	<DL	0.1	0.08	0.002	<DL		0.004	0.02	0.003	0.07	0.002
	2314.05–2314.17		0.9	0.006	0.09	<DL	0.01	0.06	<DL	1	0.09	0.004	<DL		0.003	0.02	0.01	2	0.003
	2319.26–2319.37		0.9	<DL	0.1			0.05	<DL	0.5	0.08	0.003	<DL	<DL	0.002	0.02	0.02	1	0.003
	2322.61–2322.73		1	0.01	0.09		0.005	<DL	<DL	0.3	0.1	0.008	<DL	<DL	0.01	0.04	0.02	0.3	<DL
	2323.76–2323.95		2	0.006	0.04	<DL	0.004	0.06	<DL	0.1	0.1	0.003	<DL	<DL	0.01	0.06	0.006	0.9	0.003
	2325.88–2326.00		13	0.005	0.1	<DL	0.03	0.07	<DL	0.1	0.08	0.02	<DL	<DL	0.03	0.1	0.02	1	0.007
	2328.54–2328.59	<DL	8	1	0.2	20	0.1	0.1	180	0.01	10	0.05	<DL	0.03	0.08	0.1	0.05	2	<DL
	2330.41–2330.55	<DL	1	0.006	0.04	<DL	0.005	<DL	<DL	0.7	0.07	<DL	<DL	<DL	0.008	0.03	0.008	0.1	<DL
	2333.23–2333.30		0.6	0.003	0.03		<DL	0.02	<DL	0.2	0.05	0.002	<DL		0.003	0.02	0.008	0.09	<DL
	2338.75–2338.85	<DL	2	0.03	0.09	<DL	0.01	<DL	<DL	0.08	0.1	0.005	<DL	<DL	0.01	0.05	0.01	2	<DL
West Wandoan 1	1165.57–1165.65		2	0.03	0.7	41	0.01	0.03	154	0.1	0.2	0.07	<DL	0.002	0.02	0.2	0.06	3	0.03
	1174.24–1174.33		3	0.1	2	52	0.01	0.07	192	0.04	0.4	0.3	<DL	0.003	0.06	0.4	0.1	4	0.03
	1197.76–1197.84		3	0.04	1	23	0.03	0.02	106	0.09	0.3	0.08	<DL	0.005	0.03	0.2	0.07	4	0.03
	1207.61–1207.68	<DL	7	0.5	0.6	41	0.05	0.2	<DL	0.006	4	0.07	<DL	0.05	0.2	1	0.2	45	0.02
	1225.70–1225.80		1	<DL	0.9	<DL	0.4	0.02	<DL	0.2	0.2	0.08	<DL	0.003	0.03	0.1	0.05	4	0.01
	1229.43–1229.50		1	0.006	0.5	<DL	0.04	0.01	<DL	0.3	0.2	0.04	<DL	0.003	0.01	0.05	0.03	2	0.009
Woleebee Creek GWB 4	1552.63–1553.00	<DL	0.9	0.006	0.7	<DL	0.01	0.02	97	0.1	0.3	0.06	<DL	0.0008	0.02	0.2	0.08	2	0.01
	1570.46–1570.52	<DL	2	0.007	0.4	<DL	0.02	0.03	<DL	0.04	0.1	0.02	<DL	0.002	0.01	0.2	0.04	8	0.01
Median	All (n = 36)	<DL	2	0.02	0.1	<DL	0.01	0.04	<DL	0.09	0.2	0.02	<DL	0.0006	0.01	0.06	0.04	2	0.006
	Sandstones (n = 30)	<DL	2	0.01	0.1	<DL	0.01	0.03	<DL	0.1	0.1	0.01	<DL	0.0001	0.01	0.06	0.02	1	0.005
	Interbedded (n = 6)	<DL	9	0.7	0.3	10	0.05	0.2	71	0.006	7	0.06	<DL	0.02	0.08	0.1	0.08	13	0.03
Standard Deviation	All (n = 36)	<DL	4	0.3	0.4	17	0.07	0.06	82	0.2	3	0.05	<DL	0.01	0.03	0.2	0.04	9	0.02
	Sandstones (n = 30)	<DL	2	0.05	0.4	16	0.07	0.03	82	0.2	0.6	0.05	<DL	0.004	0.01	0.1	0.03	3	0.01
	Interbedded (n = 6)	<DL	5	0	0.1	20	0.05	0.06	78	0.003	3	0.05	<DL	0.02	0.04	0.3	0.06	15	0.02

Shading indicates element was below detection limit in given rock samples.

Table A10. Step 3: pH 3 extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	411	0.009	0.8		<DL	23	1	1	0.004	2	3130	0.04	0.05	<DL		<DL	14	140	<DL	<DL	
	1218.02–1218.10	35	0.02	0.3	0.04	0.01	<DL	0.1	0.06	0.04	0.6	45	0.01	<DL	<DL	<DL	<DL	<DL	4	<DL	<DL	0.2
Tipton 153	1032.35–1032.48	189	0.1	0.2	0.002	<DL	8	0.2	0.05	<DL	1	39	0.03	0.001	<DL		<DL	3	<DL	0.0008	<DL	0.5
	1033.88–1034.00	485	0.1	0.5	0.05	0.02	23	0.3	0.3	0.04	0.6	201	0.06	0.009	<DL	<DL	<DL	10	<DL	<DL	<DL	0.6
	1066.00–1066.24	238	0.1	1	0.2	0.07	6	1	0.1	0.06	4	25	0.03	0.004	<DL	<DL	0.3	4	<DL	<DL	<DL	2
	1067.92–1068.00	64	<DL	0.2	0.01	0.005	36	0.1	0.3	0.007	0.2	3211	0.02	0.05	<DL	<DL	<DL	73	70	<DL	<DL	1
	1093.00–1093.19	278	0.03	0.3		<DL	7	0.08	0.05	<DL	2	28	0.05	0.002	<DL		<DL	3	<DL	0.004		
West Moonie 1	2263.61–2263.77	8	0.09	0.09	<DL	<DL		0.06	0.02	<DL	0.3	30	0.003	0.001	<DL	<DL	<DL	2	<DL	<DL	<DL	0.09
	2267.05–2267.23	8	0.2	0.1	0.01	0.01	10	0.2	0.06	0.01	0.3	213	0.008	0.01	0.0008	<DL	<DL	6	6		<DL	0.4
	2267.71–2267.84	153	0.02	0.2	0.03	0.006	<DL	0.07	0.02	0.002	0.2	50	0.006	0.003	<DL	<DL	<DL	4	<DL	0.0004	<DL	0.1
	2274.10–2274.18	7	0.09	0.1	0.009	<DL		0.05	0.01	<DL	0.3	50	0.004	0.001	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.06
	2281.82–2281.92	10	0.07	0.1	0.09	<DL	<DL	0.3	0.03	0.004	0.2	<DL	0.004	0.001	<DL	<DL	0.08	<DL	<DL	0.005	<DL	0.5
	2284.13–2284.24	7	0.07	0.04	0.01	<DL		0.1	0.01	<DL	0.1	<DL	0.004	<DL	<DL	<DL	0.08	<DL	<DL	<DL	<DL	0.2
	2288.49–2288.61	5	0.03	0.03	0.009	<DL		0.05	0.01	<DL	0.2	<DL	0.002	<DL	<DL	<DL	<DL	<DL	<DL	<DL		0.2
	2294.83–2294.98	6	0.03	0.06	0.006	<DL		0.04	0.01	<DL	0.2		0.003	<DL	<DL	<DL	<DL	<DL	<DL			0.1
	2297.19–2297.37	45	0.5	4	0.4	0.05	147	3	0.1	0.07	2	<DL	0.005	0.007	<DL	<DL	0.5	24	<DL	0.003	<DL	5
	2298.73–2298.82	11	0.03	0.06	0.005	<DL		0.05	0.005	0.01	0.2		0.004	<DL	<DL	<DL	<DL	<DL	<DL			0.09
	2303.99–2304.14	4	<DL	0.04	0.006	<DL		0.04	0.1	<DL	0.3	296	0.003	0.009	<DL		<DL	7	11			0.4
	2311.19–2311.25	3	0.02	0.05	0.007			0.04	0.04	<DL	0.2	130	0.004	0.005	<DL		<DL	3	5			0.2
	2314.05–2314.17	3	0.03	0.06	0.005		6	0.2	0.01	<DL	0.4		0.002	<DL	<DL		<DL	3	<DL			0.2
	2319.26–2319.37	4	0.02	0.08	0.003			0.03	0.01	<DL	0.4		0.004	<DL	<DL		<DL	2	<DL			0.1
	2322.61–2322.73	5	0.007	0.06	<DL	<DL		0.01	0.02	<DL	0.2	23	0.003	0.001	<DL	<DL	0.06	<DL	<DL		<DL	0.04
	2323.76–2323.95	5	<DL	0.07	0.006	<DL		0.03	0.01	0.01	0.1	32	0.004	<DL	<DL	<DL	<DL	<DL	<DL			0.1
	2325.88–2326.00	7	<DL	0.09	0.006	0.02		0.04	0.03	<DL	0.2		0.004	<DL	<DL	<DL	<DL	1	<DL	<DL		0.1
	2328.54–2328.59	98	0.1	1	0.3	0.02	5	3	0.1	0.1	2	28	0.02	0.006	<DL	<DL	0.3	3	<DL	<DL	<DL	2
	2330.41–2330.55	<DL	0.007	0.04	<DL	<DL	<DL	0.02	0.007	<DL	0.3	<DL	0.002	0.0008	<DL		<DL	<DL	<DL		<DL	0.04
	2333.23–2333.30	3	<DL	0.07	0.004			0.02	0.007	<DL	0.3		0.002	<DL	<DL		<DL	<DL	<DL			0.1
	2338.75–2338.85	6	0.01	0.05	0.02	<DL		0.02	0.008	<DL	0.3	<DL	0.003	0.002	<DL	<DL	0.06	<DL	<DL	<DL	<DL	0.03
West Wandoan 1	1165.57–1165.65	391		0.2			<DL	0.2	0.4	0.008	0.2	14	0.01	0.05	<DL	<DL			<DL	<DL	<DL	2
	1174.24–1174.33	764		0.3			<DL	0.08	0.05	<DL	2	28	0.04	0.002	<DL	<DL		4	<DL	0.004	<DL	0.2
	1197.76–1197.84	257		0.9			<DL	0.3	0.5	0.02	0.3	37	0.2	0.03	<DL	<DL		2	<DL	0.001	<DL	0.6
	1207.61–1207.68	160	0.003	0.2	0.02	<DL	<DL	0.5	0.2	0.003	0.4	101	0.01	0.07	<DL	<DL	<DL	3	<DL	<DL	<DL	1
	1225.70–1225.80	74		0.2			<DL	0.2	0.05	<DL	1	23	0.03	0.002	<DL	<DL			<DL	0.0008	<DL	0.5
	1229.43–1229.50	33		0.5			<DL	0.3	0.3	0.04	0.5	20	0.06	0.008	<DL	<DL			<DL	<DL	<DL	0.6

Table A10. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Woleebee Creek GWB 4	1552.63–1553.00	115	0.01	0.2		<DL	<DL	0.2	0.05	<DL	2	12	0.02	<DL	<DL		<DL	<DL	<DL		<DL	
	1570.46–1570.52	58	0.2	0.6		0.005	<DL	0.3	0.04	<DL	0.5	29	0.01	0.004	<DL		<DL	<DL	<DL	0.003	<DL	
Median	All (n = 36)	22	0.02	0.1	0.006	<DL	<DL	0.1	0.04	<DL	0.3	26	0.005	0.002	<DL	<DL	<DL	1	<DL	<DL	<DL	0.2
	Sandstones (n = 30)	8	0.01	0.1	0.004	<DL	<DL	0.08	0.04	<DL	0.3	23	0.004	0.001	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.2
	Interbedded (n = 6)	125	0.06	0.7	0.1	0.02	2	0.9	0.1	0.05	1	36	0.01	0.005	<DL	<DL	0.1	3	<DL	<DL	<DL	2
Standard Deviation	All (n = 36)	169	0.1	0.7	0.08	0.02	25	0.7	0.2	0.02	0.9	719	0.03	0.02	0.0001	<DL	0.1	12	25	0.001	<DL	1
	Sandstones (n = 30)	183	0.06	0.2	0.02	0.005	9	0.2	0.2	0.01	0.6	783	0.03	0.01	0.0001	<DL	0.02	13	28	0.001	<DL	0.4
	Interbedded (n = 6)	71	0.2	1	0.1	0.03	54	1	0.07	0.04	1	31	0.009	0.02	<DL	<DL	0.2	8	1	0.001	<DL	2

Shading indicates element was below detection limit in given rock samples.

Table A11. Step 3: pH 3 extracted concentrations of elements P–Zr (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.3	0.04	0.6	<DL	<DL	0.05	205	0.003	0.2	0.05	<DL	0.003	0.02	0.1	0.08	2	0.004
	1218.02–1218.10	<DL	0.8	0.07	0.08	<DL	0.002	0.04	<DL	0.002	0.1	0.02	<DL	0.004	0.02	0.04	0.02	3	0.003
Tipton 153	1032.35–1032.48	<DL	0.3	0.02	0.06	<DL	0.004	0.009	54	0.008	0.1	0.004	<DL	0.001	0.004	0.1	0.01	0.4	0.0008
	1033.88–1034.00	<DL	1	0.2	0.3	<DL	0.003	0.06	156	0.002	0.2	0.03	<DL	0.007	0.02	0.5	0.04	4	0.001
	1066.00–1066.24	<DL	3	0.2	0.1	<DL	0.009	0.09	109	0.002	0.3	0.07	<DL	0.006	0.03	0.6	0.02	8	0.001
	1067.92–1068.00	<DL	0.6	0.03	0.05		0.001	0.4	<DL	0.002	0.09	0.01	<DL	<DL	0.004	1	0.02	1	0.005
	1093.00–1093.19	<DL	0.1	0.02	0.02		0.002	0.003	66	0.01	0.08	0.002	<DL	<DL	0.004	0.1	0.004	0.5	0.001
	2263.61–2263.77	<DL	0.2	0.01	0.04	<DL	0.004	0.01	<DL	0.01	0.02	0.01	<DL	<DL	0.002	0.02	0.01	0.2	<DL
West Moonie 1	2267.05–2267.23		0.4	0.01	0.2	<DL	0.01	0.04	<DL	0.01	0.04	0.06	<DL	0.0002	0.003	0.1	0.05	0.5	0.0009
	2267.71–2267.84	<DL	0.2	0.008	0.1	<DL	0.003	0.02	126	0.002	0.05	0.01	<DL	<DL	0.01	0.08	0.04	0.2	0.0009
	2274.10–2274.18	<DL	0.3	0.009	0.04	<DL	0.006	0.004	<DL	0.009	0.02	0.009	<DL	<DL	0.003	0.02	0.02	0.2	<DL
	2281.82–2281.92	<DL	0.2	0.03	0.01	<DL	0.002	0.009	<DL	<DL	0.03	<DL	<DL	0.0004	0.003	0.06	0.004	0.9	<DL
	2284.13–2284.24	<DL	0.1	<DL	0.007	<DL	0.005	0.004	<DL	<DL	0.01	<DL	<DL	<DL	0.001	0.01	0.002	0.3	<DL
	2288.49–2288.61	<DL	0.1	<DL	0.005	<DL	0.002	0.003	<DL	0.01	0.009	<DL	<DL	<DL	0.0009	0.02	0.002	0.1	<DL
	2294.83–2294.98		0.08	<DL	0.05	<DL	0.006	<DL	<DL	0.03	0.02	0.009	<DL	<DL	0.005	0.04	0.007	0.06	<DL
	2297.19–2297.37	<DL	2	0.2	0.04	31	0.1	0.1	<DL	<DL	0.6	0.02	<DL	0.02	0.02	0.1	0.02	15	<DL
	2298.73–2298.82		0.1	<DL	0.03	<DL	0.004	<DL	<DL	0.02	0.008	0.003	<DL	<DL	0.003	0.03	0.005	0.07	<DL
	2303.99–2304.14		0.07	<DL	0.04	<DL	<DL	0.06	<DL	0.08	0.02	0.002	<DL	<DL	0.001	0.2	0.007	0.2	<DL
	2311.19–2311.25		0.08	0.005	0.04		<DL	0.003	<DL	0.04	0.02	0.001	<DL		0.002	0.07	0.007	0.09	<DL
	2314.05–2314.17		0.05	0.004	0.04	<DL	0.005	<DL	<DL	0.1	0.02	0.0008	<DL		0.001	0.01	0.007	0.2	<DL
	2319.26–2319.37		0.08	<DL	0.04			<DL	<DL	0.08	0.02	0.0004	<DL	<DL	0.001	0.01	0.006	0.4	<DL

Table A11. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2322.61–2322.73		0.04	<DL	0.02		0.002	0.002	<DL	0.04	0.01	<DL	<DL	<DL	0.002	0.02	0.006	0.1	<DL
	2323.76–2323.95		0.1	0.006	0.03	<DL	0.005	<DL	<DL	0.02	0.01	0.002	<DL	<DL	0.003	0.06	0.005	0.06	<DL
	2325.88–2326.00		3	<DL	0.05	<DL	0.009	<DL	<DL	0.02	0.02	0.02	<DL	<DL	0.006	0.1	0.01	0.08	<DL
	2328.54–2328.59	<DL	0.8	0.4	0.09	<DL	0.006	0.1	161	<DL	0.3	0.02	<DL	0.009	0.04	0.2	0.05	2	<DL
	2330.41–2330.55	<DL	0.05	<DL	0.007	<DL	0.001	0.002	<DL	0.08	0.007	<DL	<DL	<DL	0.001	0.01	0.002	0.08	<DL
	2333.23–2333.30		0.05	<DL	0.03		<DL	<DL	<DL	0.05	0.007	0.003	<DL		0.002	0.02	0.008	0.1	<DL
	2338.75–2338.85	<DL	0.08	0.005	0.01	<DL	0.002	0.005	<DL	0.02	0.01	<DL	<DL	<DL	0.002	0.04	0.003	0.2	<DL
West Wandoan 1	1165.57–1165.65		0.6	0.04	0.06	<DL	<DL	0.4	134	0.003	0.1	0.01	<DL	<DL	0.005	1	0.02	1	0.006
	1174.24–1174.33		0.1	0.02	0.02	<DL	0.002	0.003	212	0.01	0.08	0.002	<DL	<DL	0.004	0.1	0.004	0.4	0.001
	1197.76–1197.84		1	0.1	0.6	<DL	0.004	0.2	89	0.002	0.3	0.1	<DL	0.005	0.03	1	0.1	3	0.004
	1207.61–1207.68	<DL	0.4	0.03	0.05	<DL	0.001	0.5	56	0.003	0.2	0.007	<DL	0.002	0.003	1	0.04	1	0.01
	1225.70–1225.80		0.3	0.02	0.06	<DL	0.005	0.007	<DL	0.008	0.1	0.004	<DL	0.001	0.004	0.1	0.01	0.4	0.002
	1229.43–1229.50		1	0.2	0.3	<DL	0.004	0.08	<DL	0.002	0.2	0.03	<DL	0.006	0.02	0.5	0.04	4	0.002
Woleebee Creek GWB 4	1552.63–1553.00	<DL	0.1	0.007	0.09	<DL	0.004	0.003	<DL	0.009	0.03	0.01	<DL	<DL	0.004	0.07	0.02	0.3	<DL
	1570.46–1570.52	<DL	0.7	0.01	0.1	<DL	0.01	0.009	<DL	0.003	0.06	0.006	<DL	0.0007	0.004	0.2	0.01	1	0.0009
Median	All (n = 36)	<DL	0.2	0.01	0.05	<DL	0.003	0.008	<DL	0.009	0.04	0.006	<DL	<DL	0.004	0.09	0.01	0.4	<DL
	Sandstones (n = 30)	<DL	0.1	0.008	0.04	<DL	0.003	0.004	<DL	0.01	0.02	0.003	<DL	<DL	0.003	0.07	0.008	0.3	<DL
	Interbedded (n = 6)	<DL	0.8	0.1	0.08	<DL	0.005	0.1	83	0.002	0.2	0.02	<DL	0.005	0.02	0.2	0.03	2	0.001
Standard Deviation	All (n = 36)	<DL	0.7	0.09	0.1	5	0.02	0.1	64	0.03	0.1	0.02	<DL	0.003	0.009	0.3	0.03	3	0.002
	Sandstones (n = 30)	<DL	0.5	0.05	0.2	<DL	0.003	0.1	62	0.03	0.08	0.02	<DL	0.002	0.006	0.3	0.03	1	0.002
	Interbedded (n = 6)	<DL	1	0.1	0.03	11	0.03	0.2	61	0.001	0.2	0.02	<DL	0.005	0.01	0.3	0.01	5	0.004

Shading indicates element was below detection limit in given rock samples.

Table A12. Sum of acid steps extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	757	0.05	7		<DL	72	2	2	0.01	6	3885	0.07	0.06	<DL		<DL	29	199	0.001	<DL	
	1218.02–1218.10	90	0.2	6	0.1	0.05	62	0.4	0.2	0.3	2	59	0.03	0.004	0.001	<DL	<DL	24	9	0.002	<DL	0.8
Tipton 153	1032.35–1032.48	741	1	3	0.009	0.001	58	0.8	0.3	0.004	8	112	0.06	0.003	<DL		0.1	11	<DL	0.01	<DL	1
	1033.88–1034.00	1049	1	8	0.1	0.07	61	1	1	0.2	2	252	0.09	0.02	<DL	<DL	0.4	27	<DL	0.009	<DL	2
	1066.00–1066.24	552	0.7	10	0.3	0.3	195	4	0.4	0.7	15	43	0.05	0.005	0.0006	<DL	1	30	<DL	0.03	<DL	6
	1067.92–1068.00	149	0.02	0.9	0.02	0.02	55	0.2	0.4	0.02	0.7	3385	0.02	0.05	0.0007	<DL	<DL	97	82	0.0002	<DL	2
	1093.00–1093.19	1473	0.2	3		0.002	16	0.3	0.2	0.004	9	83	0.1	0.006	0.002		<DL	10	<DL	0.08		
West Moonie 1	2263.61–2263.77	23	0.9	1	0.02	0.01		0.7	0.04	0.005	4	59	0.009	0.004	<DL	<DL	0.02	2	<DL	<DL	<DL	1
	2267.05–2267.23	25	1	1	0.04	0.04	38	0.8	0.08	0.03	2	1352	0.01	0.02	0.0008	<DL	<DL	35	36		<DL	2

Table A12. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2267.71–2267.84	484	0.6	22	0.7	0.4	87	15	0.2	0.2	4	96	0.02	0.007	<DL	<DL	0.1	9	<DL	0.05	<DL	30
	2274.10–2274.18	22	1	1	0.03	0.06		0.6	0.03	0.005	4	108	0.009	0.004	<DL	<DL	0.003	<DL	<DL	<DL	<DL	0.8
	2281.82–2281.92	46	1	6	0.3	0.1	23	4	0.07	0.07	3	15	0.009	0.004	<DL	<DL	0.2	3	<DL	0.06	<DL	8
	2284.13–2284.24	29	1	1	0.06	0.03		1	0.03	0.005	2	7	0.007	0.002	<DL	<DL	0.1	<DL	<DL	0.05	<DL	3
	2288.49–2288.61	19	0.4	0.6	0.04	0.03		0.6	0.04	0.004	4	4	0.004	0.002	<DL	<DL	0.02	<DL	<DL	<DL		2
	2294.83–2294.98	16	0.2	0.5	0.02	0.01		0.4	0.02	<DL	2		0.005	<DL	<DL	<DL	<DL	<DL	<DL			0.7
	2297.19–2297.37	145	2	28	0.8	0.1	147	12	0.2	1	6	22	0.009	0.01	<DL	<DL	1	26	<DL	0.1	<DL	15
	2298.73–2298.82	21	0.2	0.5	0.01	0.01		0.4	0.02	0.02	2		0.006	<DL	<DL	<DL	<DL	<DL	<DL			0.6
	2303.99–2304.14	13	0.1	0.6	0.006	0.01		0.6	0.1	0.01	8	1271	0.005	0.01	<DL		<DL	27	49			2
	2311.19–2311.25	12	0.09	0.2	0.009			0.2	0.05	<DL	1	469	0.005	0.005	<DL		<DL	10	17			0.5
	2314.05–2314.17	13	0.3	0.8	0.009		6	1	0.04	<DL	11		0.004	<DL	<DL		<DL	4	<DL			2
	2319.26–2319.37	14	0.07	1	0.009			0.5	0.03	<DL	7		0.005	<DL	<DL		<DL	4	<DL			1
	2322.61–2322.73	13	0.07	2	0.008	0.01		0.2	0.05	0.002	8	70	0.006	0.004	<DL	<DL	0.07	2	<DL		<DL	0.2
	2323.76–2323.95	14	0.09	0.7	0.02	0.01		0.2	0.03	0.02	2	117	0.006	<DL	<DL	<DL	<DL	2	<DL			0.6
	2325.88–2326.00	19	0.06	1	0.02	0.1		0.4	0.05	0.01	2		0.007	0.004	<DL	<DL	<DL	4	3	0.2		0.7
	2328.54–2328.59	283	0.7	30	0.9	0.3	113	8	0.3	0.9	13	61	0.03	0.01	<DL	<DL	1	26	<DL	0.007	<DL	11
	2330.41–2330.55	8	0.08	1	0.008	0.009	5	0.2	0.02	0.002	13	<DL	0.004	0.002	<DL		0.01	<DL	<DL		<DL	0.4
	2333.23–2333.30	13	0.03	0.6	0.006			0.3	0.007	<DL	3		0.004	<DL	<DL		<DL	<DL	<DL			0.4
	2338.75–2338.85	19	0.1	1	0.04	0.06		0.3	0.03	0.006	7	<DL	0.007	0.005	<DL	<DL	0.09	<DL	<DL	<DL	<DL	0.4
West Wandoan 1	1165.57–1165.65	918		3			4	1	0.6	0.01	11	40	0.05	0.06	<DL	<DL			<DL	0.03	<DL	3
	1174.24–1174.33	1431		4			6	0.9	0.5	0.01	8	55	0.1	0.02	<DL	<DL		7	<DL	0.05	<DL	2
	1197.76–1197.84	556		3			9	2	0.8	0.02	16	95	0.2	0.04	<DL	<DL		4	<DL	0.08	<DL	4
	1207.61–1207.68	284	3	9	0.3	0.1	114	12	0.5	0.4	8	180	0.04	0.08	0.0006	<DL	0.1	32	<DL	0.1	<DL	18
	1225.70–1225.80	145		1			4	0.9	0.2	<DL	10	105	0.06	0.01	<DL	<DL			<DL	0.08	<DL	2
	1229.43–1229.50	60		1			6	0.9	0.4	0.04	9	113	0.07	0.01	<DL	<DL			<DL	0.03	<DL	1
Woleebee Creek GWB 4	1552.63–1553.00	321	0.1	6		0.007	6	1	0.2	0.002	11	39	0.04	0.005	<DL		<DL	2	<DL		<DL	
	1570.46–1570.52	122	0.9	3		0.04	4	1	0.1	0.003	3	55	0.02	0.007	<DL		<DL	<DL	<DL	0.04	<DL	
Median	All (n = 36)	53	0.2	1	0.01	0.01	5	0.8	0.1	0.01	6	59	0.01	0.005	<DL	<DL	<DL	4	<DL	0.001	<DL	1
	Sandstones (n = 30)	24	0.1	1	0.009	0.01	4	0.7	0.06	0.005	5	57	0.009	0.005	<DL	<DL	<DL	2	<DL	<DL	<DL	1
	Interbedded (n = 6)	283	0.7	16	0.5	0.2	113	10	0.3	0.6	7	60	0.03	0.009	0.0003	<DL	0.6	26	<DL	0.04	<DL	13
Standard Deviation	All (n = 36)	400	0.6	7	0.2	0.09	48	4	0.4	0.2	4	855	0.04	0.02	0.0004	<DL	0.3	18	36	0.05	<DL	6
	Sandstones (n = 30)	432	0.4	2	0.06	0.03	21	0.8	0.4	0.04	4	928	0.05	0.02	0.0003	<DL	0.08	19	39	0.04	<DL	1
	Interbedded (n = 6)	166	0.8	10	0.3	0.1	43	5	0.1	0.3	5	51	0.01	0.03	0.0005	<DL	0.5	7	3	0.05	<DL	9

Shading indicates element was below detection limit in given rock samples.

Table A13. Sum of acid steps extracted concentrations of elements P–Zr (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.7	0.08	1	48	0.006	0.1	447	0.02	1	0.1	<DL	0.01	0.05	0.2	0.2	5	0.02
	1218.02–1218.10	<DL	4	0.3	0.4	46	0.02	0.1	<DL	0.007	2	0.07	<DL	0.02	0.1	0.07	0.1	10	0.07
Tipton 153	1032.35–1032.48	<DL	2	0.04	0.3	<DL	0.02	0.04	226	0.1	1	0.03	<DL	0.007	0.02	0.4	0.06	2	0.02
	1033.88–1034.00	<DL	6	0.5	0.8	<DL	0.02	0.2	385	0.01	3	0.1	<DL	0.02	0.08	0.9	0.1	21	0.04
	1066.00–1066.24	<DL	22	1	0.4	<DL	0.06	0.3	251	0.008	8	0.2	<DL	0.03	0.1	1	0.08	27	0.05
	1067.92–1068.00	<DL	1	0.05	0.1		0.003	0.5	<DL	0.01	0.4	0.02	<DL	0.0005	0.02	1	0.03	2	0.04
	1093.00–1093.19	<DL	0.7	0.05	0.4		0.009	0.03	275	0.1	0.5	0.03	<DL	0.0007	0.02	0.5	0.05	2	0.05
	2263.61–2263.77	<DL	3	0.04	0.2	<DL	0.03	0.03	<DL	0.1	0.2	0.07	<DL	0.001	0.01	0.05	0.07	2	<DL
West Moonie 1	2267.05–2267.23		2	0.03	0.3	<DL	0.04	0.09	<DL	0.1	0.3	0.09	<DL	0.0002	0.008	0.2	0.07	3	0.009
	2267.71–2267.84	<DL	14	0.008	0.4	<DL	0.003	0.2	268	0.006	6	0.1	<DL	<DL	0.05	0.3	0.1	7	0.03
	2274.10–2274.18	<DL	2	0.03	0.2	45	0.06	0.004	<DL	0.08	0.2	0.02	<DL	0.0002	0.01	0.04	0.06	1	<DL
	2281.82–2281.92	<DL	6	0.1	0.1	<DL	0.07	0.04	<DL	<DL	2	0.01	<DL	0.005	0.03	0.1	0.05	11	<DL
	2284.13–2284.24	<DL	5	0.02	0.06	<DL	0.05	0.004	<DL	0.02	0.2	<DL	<DL	<DL	0.009	0.05	0.02	3	<DL
	2288.49–2288.61	<DL	3	0.02	0.05	<DL	0.02	0.003	<DL	0.07	0.1	<DL	<DL	<DL	0.009	0.05	0.01	0.8	<DL
	2294.83–2294.98		2	0.01	0.1	<DL	0.02	0.04	<DL	0.3	0.1	0.01	<DL	<DL	0.01	0.08	0.01	0.3	0.004
	2297.19–2297.37	<DL	12	1	0.2	31	0.2	0.2	<DL	<DL	10	0.04	<DL	0.06	0.06	0.2	0.07	43	<DL
	2298.73–2298.82		2	0.007	0.06	<DL	0.01	0.05	<DL	0.2	0.09	0.005	<DL	<DL	0.01	0.06	0.01	0.9	0.005
	2303.99–2304.14		1	<DL	0.1	<DL	0.007	0.1	<DL	0.9	0.1	0.006	<DL	<DL	0.003	0.2	0.02	0.7	0.004
	2311.19–2311.25		0.9	0.01	0.07		0.001	0.05	<DL	0.1	0.1	0.003	<DL		0.006	0.09	0.01	0.2	0.002
	2314.05–2314.17		0.9	0.01	0.1	<DL	0.02	0.06	<DL	1	0.1	0.005	<DL		0.004	0.03	0.02	2	0.003
	2319.26–2319.37		1	<DL	0.1			0.05	<DL	0.6	0.09	0.003	<DL	<DL	0.003	0.03	0.02	1	0.003
	2322.61–2322.73		1	0.01	0.1		0.007	0.002	<DL	0.3	0.1	0.008	<DL	<DL	0.01	0.05	0.02	0.5	<DL
	2323.76–2323.95		2	0.01	0.07	<DL	0.009	0.06	<DL	0.2	0.1	0.005	<DL	<DL	0.02	0.1	0.01	0.9	0.003
	2325.88–2326.00		16	0.005	0.2	<DL	0.04	0.07	<DL	0.2	0.1	0.04	<DL	<DL	0.03	0.3	0.03	1	0.007
	2328.54–2328.59	<DL	9	2	0.3	20	0.1	0.3	340	0.01	10	0.07	<DL	0.04	0.11	0.3	0.09	4	<DL
	2330.41–2330.55	<DL	1	0.006	0.05	<DL	0.006	0.002	<DL	0.8	0.08	<DL	<DL	<DL	0.009	0.04	0.01	0.2	<DL
	2333.23–2333.30		0.7	0.003	0.07		<DL	0.02	<DL	0.3	0.05	0.004	<DL		0.005	0.04	0.02	0.2	<DL
	2338.75–2338.85	<DL	2	0.03	0.1	<DL	0.01	0.005	<DL	0.1	0.2	0.005	<DL	<DL	0.02	0.09	0.02	2	<DL
	1165.57–1165.65		3	0.07	0.8	41	0.01	0.4	287	0.1	0.3	0.08	<DL	0.002	0.03	1	0.08	4	0.03
	1174.24–1174.33		3	0.1	2	52	0.01	0.07	404	0.05	0.5	0.3	<DL	0.003	0.07	0.6	0.1	5	0.03
	1197.76–1197.84		4	0.1	2	23	0.04	0.2	195	0.09	0.6	0.2	<DL	0.01	0.05	1	0.2	8	0.03
	1207.61–1207.68	<DL	7	0.5	0.6	41	0.05	0.7	56	0.009	4	0.08	<DL	0.05	0.2	2	0.3	47	0.03
	1225.70–1225.80		2	0.02	1	<DL	0.4	0.02	<DL	0.2	0.3	0.08	<DL	0.005	0.03	0.2	0.07	4	0.02
	1229.43–1229.50		2	0.2	0.7	<DL	0.05	0.09	<DL	0.3	0.4	0.07	<DL	0.009	0.03	0.5	0.07	6	0.01

Table A13. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Woleebee Creek GWB 4	1552.63–1553.00	<DL	1	0.01	0.8	<DL	0.02	0.02	97	0.1	0.3	0.07	<DL	0.0008	0.02	0.3	0.1	2	0.01
	1570.46–1570.52	<DL	3	0.02	0.5	<DL	0.04	0.04	<DL	0.04	0.2	0.03	<DL	0.002	0.02	0.3	0.06	9	0.01
Median	All (n = 36)	<DL	2	0.03	0.2	<DL	0.02	0.05	<DL	0.1	0.3	0.03	<DL	0.0006	0.02	0.2	0.06	2	0.006
	Sandstones (n = 30)	<DL	2	0.02	0.2	<DL	0.02	0.05	<DL	0.1	0.2	0.02	<DL	0.0002	0.02	0.2	0.04	2	0.005
	Interbedded (n = 6)	<DL	10	0.8	0.4	25	0.06	0.2	154	0.007	7	0.08	<DL	0.03	0.1	0.3	0.1	18	0.03
Standard Deviation	All (n = 36)	<DL	5	0.4	0.4	18	0.07	0.2	142	0.3	3	0.06	<DL	0.02	0.04	0.4	0.06	11	0.02
	Sandstones (n = 30)	<DL	3	0.09	0.5	16	0.07	0.1	140	0.3	0.6	0.06	<DL	0.005	0.02	0.4	0.05	4	0.01
	Interbedded (n = 6)	<DL	6	0.6	0.1	18	0.08	0.2	138	0.004	3	0.07	<DL	0.02	0.04	0.7	0.06	17	0.02

Shading indicates element was below detection limit in given rock samples.

Table A14. Sum of all three steps extracted concentrations of elements Al–Ni (mg element per kg rock).

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	757	0.05	9		<DL	146	2	2	0.04	6	3885	0.07	0.06	<DL		0.2	69	204	0.001	<DL	
	1218.02–1218.10	90	0.2	13	0.1	0.05	199	0.4	0.2	0.5	2	59	0.03	0.004	0.001	<DL	0.2	94	12	0.002	<DL	0.9
Tipton 153	1032.35–1032.48	741	1	4	0.009	0.001	103	0.8	0.3	0.02	8	112	0.06	0.003	<DL		0.1	18	<DL	0.02	<DL	1
	1033.88–1034.00	1049	1	10	0.1	0.07	107	1	1	0.4	2	252	0.09	0.02	<DL	275	0.6	54	<DL	0.01	659	2
	1066.00–1066.24	552	0.7	14	0.3	0.3	362	4	0.4	1	15	43	0.05	0.005	0.0006	198	1	60	<DL	0.07	332	6
	1067.92–1068.00	149	0.02	2	0.02	0.02	83	0.2	0.4	0.06	0.7	3385	0.02	0.05	0.0007	<DL	<DL	129	82	0.0002	<DL	3
	1093.00–1093.19	1473	0.2	7		0.002	69	0.3	0.2	0.02	9	83	0.1	0.006	0.002		<DL	21	<DL	0.08		
West Moonie 1	2263.61–2263.77	23	0.9	3	0.02	0.01		2	0.04	0.02	5	59	0.01	0.004	<DL	193	0.05	6	1	0.005	63	3
	2267.05–2267.23	25	1	3	0.04	0.04	57	1	0.08	0.05	3	1352	0.01	0.02	0.0008	285	<DL	43	36		<DL	2
	2267.71–2267.84	484	0.6	33	0.7	0.4	207	17	0.2	0.5	4	96	0.02	0.01	0.001	345	0.7	28	<DL	0.5	679	34
	2274.10–2274.18	22	1	3	0.03	0.06		2	0.03	0.02	5	108	0.01	0.004	<DL	152	0.03	4	3	0.002	<DL	2
	2281.82–2281.92	46	1	12	0.3	0.1	70	6	0.08	0.2	3	15	0.01	0.005	<DL	139	0.3	10	<DL	0.2	158	10
	2284.13–2284.24	29	1	4	0.06	0.03		2	0.03	0.03	2	7	0.008	0.003	<DL	169	0.2	2	<DL	0.09	61	4
	2288.49–2288.61	19	0.4	2	0.04	0.03		0.8	0.04	0.02	5	4	0.005	0.002	<DL	167	0.06	0.9	<DL	0.01		3
	2294.83–2294.98	36	0.2	1	0.02	0.01		0.5	0.07	0.02	4		0.01	<DL	<DL	821	<DL	5	<DL			1
	2297.19–2297.37	145	2	35	0.8	0.1	270	16	0.2	1	6	22	0.01	0.02	<DL	487	4	54	<DL	0.3	493	20
	2298.73–2298.82	37	0.2	1	0.01	0.01		0.6	0.04	0.04	3		0.01	<DL	<DL	411	<DL	3	<DL			0.7
	2303.99–2304.14	20	0.1	2	0.006	0.01		0.7	0.1	0.03	9	1271	0.006	0.01	<DL		<DL	31	49			2
	2311.19–2311.25	16	0.1	2	0.009			0.3	0.05	0.02	2	469	0.007	0.005	<DL		<DL	15	17			0.6
	2314.05–2314.17	15	0.4	2	0.009		58	2	0.04	0.01	15		0.004	<DL	<DL		<DL	8	<DL			2

Table A14. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2319.26–2319.37	14	0.09	3	0.009			0.6	0.03	0.01	8		0.006	<DL	<DL		<DL	7	<DL			1
	2322.61–2322.73	13	0.09	5	0.008	0.01		0.4	0.06	0.01	10	70	0.01	0.006	<DL	417	0.1	5	0.3		106	0.3
	2323.76–2323.95	40	0.1	2	0.02	0.01		0.3	0.07	0.04	3	117	0.01	<DL	<DL	678	<DL	6	<DL			0.8
	2325.88–2326.00	32	0.08	3	0.02	0.1		0.6	0.08	0.03	3		0.01	0.004	<DL	286	<DL	7	3	0.4		0.8
	2328.54–2328.59	283	0.7	41	0.9	0.3	212	8	0.3	1	13	61	0.03	0.02	<DL	270	2	48	<DL	0.07	375	11
	2330.41–2330.55	8	0.1	4	0.008	0.009	21	0.4	0.02	0.009	18	<DL	0.006	0.003	<DL		0.03	1	<DL		48	0.5
	2333.23–2333.30	25	0.05	2	0.006			0.3	0.03	0.01	5		0.008	<DL	<DL		<DL	5	<DL			0.5
	2338.75–2338.85	19	0.1	4	0.04	0.06		0.4	0.03	0.02	8	<DL	0.007	0.006	<DL	207	0.1	2	<DL	0.02	79	0.4
West Wandoan 1	1165.57–1165.65	918		4			16	2	0.6	0.03	12	40	0.05	0.06	<DL	2226			<DL	0.08	581	3
	1174.24–1174.33	1431		5			20	1	0.5	0.04	8	55	0.1	0.02	<DL	2811		20	<DL	0.1	641	2
	1197.76–1197.84	556		3			53	3	0.8	0.03	17	95	0.2	0.04	<DL	4978		17	<DL	0.2	732	4
	1207.61–1207.68	284	3	13	0.3	0.1	315	30	0.5	0.7	8	180	0.04	0.08	0.0006	157	0.5	104	3	0.2	351	36
	1225.70–1225.80	145		2			10	1	0.2	0.007	12	105	0.06	0.01	<DL	1236			<DL	0.2	323	2
	1229.43–1229.50	63		2			26	1	0.4	0.05	12	113	0.07	0.01	0.001	2018			<DL	0.08	439	2
Woleebee Creek GWB 4	1552.63–1553.00	321	0.1	8		0.007	16	2	0.2	0.02	11	39	0.05	0.005	<DL		<DL	6	<DL		291	
	1570.46–1570.52	122	0.9	6		0.04	14	2	0.1	0.01	3	55	0.03	0.007	<DL		<DL	3	<DL	0.07	<DL	
Median	All (n = 36)	55	0.2	4	0.01	0.01	18	1	0.1	0.03	6	59	0.01	0.006	<DL	181	<DL	7	<DL	0.01	24	2
	Sandstones (n = 30)	37	0.1	3	0.009	0.01	12	0.9	0.08	0.02	5	57	0.01	0.005	<DL	168	<DL	6	<DL	0.003	<DL	2
	Interbedded (n = 6)	283	0.7	23	0.5	0.2	241	12	0.3	0.9	7	60	0.03	0.01	0.0006	234	1	57	<DL	0.1	363	16
Standard Deviation	All (n = 36)	399	0.6	9	0.2	0.09	97	6	0.4	0.3	5	855	0.04	0.02	0.0004	995	0.7	32	37	0.1	241	8
	Sandstones (n = 30)	430	0.4	3	0.06	0.03	39	1	0.4	0.07	5	928	0.04	0.02	0.0004	1080	0.1	27	40	0.09	229	2
	Interbedded (n = 6)	166	0.8	12	0.3	0.1	61	10	0.1	0.3	5	51	0.01	0.03	0.0005	152	1.1	26	5	0.2	204	13

Shading indicates element was below detection limit in given rock samples.

Table A15. Sum of all three steps extracted concentrations of elements P–Zr (mg element per kg rock).

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.7	0.4	1	185	0.006	0.1	447	0.02	3	0.1	<DL	0.03	0.05	0.2	0.2	5	0.02
	1218.02–1218.10	<DL	4	1	0.4	266	0.02	0.1	<DL	0.01	7	0.07	<DL	0.05	0.1	0.07	0.1	10	0.07
Tipton 153	1032.35–1032.48	<DL	2	0.3	0.3	<DL	0.03	0.04	226	0.1	4	0.03	<DL	0.01	0.02	0.4	0.06	2	0.02
	1033.88–1034.00	<DL	6	2	0.8	27	0.02	0.2	385	0.01	6	0.1	<DL	0.04	0.08	0.9	0.1	21	0.04
	1066.00–1066.24	<DL	22	3	0.4	47	0.07	0.3	251	0.008	15	0.2	<DL	0.06	0.1	1	0.08	27	0.05
	1067.92–1068.00	<DL	1	0.2	0.1		0.003	0.5	<DL	0.01	1	0.02	<DL	0.003	0.02	1	0.03	2	0.04
	1093.00–1093.19	<DL	0.7	0.3	0.4		0.01	0.03	275	0.1	2	0.03	<DL	0.004	0.02	0.5	0.05	2	0.05

Table A15. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2263.61–2263.77	<DL	3	0.2	0.2	44	0.04	0.03	<DL	0.1	1	0.07	<DL	0.02	0.01	0.05	0.07	5	<DL
	2267.05–2267.23		2	0.2	0.3	31	0.05	0.09	<DL	0.1	1	0.09	<DL	0.02	0.008	0.2	0.07	5	0.01
	2267.71–2267.84	<DL	14	2	0.4	<DL	0.02	0.2	268	0.006	18	0.1	<DL	0.02	0.05	0.3	0.1	7	0.03
	2274.10–2274.18	<DL	2	0.2	0.2	87	0.07	0.004	<DL	0.08	0.7	0.02	<DL	0.01	0.01	0.04	0.06	4	<DL
	2281.82–2281.92	<DL	6	0.8	0.1	46	0.09	0.04	15	<DL	6	0.01	<DL	0.02	0.03	0.1	0.05	13	<DL
	2284.13–2284.24	<DL	5	0.2	0.06	10	0.07	0.005	8	0.02	0.8	<DL	<DL	0.01	0.009	0.05	0.02	5	<DL
	2288.49–2288.61	<DL	3	0.1	0.05	7	0.03	0.004	<DL	0.07	0.5	<DL	<DL	0.003	0.009	0.06	0.01	1	<DL
	2294.83–2294.98		2	0.2	0.2	<DL	0.03	0.04	<DL	0.3	1	0.03	<DL	0.0003	0.03	0.2	0.02	0.5	0.04
	2297.19–2297.37	<DL	12	4	0.2	176	0.3	0.2	<DL	<DL	18	0.04	<DL	0.1	0.06	0.2	0.09	46	<DL
	2298.73–2298.82		3	0.09	0.1	<DL	0.02	0.05	<DL	0.2	0.6	0.01	<DL	0.0007	0.02	0.1	0.02	1	0.03
	2303.99–2304.14		1	0.07	0.1	<DL	0.007	0.1	<DL	0.9	0.8	0.01	<DL	<DL	0.004	0.3	0.02	1	0.01
	2311.19–2311.25		0.9	0.1	0.09		0.001	0.05	<DL	0.1	0.8	0.003	<DL		0.007	0.1	0.01	0.4	0.009
	2314.05–2314.17		1	0.09	0.1	<DL	0.02	0.06	<DL	1	0.8	0.005	<DL		0.005	0.04	0.02	4	0.01
	2319.26–2319.37		1	0.05	0.1			0.05	<DL	0.6	0.7	0.003	<DL	<DL	0.003	0.04	0.02	2	0.003
	2322.61–2322.73		1	0.2	0.2		0.01	0.006	15	0.3	1	0.02	0.8	0.001	0.01	0.08	0.03	0.9	0.03
	2323.76–2323.95		2	0.2	0.1	<DL	0.01	0.06	<DL	0.2	0.9	0.01	<DL	<DL	0.02	0.2	0.02	2	0.05
	2325.88–2326.00		16	0.09	0.2	<DL	0.06	0.07	<DL	0.2	0.6	0.05	<DL	0.005	0.04	0.3	0.03	2	0.03
	2328.54–2328.59	<DL	9	4	0.3	42	0.19	0.3	385	0.01	18	0.07	<DL	0.06	0.1	0.4	0.09	4	<DL
	2330.41–2330.55	<DL	1	0.07	0.07	5	0.01	0.004	8	0.8	0.5	0.002	<DL	0.001	0.009	0.06	0.01	0.4	0.01
	2333.23–2333.30		0.7	0.1	0.09		<DL	0.02	<DL	0.3	0.9	0.009	<DL		0.007	0.09	0.02	0.7	0.02
	2338.75–2338.85	<DL	2	0.2	0.1	8	0.02	0.006	<DL	0.1	0.6	0.005	<DL	0.004	0.02	0.1	0.02	4	<DL
West Wandoan 1	1165.57–1165.65		3	0.6	0.8	1303	0.02	0.4	287	0.1	0.9	0.08	<DL	0.01	0.03	1	0.08	4	0.03
	1174.24–1174.33		3	2	2	1832	0.02	0.07	404	0.05	1	0.3	<DL	0.01	0.07	0.6	0.1	5	0.03
	1197.76–1197.84		4	0.8	2	2770	0.06	0.2	195	0.09	2	0.2	<DL	0.03	0.05	1	0.2	8	0.03
	1207.61–1207.68	<DL	7	2	0.6	301	0.06	0.7	56	0.009	11	0.08	<DL	0.1	0.2	2	0.3	63	0.03
	1225.70–1225.80		2	0.2	1	763	0.56	0.02	<DL	0.2	0.9	0.08	<DL	0.02	0.03	0.2	0.07	5	0.02
	1229.43–1229.50		2	0.5	0.8	1342	0.07	0.09	<DL	0.3	0.9	0.07	<DL	0.02	0.03	0.6	0.07	7	0.02
Woleebee Creek GWB 4	1552.63–1553.00	<DL	1	0.1	0.8	55	0.03	0.03	97	0.1	1	0.07	<DL	0.003	0.02	0.4	0.1	2	0.01
	1570.46–1570.52	<DL	3	0.1	0.5	111	0.04	0.04	<DL	0.04	0.8	0.03	<DL	0.01	0.02	0.4	0.06	12	0.01
Median	All (n = 36)	<DL	2	0.2	0.2	19	0.02	0.05	<DL	0.1	1	0.03	<DL	0.01	0.02	0.2	0.06	4	0.02
	Sandstones (n = 30)	<DL	2	0.2	0.2	8	0.02	0.05	<DL	0.1	0.9	0.03	<DL	0.004	0.02	0.2	0.04	3	0.02
	Interbedded (n = 6)	<DL	10	2	0.4	111	0.07	0.2	154	0.008	16	0.08	<DL	0.06	0.1	0.3	0.1	19	0.03
Standard Deviation	All (n = 36)	<DL	5	1	0.4	598	0.1	0.2	144	0.3	5	0.06	0.1	0.03	0.04	0.4	0.06	13	0.02
	Sandstones (n = 30)	<DL	3	0.4	0.5	650	0.1	0.1	139	0.3	1	0.06	0.1	0.01	0.02	0.4	0.05	4	0.02
	Interbedded (n = 6)	<DL	6	1	0.1	116	0.1	0.2	149	0.004	4	0.07	<DL	0.04	0.04	0.7	0.06	22	0.02

Shading indicates element was below detection limit in given rock samples.

Appendix B.2. Proportions of Elements Extracted from Rocks

Table A16. Step 1: pH 7 extraction of elements Al–Ni (%) relative to whole rock element abundance.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	<DL	0.06	7		<DL	10	0.5	<DL	12	<DL	<DL	<DL	<DL	<DL		7	17	0.3	<DL	<DL	
	1218.02–1218.10	<DL	0.04	3	0.03	<DL	36	0.3	<DL	2	<DL	<DL	<DL	<DL	<DL	<DL	0.5	5	1	<DL	<DL	0.5
Tipton 153	1032.35–1032.48	<DL	0.2	3	<DL	<DL	15	0.3	<DL	7	<DL	<DL	0.09	<DL	<DL		<DL	7	<DL	3	<DL	<DL
	1033.88–1034.00	<DL	0.3	2	<DL	<DL	17	0.9	<DL	5	<DL	<DL	<DL	<DL	<DL	4	1	3	<DL	0.6	100	0.7
	1066.00–1066.24	<DL	0.2	1	<DL	<DL	23	2	<DL	2	<DL	<DL	<DL	<DL	<DL	1	0.5	2	<DL	6	36	0.8
	1067.92–1068.00	<DL	<DL	1	<DL	<DL	8	0.04	<DL	3	<DL	<DL	<DL	<DL	<DL	<DL	<DL	3	<DL	<DL	<DL	0.3
	1093.00–1093.19	<DL	2	16		<DL	26	0.3	<DL	7	<DL	<DL	<DL	<DL	<DL		<DL	10	<DL	0.8		
	2263.61–2263.77	<DL	0.3	1	<DL	<DL		25	<DL	1	10	<DL	0.01	0.1	<DL	1	0.5	2	7	2	12	31
West Moonie 1	2267.05–2267.23	<DL	<DL	0.9	<DL	<DL	6	9	<DL	1	2	<DL	<DL	<DL	<DL	1	<DL	0.9	<DL		<DL	7
	2267.71–2267.84	<DL	0.3	3	<DL	<DL	30	6	<DL	2	<DL	<DL	<DL	0.1	0.02	2	0.7	1	<DL	13	61	5
	2274.10–2274.18	<DL	0.2	1	0.3	<DL		23	<DL	1	9	<DL	0.01	0.1	<DL	1	0.4	2	4	0.4	<DL	21
	2281.82–2281.92	<DL	0.5	3	0.1	<DL	56	16	0.002	2	0.3	<DL	0.003	0.07	<DL	0.9	0.7	1	<DL	14	23	11
	2284.13–2284.24	<DL	1	6	0.2	<DL		11	<DL	3	0.6	<DL	0.01	0.2	<DL	8	0.7	0.9	<DL	7	32	7
	2288.49–2288.61	<DL	2	4	<DL	<DL		11	<DL	2	6	<DL	0.01	0.1	<DL	8	0.6	0.5	<DL	9		9
	2294.83–2294.98	0.3	5	2	<DL	<DL		13	0.8	6	20		0.4	<DL	<DL	34	<DL	5	<DL			8
	2297.19–2297.37	<DL	0.4	2	<DL	<DL	44	12	0.01	1	0.03	<DL	0.004	0.2	<DL	2	2	1	<DL	6	53	6
	2298.73–2298.82	0.1	4	2	<DL	<DL		7	0.3	4	8		0.3	<DL	<DL	16	<DL	2	<DL			4
	2303.99–2304.14	0.1	<DL	3	0.2	<DL		7	0.2	5	13	<DL	0.06	<DL	<DL		<DL	2	<DL			6
	2311.19–2311.25	0.07	3	3	<DL			8	<DL	5	12	<DL	0.08	<DL	<DL		<DL	6	<DL			6
	2314.05–2314.17	0.1	6	3	<DL		21	6	0.4	5	21		<DL	<DL	<DL		<DL	9	<DL			6
	2319.26–2319.37	<DL	6	4	<DL			5	<DL	4	11		0.03	<DL	<DL		<DL	5	<DL			3
	2322.61–2322.73	<DL	5	6	<DL	<DL		32	0.2	3	14	<DL	0.2	0.6	<DL	32	0.9	3	3		64	4
	2323.76–2323.95	0.2	5	2	<DL	<DL		8	0.5	4	9	<DL	0.3	<DL	<DL	20	<DL	4	<DL			6
	2325.88–2326.00	0.09	2	3	<DL	<DL		14	0.2	4	5		0.1	<DL	<DL	16	<DL	2	<DL	19		6
	2328.54–2328.59	<DL	1	3	0.02	<DL	33	0.6	<DL	1	0.09	<DL	0.003	0.09	<DL	1	0.5	1	<DL	9	35	1
	2330.41–2330.55	<DL	4	4	<DL	<DL	9	20	0.08	2	23	<DL	0.09	0.2	<DL		0.6	2	<DL		21	7
	2333.23–2333.30	0.3	5	3	<DL			10	0.4	4	38		0.6	<DL	<DL		<DL	8	<DL			9
	2338.75–2338.85	<DL	0.8	5	0.2	<DL		10	0.002	3	9	<DL	0.02	0.2	<DL	14	0.7	1	<DL	16	41	3
	1165.57–1165.65	<DL		3			6	22	<DL	8	5	<DL	0.08	<DL	<DL	67			<DL	19	81	11
	1174.24–1174.33	<DL		2			21	3	<DL	8	0.7	<DL	0.05	<DL	<DL	61		9	<DL	17	58	3
	1197.76–1197.84	<DL		0.9			45	16	<DL	8	4	<DL	0.1	<DL	<DL	80		6	<DL	30	78	7

Table A16. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Wandoan 1	1207.61–1207.68	<DL	0.08	1	<DL	<DL	35	41	<DL	1	<DL	<DL	<DL	<DL	<DL	1	0.4	4	12	2	36	20
	1225.70–1225.80	<DL		2			6	12	<DL	7	13	<DL	0.1	<DL	<DL	63			<DL	26	51	8
	1229.43–1229.50	0.07		2			2	13	0.4	5	12	<DL	0.2	<DL	0.2	69			<DL	23	57	14
Woleebee Creek GWB 4	1552.63–1553.00	<DL	6	8		<DL	7	9	<DL	9	0.8	<DL	0.3	<DL	<DL		<DL	16	<DL		99	
	1570.46–1570.52	<DL	0.9	10		<DL	6	20	<DL	4	0.8	<DL	0.06	<DL	<DL		<DL	4	<DL	18	<DL	
Median	All (n = 36)	<DL	0.4	3	<DL	<DL	6	10	<DL	4	4	<DL	0.02	<DL	<DL	1	<DL	3	<DL	1	6	6
	Sandstones (n = 30)	<DL	0.8	3	<DL	<DL	4	10	<DL	4	7	<DL	0.06	<DL	<DL	1	<DL	3	<DL	0.5	<DL	6
	Interbedded (n = 6)	<DL	0.3	2	<DL	<DL	34	4	<DL	2	<DL	<DL	<DL	0.04	<DL	1	0.5	1	<DL	6	36	3
Standard Deviation	All (n = 36)	1	31	23	6	3	0.08	4	16	4	3	0.07	0.1	0.3	0.09	0.05	0.02	0.03	0.03	0.4	0.2	9
	Sandstones (n = 30)	1	33	25	6	3	0.09	4	13	4	3	0.08	0.1	0.3	0.09	0.05	0.02	0.03	0.03	0.4	0.2	9
	Interbedded (n = 6)	0.7	19	0.7	0.3	0.4	0.01	2	6	5	0.7	<0.001	<0.001	0.004	0.01	0.02	<DL	<0.001	0.007	0.004	0.004	4

Shading indicates element was below detection limit in given rock samples.

Table A17. Step 1: pH 7 extraction of elements P–Zr (%) relative to whole rock element abundance.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	0.03	12	<DL	21	<DL	<DL	<DL	<DL	13	<DL	<DL	33	<DL	<DL	<DL	0.2	<DL
	1218.02–1218.10	<DL	0.007	0.9	<0.001	27	<DL	<DL	<DL	0.1	6	<DL	<DL	6	<DL	<DL	<DL	0.2	<DL
	1032.35–1032.48	<DL	0.08	8	0.008	<DL	5	<DL	<DL	<DL	16	<DL	<DL	12	<DL	0.1	<DL	<DL	<DL
Tipton 153	1033.88–1034.00	<DL	0.01	3	<DL	9	0.8	<DL	<DL	<DL	7	<DL	<DL	6	<DL	0.006	<DL	0.4	<DL
	1066.00–1066.24	<DL	0.02	1	<0.001	11	1	<DL	<DL	<DL	10	<DL	<DL	4	<DL	0.01	<DL	0.4	<DL
	1067.92–1068.00	<DL	<DL	1	<DL		<DL	<DL	<DL	<DL	4	<DL	<DL	3	<DL	<DL	<DL	<DL	<DL
	1093.00–1093.19	<DL	0.04	8	0.004		1	<DL	<DL	<DL	18	<DL	<DL	23	<DL	0.1	<DL	0.3	<DL
	2263.61–2263.77	<DL	0.6	0.3	0.004	23	1	0.04	<DL	<DL	3	<DL	<DL	6	<DL	0.003	0.002	20	<DL
West Moonie 1	2267.05–2267.23		<DL	0.2	<DL	14	1	<DL	<DL	<DL	2	<DL	<DL	4	<DL	<DL	0.005	5	0.008
	2267.71–2267.84	<DL	<DL	2	0.002	<DL	2	<DL	<DL	<DL	19	<0.001	<DL	3	<DL	0.009	<0.001	<DL	<0.001
	2274.10–2274.18	<DL	0.2	0.3	0.003	3	2	0.06	<DL	<DL	2	<DL	<DL	3	<DL	<DL	<DL	14	<DL
	2281.82–2281.92	<DL	0.09	0.8	0.002	14	2	0.03	0.004	<DL	8	<DL	<DL	4	<DL	0.006	<DL	5	<DL
	2284.13–2284.24	<DL	1	1	0.003	11	5	0.07	0.002	<DL	3	<DL	<DL	10	<DL	0.03	<DL	10	<DL
	2288.49–2288.61	<DL	1	0.9	0.002	9	4	0.05	<DL	<DL	3	<DL	<DL	4	<DL	0.03	<DL	7	<DL
	2294.83–2294.98		2	4	0.2	<DL	8	<DL	<DL	1	5	0.2	<DL	0.5	1	1	0.09	2	0.06
	2297.19–2297.37	<DL	0.01	2	<0.001	14	4	<DL	<DL	<DL	7	<DL	<DL	7	0.01	0.01	0.07	1	<DL
	2298.73–2298.82		1	1	0.2	<DL	4	<DL	<DL	<DL	3	0.2	<DL	1	0.5	0.6	0.1	2	0.04
	2303.99–2304.14		0.4	2	0.06	<DL	<DL	<DL	<DL	0.4	7	0.1	<DL	<DL	0.1	0.3	0.07	4	0.03
	2311.19–2311.25		0.4	3	0.05		<DL	<DL	<DL	<DL	5	<DL	<DL		0.2	0.4	0.06	2	0.02

Table A17. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2314.05–2314.17		0.7	4	0.08	<DL	5	<DL	<DL	0.2	8	<DL	<DL		0.2	0.5	0.05	18	0.06
	2319.26–2319.37		0.1	2	0.02			<DL	<DL	<DL	6	<DL	<DL	<DL	0.1	0.4	<DL	6	<DL
	2322.61–2322.73		1	3	0.3		4	0.4	0.004	0.6	7	0.3	0.1	4	0.3	0.5	0.1	7	0.05
	2323.76–2323.95		1	3	0.2	<DL	4	<DL	<DL	0.7	5	0.2	<DL	<DL	0.4	1	0.2	5	0.1
	2325.88–2326.00		0.6	1	0.03	<DL	9	<DL	<DL	0.4	2	0.05	<DL	9	0.1	0.4	0.03	3	0.01
	2328.54–2328.59	<DL	0.002	2	0.001	6	8	0.04	0.02	<DL	6	<DL	<DL	3	<DL	0.01	<0.001	<DL	<DL
	2330.41–2330.55	<DL	0.8	2	0.09	11	3	0.2	0.002	0.2	4	0.09	<DL	4	0.1	0.4	0.04	3	0.04
	2333.23–2333.30		3	6	0.2		<DL	<DL	<DL	1	10	0.4	<DL		0.5	2	0.2	5	0.1
	2338.75–2338.85	<DL	0.2	2	0.002	27	4	0.06	<DL	<DL	3	<DL	<DL	6	<DL	0.05	<DL	23	<DL
West Wandoan 1	1165.57–1165.65		0.3	12	0.07	67	4	<DL	<DL	0.04	5	<DL	<DL	15	0.1	0.3	<DL	3	<DL
	1174.24–1174.33		0.1	19	0.08	85	3	<DL	<DL	<DL	5	<DL	<DL	11	0.2	0.2	0.02	0.2	<DL
	1197.76–1197.84		0.02	27	0.004	88	10	<DL	<DL	<DL	9	<DL	<DL	32	<DL	0.2	<DL	5	0.005
	1207.61–1207.68	<DL	<DL	1	<0.001	27	0.9	<DL	<DL	<DL	5	<DL	<DL	10	<DL	0.008	<DL	8	<DL
	1225.70–1225.80		0.03	9	<DL	99	12	<DL	<DL	<DL	6	<DL	<DL	30	<DL	0.3	<DL	2	<DL
	1229.43–1229.50		0.6	19	0.2	91	13	<DL	<DL	0.3	6	0.3	<DL	28	0.1	0.7	0.09	3	0.06
Woleebee Creek GWB 4	1552.63–1553.00	<DL	0.08	10	<DL	22	5	0.3	<DL	0.09	13	<DL	<DL	28	<DL	1	<DL	3	<DL
	1570.46–1570.52	<DL	0.04	3	<DL	26	5	<DL	<DL	<DL	4	<DL	<DL	18	<DL	0.09	<DL	12	<DL
Median	All (n = 36)	<DL	0.1	2	0.003	10	3	<DL	<DL	<DL	6	<DL	<DL	5	<DL	0.1	<DL	3	<DL
	Sandstones (n = 30)	<DL	0.2	3	0.006	9	4	<DL	<DL	<DL	5	<DL	<DL	5	<DL	0.2	<DL	4	<DL
	Interbedded (n = 6)	<DL	0.005	2	<0.001	13	2	<DL	<DL	<DL	7	<DL	<DL	5	<DL	0.01	<0.001	0.3	<DL
Standard Deviation	All (n = 36)	2	<DL	9	7	8	6	0.08	0.1	10	0.3	0.6	<DL	0.003	0.1	2	3	<DL	29
	Sandstones (n = 30)	2	<DL	8	6	9	6	0.09	0.1	11	0.3	0.6	<DL	0.001	0.1	2	3	<DL	31
	Interbedded (n = 6)	4	<DL	14	7	0.03	3	<DL	0.002	2	0.05	0.008	<DL	0.006	0.08	0.3	3	<DL	10

Shading indicates element was below detection limit in given rock samples.

Table A18. Step 2: pH 5 extraction of elements Al–Ni (%) relative to whole rock element abundance.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	6	0.9	20		<DL	6	7	13	4	32	2	1	4	<DL		<DL	7	4	0.2	<DL	
	1218.02–1218.10	0.06	1	2	5	10	16	2	0.2	3	7	0.1	0.05	0.2	0.02	<DL	<DL	2	2	0.09	<DL	2
Tipton 153	1032.35–1032.48	6	36	10	15	7	17	31	6	2	33	12	2	1	<DL		3	10	<DL	7	<DL	10
	1033.88–1034.00	1	15	6	13	27	15	14	2	4	16	0.6	0.2	0.6	<DL	<DL	3	2	<DL	2	<DL	9
	1066.00–1066.24	0.2	12	3	7	26	26	25	0.3	3	28	0.3	0.04	0.06	0.008	<DL	0.9	1	<DL	4	<DL	8
	1067.92–1068.00	0.3	1	0.9	4	13	6	2	0.5	0.7	8	0.4	0.08	0.3	0.03	<DL	<DL	2	1	0.2	<DL	4
	1093.00–1093.19	14	47	9		12	5	27	6	2	42	12	3	2	0.2		<DL	6	<DL	37		

Table A18. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2263.61–2263.77	0.06	26	0.6	8	32		15	0.2	0.3	45	2	0.1	0.7	<DL	<DL	0.3	<DL	<DL	<DL	<DL	16
	2267.05–2267.23	0.05	19	0.6	5	24	8	12	0.1	0.6	29	6	0.07	0.6	<DL	<DL	<DL	3	5		<DL	13
	2267.71–2267.84	0.3	11	6	11	39	22	38	0.3	1	16	0.9	0.04	0.2	<DL	<DL	0.1	0.3	<DL	1	<DL	37
	2274.10–2274.18	0.07	21	0.6	5	54		12	0.2	0.3	40	2	0.1	0.5	<DL	<DL	0.04	<DL	<DL	<DL	<DL	10
	2281.82–2281.92	0.07	25	2	12	48	27	31	0.09	1	21	0.6	0.04	0.2	<DL	<DL	0.5	0.5	<DL	6	<DL	34
	2284.13–2284.24	0.09	41	2	11	23		19	0.2	0.8	10	1	0.06	0.8	<DL	<DL	0.4	<DL	<DL	8	<DL	25
	2288.49–2288.61	0.07	41	1	9	48		30	0.2	0.5	57	0.8	0.04	0.7	<DL	<DL	0.2	<DL	<DL	<DL		28
	2294.83–2294.98	0.1	15	0.9	6	19		24	0.2	<DL	35		0.06	<DL	<DL	<DL	<DL	<DL				16
	2297.19–2297.37	0.07	7	6	5	6	<DL	22	0.05	3	8	0.3	0.01	0.1	<DL	<DL	0.5	0.08	<DL	4	<DL	13
	2298.73–2298.82	0.08	17	0.9	2	20		15	0.1	2	41		0.1	<DL	<DL	<DL	<DL	<DL				15
	2303.99–2304.14	0.2	19	1	<DL	19		49	2	4	60	32	0.1	2	<DL		<DL	12	21			27
	2311.19–2311.25	0.2	9	0.4	1			12	0.5	<DL	17	28	0.05	<DL	<DL		<DL	9	20			12
	2314.05–2314.17	0.5	23	2	2		<DL	19	1	<DL	51		0.2	<DL	<DL		<DL	3	<DL			31
	2319.26–2319.37	0.4	17	2	4			41	1	<DL	52		0.1	<DL	<DL		<DL	3	<DL			22
	2322.61–2322.73	0.1	13	3	7	16		19	0.4	0.5	59	8	0.2	1	<DL	<DL	0.6	2	<DL		<DL	8
	2323.76–2323.95	0.07	18	1	4	20		23	0.2	3	49	8	0.1	<DL	<DL	<DL	<DL	2	<DL			19
	2325.88–2326.00	0.09	6	1	6	36		28	0.1	2	42		0.06	0.4	<DL	<DL	<DL	2	14	22		19
	2328.54–2328.59	0.1	13	7	10	55	36	23	0.2	3	26	0.5	0.03	0.2	<DL	<DL	1	1	<DL	0.9	<DL	20
	2330.41–2330.55	0.1	17	2	5	17	3	16	0.3	0.4	68	<DL	0.1	0.8	<DL		0.4	<DL	<DL		<DL	20
	2333.23–2333.30	0.3	6	0.9	1			37	<DL	<DL	50		0.3	<DL	<DL		<DL	<DL	<DL			21
	2338.75–2338.85	0.1	18	2	9	71		16	0.3	1	66	<DL	0.1	0.7	<DL	<DL	0.7	<DL	<DL	<DL	<DL	10
West Wandoan 1	1165.57–1165.65	6		7			2	29	7	2	52	7	2	5	<DL	<DL			<DL	11	<DL	21
	1174.24–1174.33	5		9			8	30	4	3	42	5	2	4	<DL	<DL		2	<DL	10	<DL	21
	1197.76–1197.84	4		4			9	39	6	2	63	14	2	7	<DL	<DL		1	<DL	15	<DL	41
	1207.61–1207.68	0.09	19	3	13	33	20	28	0.2	3	22	1	0.07	0.3	0.009	<DL	0.2	2	<DL	4	<DL	20
	1225.70–1225.80	1		5			4	34	3	<DL	54	19	2	5	<DL	<DL			<DL	21	<DL	22
	1229.43–1229.50	0.5		5			0.5	31	4	<DL	39	14	0.8	4	<DL	<DL			<DL	13	<DL	24
Woleebee Creek GWB 4	1552.63–1553.00	7	63	16		37	4	41	8	2	45	11	2	6	<DL		<DL	7	<DL		<DL	
	1570.46–1570.52	0.4	36	7		44	3	29	1	1	25	5	0.3	0.8	<DL		<DL	<DL	<DL	16	<DL	
Median	All (n = 36)	0.2	16	2	5	19	2	25	0.3	1	40	1	0.1	0.6	<DL	<DL	<DL	1	<DL	0.2	<DL	18
	Sandstones (n = 30)	0.2	17	2	4	18	0.3	26	0.5	0.9	42	2	0.1	0.7	<DL	<DL	<DL	1	<DL	<DL	<DL	18
	Interbedded (n = 6)	0.1	11	4	9	30	21	24	0.2	3	19	0.4	0.04	0.2	0.004	<DL	0.4	1	<DL	3	<DL	17
Standard Deviation	All (n = 36)	0.7	<DL	<DL	0.4	1	4	3	9	3	4	1	1	2	3	1	<DL	0.04	0.03	2	3	8
	Sandstones (n = 30)	0.7	<DL	<DL	0.5	1	4	3	6	2	5	1	1	2	4	1	<DL	0.04	0.04	2	3	9
	Interbedded (n = 6)	0.4	<DL	<DL	0.3	0.7	3	0.6	11	3	2	0.04	0.2	0.6	0.3	0.2	<DL	0.01	0.007	0.2	0.09	2

Shading indicates element was below detection limit in given rock samples.

Table A19. Step 2: pH 5 extraction of elements P–Zr (%) relative to whole rock element abundance.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	9	2	3	7	2	6	0.06	0.9	9	4	<DL	15	6	0.7	4	12	0.05
	1218.02–1218.10	<DL	12	0.3	0.2	6	3	0.6	<DL	0.1	3	0.3	<DL	4	2	0.03	0.3	5	0.03
Tipton 153	1032.35–1032.48	<DL	33	0.8	1	<DL	12	5	0.04	2	10	2	<DL	10	2	6	2	31	0.09
	1033.88–1034.00	<DL	32	0.7	0.4	<DL	4	2	0.06	0.3	5	0.7	<DL	6	2	0.8	0.5	25	0.02
	1066.00–1066.24	<DL	40	0.7	0.1	<DL	6	0.8	0.05	0.1	10	0.6	<DL	2	1	0.3	0.2	18	0.02
	1067.92–1068.00	<DL	9	0.1	0.07		2	1	<DL	0.5	1	0.2	<DL	0.4	0.8	0.2	0.1	4	0.03
	1093.00–1093.19	<DL	19	1	1		6	4	0.05	4	4	2	<DL	5	3	7	2	19	0.2
	2263.61–2263.77	<DL	32	0.06	0.8	<DL	8	0.9	<DL	3	0.9	2	<DL	0.3	1	0.2	0.9	10	<DL
West Moonie 1	2267.05–2267.23		13	0.03	0.2	<DL	4	2	<DL	3	0.6	1	<DL	<DL	0.5	0.2	0.3	6	0.02
	2267.71–2267.84	<DL	40	<DL	0.1	<DL	<DL	1	0.05	0.06	10	0.6	<DL	<DL	0.8	0.2	0.3	7	0.02
	2274.10–2274.18	<DL	19	0.05	0.4	4	12	<DL	<DL	3	1	0.6	<DL	0.06	1	0.2	0.8	7	<DL
	2281.82–2281.92	<DL	37	0.2	0.07	<DL	12	0.4	<DL	<DL	4	0.1	<DL	1	1	0.1	0.1	18	<DL
	2284.13–2284.24	<DL	61	0.2	0.2	<DL	10	<DL	<DL	0.5	0.8	<DL	<DL	<DL	1	0.3	0.2	13	<DL
	2288.49–2288.61	<DL	42	0.2	0.2	<DL	7	<DL	<DL	3	0.8	<DL	<DL	<DL	1	0.3	0.2	8	<DL
	2294.83–2294.98		31	0.2	0.08	<DL	7	3	<DL	10	0.5	0.05	<DL	<DL	1	0.5	0.1	2	0.008
	2297.19–2297.37	<DL	20	0.9	0.04	<DL	5	0.3	<DL	<DL	8	0.07	<DL	5	0.6	0.03	0.2	9	<DL
	2298.73–2298.82		38	0.1	0.1	<DL	4	4	<DL	9	0.6	0.08	<DL	<DL	1	0.4	0.2	5	0.01
	2303.99–2304.14		27	<DL	0.2	<DL	7	7	<DL	24	0.9	0.1	<DL	<DL	0.5	1	0.6	6	0.01
	2311.19–2311.25		19	0.3	0.08		1	5	<DL	6	0.7	0.04	<DL		0.7	0.4	0.1	0.7	0.005
	2314.05–2314.17		25	0.3	0.5	<DL	10	17	<DL	20	1	0.4	<DL		0.8	0.7	1	14	0.02
	2319.26–2319.37		23	<DL	0.4			11	<DL	46	0.8	0.2	<DL	<DL	0.5	0.9	0.9	9	0.01
	2322.61–2322.73		31	0.2	0.3		4	<DL	<DL	10	1	0.3	<DL	<DL	2	0.6	0.4	5	<DL
	2323.76–2323.95		40	0.1	0.1	<DL	3	5	<DL	8	0.6	0.08	<DL	<DL	2	0.7	0.2	7	0.007
	2325.88–2326.00		31	0.09	0.07	<DL	14	2	<DL	3	0.4	0.09	<DL	<DL	1	0.9	0.2	5	0.003
	2328.54–2328.59	<DL	24	0.8	0.08	5	15	0.8	0.06	0.2	7	0.1	<DL	4	1	0.1	0.1	7	<DL
	2330.41–2330.55	<DL	24	0.2	0.2	<DL	4	<DL	<DL	17	0.7	<DL	<DL	<DL	1	0.4	0.3	2	<DL
	2333.23–2333.30		32	0.1	0.2		<DL	5	<DL	14	0.6	0.1	<DL		0.8	0.6	0.6	0.8	<DL
	2338.75–2338.85	<DL	37	0.4	0.2	<DL	7	<DL	<DL	4	0.9	0.2	<DL	<DL	3	0.5	0.4	22	<DL
	1165.57–1165.65		32	0.8	3	2	7	3	0.04	3	1	3	<DL	4	4	4	2	19	0.06
	1174.24–1174.33		34	2	3	3	5	3	0.05	1	2	4	<DL	6	5	3	2	15	0.02
	1197.76–1197.84		42	2	4	0.7	15	4	0.03	2	3	4	<DL	9	5	3	3	30	0.1
	1207.61–1207.68	<DL	16	0.5	0.2	4	4	1	<DL	0.09	3	0.2	<DL	7	2	0.6	0.7	22	0.009
	1225.70–1225.80		36	<DL	4	<DL	31	2	<DL	8	1	4	<DL	7	5	2	1	27	0.05
	1229.43–1229.50		30	0.4	2	<DL	25	3	<DL	8	2	2	<DL	6	1	1	1	29	0.05

Table A19. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Woleebee Creek GWB 4	1552.63–1553.00	<DL	31	0.5	5	<DL	7	4	0.02	4	4	4	<DL	9	4	7	4	34	0.05
	1570.46–1570.52	<DL	24	0.2	0.8	<DL	13	2	<DL	1	0.8	0.6	<DL	4	2	1	1	34	0.04
Median	All (n = 36)	<DL	31	0.2	0.2	<DL	6	2	<DL	3	1	0.3	<DL	0.4	1	0.6	0.5	9	0.01
	Sandstones (n = 30)	<DL	31	0.2	0.4	<DL	7	3	<DL	4	0.9	0.3	<DL	0.03	1	0.7	0.6	11	0.01
	Interbedded (n = 6)	<DL	22	0.6	0.1	2	5	0.8	0.02	0.09	8	0.2	<DL	4	1	0.1	0.2	8	0.01
Standard Deviation	All (n = 36)	5	8	11	10	17	10	3	0.8	4	9	11	19	0.02	2	15	7	<DL	2
	Sandstones (n = 30)	6	8	11	10	16	10	3	0.9	4	9	11	19	0.02	2	16	7	<DL	2
	Interbedded (n = 6)	0.8	0.4	11	11	8	6	0.09	0.02	2	0.05	11	17	0.03	0.06	6	5	<DL	3

Shading indicates element was below detection limit in given rock samples.

Table A20. Step 3: pH 3 extraction of elements Al–Ni (%) relative to whole rock element abundance.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	7	0.2	2		<DL	3	7	12	2	12	8	3	11	<DL		<DL	6	9	<DL	<DL	
	1218.02–1218.10	0.04	0.1	0.1	3	4	<DL	0.7	0.08	0.4	3	0.3	0.04	<DL	<DL	<DL	<DL	<DL	1	<DL	<DL	0.8
Tipton 153	1032.35–1032.48	2	6	0.7	4	<DL	3	11	1	<DL	8	6	2	0.7	<DL		<DL	3	<DL	0.5	<DL	5
	1033.88–1034.00	0.8	2	0.4	9	9	9	4	0.8	0.8	7	2	0.4	0.8	<DL	<DL	<DL	1	<DL	<DL	<DL	4
	1066.00–1066.24	0.2	2	0.3	6	10	0.8	13	0.1	0.3	9	0.4	0.07	0.1	<DL	<DL	0.4	0.2	<DL	<DL	<DL	6
	1067.92–1068.00	0.2	<DL	0.3	5	6	11	6	2	0.5	2	8	0.2	6	<DL	<DL	<DL	6	8	<DL	<DL	6
	1093.00–1093.19	3	7	1		<DL	3	11	2	<DL	14	6	2	0.8	<DL		<DL	3	<DL	2		
West Moonie 1	2263.61–2263.77	0.03	3	0.05	<DL	<DL		1	0.2	<DL	3	2	0.07	0.4	<DL	<DL	<DL	0.7	<DL	<DL	<DL	1
	2267.05–2267.23	0.02	4	0.06	2	9	3	3	0.5	0.6	4	1	0.1	1	0.05	<DL	<DL	0.7	0.9		<DL	4
	2267.71–2267.84	0.1	0.3	0.04	0.4	0.6	<DL	0.2	0.04	0.01	1	0.9	0.02	0.1	<DL	<DL	<DL	0.3	<DL	0.01	<DL	0.2
	2274.10–2274.18	0.03	2	0.06	2	<DL		1	0.1	<DL	3	2	0.09	0.2	<DL	<DL	<DL	<DL	<DL	<DL	<DL	0.8
	2281.82–2281.92	0.02	2	0.05	5	<DL	<DL	3	0.05	0.08	1	<DL	0.03	0.07	<DL	<DL	0.4	<DL	<DL	0.6	<DL	2
	2284.13–2284.24	0.03	2	0.09	4	<DL		2	0.1	<DL	0.5	<DL	0.09	<DL	<DL	<DL	0.9	<DL	<DL	<DL	<DL	2
	2288.49–2288.61	0.02	3	0.09	2	<DL		3	0.1	<DL	3	<DL	0.05	<DL	<DL	<DL	<DL	<DL	<DL	<DL		3
	2294.83–2294.98	0.1	3	0.1	3	<DL		3	0.2	<DL	3		0.1	<DL	<DL	<DL	<DL	<DL	<DL			3
	2297.19–2297.37	0.03	4	1	5	7	52	9	0.1	0.3	5	<DL	0.01	0.3	<DL	<DL	0.4	1	<DL	0.1	<DL	6
	2298.73–2298.82	0.09	3	0.1	2	<DL		2	0.06	2	3		0.1	<DL	<DL	<DL	<DL	<DL				3
	2303.99–2304.14	0.07	<DL	0.1	4	<DL		3	3	<DL	3	10	0.1	3	<DL		<DL	4	6			9
	2311.19–2311.25	0.05	3	0.1	3			4	1	<DL	3	11	0.2	1	<DL		<DL	4	8			9
	2314.05–2314.17	0.2	3	0.2	3		2	2	0.6	<DL	2		0.2	<DL	<DL		<DL	6	<DL			5
	2319.26–2319.37	0.1	5	0.2	2			2	0.7	<DL	3		0.3	<DL	<DL		<DL	4	<DL			4

Table A20. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2322.61–2322.73	0.08	2	0.1	<DL	<DL		2	0.2	<DL	1	4	0.1	0.6	<DL	<DL	2	<DL	<DL		<DL	2
	2323.76–2323.95	0.04	<DL	0.1	3	<DL		3	0.2	3	3	3	0.1	<DL	<DL	<DL	<DL	<DL	<DL			4
	2325.88–2326.00	0.05	<DL	0.1	2	5		3	0.2	<DL	4		0.08	<DL	<DL	<DL	<DL	1	<DL	<DL		5
	2328.54–2328.59	0.07	3	0.3	4	4	2	12	0.1	0.5	5	0.4	0.05	0.2	<DL	<DL	0.4	0.2	<DL	<DL	<DL	5
	2330.41–2330.55	<DL	2	0.06	<DL	<DL	<DL	2	0.2	<DL	2	<DL	0.1	0.4	<DL		<DL	<DL	<DL		<DL	2
	2333.23–2333.30	0.08	<DL	0.1	2			3	0.1	<DL	6		0.2	<DL	<DL		<DL	<DL	<DL			8
	2338.75–2338.85	0.04	1	0.1	5	<DL		2	0.08	<DL	3	<DL	0.09	0.4	<DL	<DL	1	<DL	<DL	<DL	<DL	1
West Wandoan 1	1165.57–1165.65	4		0.7			<DL	4	9	4	0.9	4	0.5	26	<DL	<DL			<DL	<DL	<DL	38
	1174.24–1174.33	6		0.8			<DL	3	0.4	<DL	17	5	1	0.3	<DL	<DL		3	<DL	0.9	<DL	3
	1197.76–1197.84	3		2			<DL	6	14	10	1	9	8	15	<DL	<DL		0.8	<DL	0.2	<DL	8
	1207.61–1207.68	0.1	0.02	0.07	0.9	<DL	<DL	1	0.2	0.02	1	2	0.03	2	<DL	<DL	<DL	0.1	<DL	<DL	<DL	1
	1225.70–1225.80	1		0.9			<DL	9	1	<DL	9	6	2	1	<DL	<DL			<DL	0.2	<DL	10
	1229.43–1229.50	0.7		3			<DL	15	15	29	2	3	5	5	<DL	<DL			<DL	<DL	<DL	17
Woleebee Creek GWB 4	1552.63–1553.00	4	8	0.6		<DL	<DL	10	2	<DL	8	5	2	<DL	<DL		<DL	<DL	<DL		<DL	
	1570.46–1570.52	0.4	11	2		6	<DL	9	0.4	<DL	5	5	0.3	1	<DL		<DL	<DL	<DL	1	<DL	
Median	All (n = 36)	0.09	2	0.1	2	<DL	<DL	3	0.2	<DL	3	2	0.1	0.3	<DL	<DL	<DL	0.1	<DL	<DL	<DL	3
	Sandstones (n = 30)	0.09	2	0.1	2	<DL	<DL	3	0.5	<DL	3	3	0.2	0.4	<DL	<DL	<DL	<DL	<DL	<DL	<DL	3
	Interbedded (n = 6)	0.1	1	0.2	4	4	0.4	5	0.1	0.3	4	0.4	0.04	0.2	<DL	<DL	0.2	0.2	<DL	<DL	<DL	3
Standard Deviation	All (n = 36)	0.4	<DL	<DL	2	5	2	2	9	0.6	0.7	0.5	0.8	1	8	1	<DL	0.004	0.008	5	4	0.4
	Sandstones (n = 30)	0.5	<DL	<DL	2	5	2	2	3	0.7	0.7	0.6	0.9	1	9	1	<DL	0.004	0.009	5	4	0.5
	Interbedded (n = 6)	0.2	<DL	<DL	0.1	0.2	2	0.4	19	0.2	0.4	0.02	0.07	0.1	0.8	0.03	<DL	0.001	<DL	0.2	0.06	0.04

Shading indicates element was below detection limit in given rock samples.

Table A21. Step 3: pH 3 extraction of elements P–Zr (%) relative to whole rock element abundance.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	7	2	2	<DL	<DL	5	0.05	0.1	2	2	<DL	4	3	1	2	10	0.01
	1218.02–1218.10	<DL	3	0.09	0.03	<DL	0.3	0.3	<DL	0.04	0.1	0.09	<DL	0.8	0.4	0.04	0.06	2	0.001
Tipton 153	1032.35–1032.48	<DL	6	0.5	0.3	<DL	3	1	0.01	0.2	0.7	0.2	<DL	2	0.9	2	0.5	9	0.003
	1033.88–1034.00	<DL	9	0.4	0.2	<DL	0.7	0.9	0.04	0.07	0.5	0.3	<DL	2	0.7	1	0.2	6	<0.001
	1066.00–1066.24	<DL	6	0.2	0.04	<DL	1	0.4	0.04	0.03	0.4	0.2	<DL	0.7	0.3	0.4	0.06	7	<0.001
	1067.92–1068.00	<DL	6	0.2	0.07		1	4	<DL	0.1	0.4	0.2	<DL	<DL	0.3	3	0.2	3	0.005
	1093.00–1093.19	<DL	4	0.9	0.07		1	0.5	0.01	0.4	0.7	0.08	<DL	<DL	1	2	0.1	7	0.005

Table A21. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2263.61–2263.77	<DL	3	0.02	0.2	<DL	1	0.5	<DL	0.4	0.1	0.6	<DL	<DL	0.3	0.2	0.2	1	<DL
	2267.05–2267.23		2	0.02	0.3	<DL	2	1	<DL	0.3	0.1	1	<DL	0.04	0.3	0.8	0.6	1	0.002
	2267.71–2267.84	<DL	0.6	0.007	0.06	<DL	0.4	0.1	0.04	0.03	0.09	0.07	<DL	<DL	0.2	0.07	0.1	0.2	<0.001
	2274.10–2274.18	<DL	3	0.02	0.2	<DL	1	0.3	<DL	0.4	0.08	0.4	<DL	<DL	0.4	0.1	0.3	0.8	<DL
	2281.82–2281.92	<DL	1	0.04	0.01	<DL	0.4	0.1	<DL	<DL	0.06	<DL	<DL	0.09	0.1	0.1	0.01	2	<DL
	2284.13–2284.24	<DL	2	<DL	0.02	<DL	1	0.2	<DL	<DL	0.06	<DL	<DL	<DL	0.2	0.1	0.04	2	<DL
	2288.49–2288.61	<DL	1	<DL	0.02	<DL	0.9	0.2	<DL	0.5	0.07	<DL	<DL	<DL	0.1	0.2	0.04	1	<DL
	2294.83–2294.98		2	<DL	0.07	<DL	4	<DL	<DL	1	0.08	0.1	<DL	<DL	0.5	0.5	0.1	0.5	<DL
	2297.19–2297.37	<DL	4	0.2	0.01	3	4	0.5	<DL	<DL	0.5	0.07	<DL	2	0.2	0.08	0.06	5	<DL
	2298.73–2298.82		2	<DL	0.09	<DL	3	<DL	<DL	1	0.06	0.09	<DL	<DL	0.5	0.3	0.1	0.4	<DL
	2303.99–2304.14		2	<DL	0.1	<DL	<DL	6	<DL	3	0.2	0.06	<DL	<DL	0.2	4	0.3	3	<DL
	2311.19–2311.25		2	0.2	0.1		<DL	0.4	<DL	2	0.1	0.03	<DL		0.4	2	0.3	0.9	<DL
	2314.05–2314.17		2	0.2	0.2	<DL	4	<DL	<DL	3	0.2	0.07	<DL		0.4	0.6	0.4	2	<DL
	2319.26–2319.37		2	<DL	0.2			<DL	<DL	7	0.2	0.02	<DL	<DL	0.3	0.7	0.3	4	<DL
	2322.61–2322.73		1	<DL	0.07		2	0.2	<DL	1	0.08	<DL	<DL	<DL	0.3	0.3	0.1	2	<DL
	2323.76–2323.95		2	0.1	0.07	<DL	3	<DL	<DL	1	0.09	0.06	<DL	<DL	0.4	0.7	0.2	0.5	<DL
	2325.88–2326.00		6	<DL	0.04	<DL	4	<DL	<DL	0.4	0.08	0.1	<DL	<DL	0.3	0.7	0.1	0.4	<DL
	2328.54–2328.59	<DL	3	0.3	0.03	<DL	0.8	0.6	0.06	<DL	0.2	0.07	<DL	1	0.5	0.2	0.1	5	<DL
	2330.41–2330.55	<DL	0.9	<DL	0.03	<DL	1	0.2	<DL	2	0.07	<DL	<DL	<DL	0.2	0.2	0.07	1	<DL
	2333.23–2333.30		2	<DL	0.2		<DL	<DL	<DL	3	0.08	0.2	<DL		0.6	0.7	0.6	0.9	<DL
	2338.75–2338.85	<DL	2	0.07	0.03	<DL	1	0.3	<DL	0.8	0.06	<DL	<DL	<DL	0.3	0.4	0.09	2	<DL
West Wandoan 1	1165.57–1165.65		8	0.9	0.2	<DL	<DL	39	0.03	0.06	0.9	0.6	<DL	<DL	1	20	0.6	8	0.01
	1174.24–1174.33		1	0.2	0.02	<DL	0.7	0.1	0.05	0.3	0.4	0.02	<DL	<DL	0.3	1	0.05	1	<0.001
	1197.76–1197.84		17	4	2	<DL	2	30	0.02	0.04	2	4	<DL	10	5	18	6	22	0.01
	1207.61–1207.68	<DL	1	0.03	0.02	<DL	0.1	3	0.02	0.05	0.1	0.02	<DL	0.3	0.06	0.6	0.1	0.7	0.004
	1225.70–1225.80		8	1	0.2	<DL	0.4	0.9	<DL	0.3	1	0.2	<DL	3	0.8	2	0.3	3	0.006
	1229.43–1229.50		40	13	1	<DL	2	18	<DL	0.06	3	2	<DL	13	2	14	2	45	0.009
Woleebee Creek GWB 4	1552.63–1553.00	<DL	4	0.6	0.6	<DL	2	0.7	<DL	0.3	0.4	0.7	<DL	<DL	1	2	0.9	6	<DL
	1570.46–1570.52	<DL	10	0.4	0.2	<DL	6	0.5	<DL	0.1	0.4	0.1	<DL	1	0.6	0.9	0.4	6	0.003
Median	All (n = 36)	<DL	2	0.1	0.08	<DL	1	0.4	<DL	0.3	0.1	0.09	<DL	<DL	0.4	0.7	0.2	2	<DL
	Sandstones (n = 30)	<DL	2	0.1	0.1	<DL	1	0.3	<DL	0.4	0.1	0.1	<DL	<DL	0.4	0.8	0.3	2	<DL
	Interbedded (n = 6)	<DL	3	0.1	0.03	<DL	0.6	0.4	0.03	0.03	0.2	0.07	<DL	0.8	0.3	0.1	0.08	4	<0.001
Standard Deviation	All (n = 36)	2	3	4	7	4	8	2	2	3	1	7	3	0.02	5	2	1	<DL	0.5
	Sandstones (n = 30)	3	3	3	7	4	9	2	2	3	1	7	3	0.01	5	3	1	<DL	<DL
	Interbedded (n = 6)	0.5	0.5	6	3	3	3	0.05	0.02	0.6	0.02	2	4	0.02	0.7	1	1	<DL	1

Shading indicates element was below detection limit in given rock samples.

Table A22. Sum of acid steps extraction of elements Al–Ni (%) relative to whole rock element abundance.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	13	1	22		<DL	10	14	25	5	44	9	4	15	<DL		<DL	13	12	0.2	<DL	
	1218.02–1218.10	0.1	1	3	7	14	16	3	0.2	3	10	0.4	0.1	0.2	0.02	<DL	<DL	2	3	0.09	<DL	3
Tipton 153	1032.35–1032.48	8	41	10	19	7	20	43	7	2	41	18	3	2	<DL		3	12	<DL	8	<DL	15
	1033.88–1034.00	2	17	6	22	36	23	18	3	5	23	3	0.6	1	<DL	<DL	3	3	<DL	2	<DL	13
	1066.00–1066.24	0.4	14	3	13	37	27	38	0.4	4	38	0.6	0.1	0.2	0.008	<DL	1	2	<DL	4	<DL	15
	1067.92–1068.00	0.5	1	1	9	19	17	8	2	1	11	8	0.3	6	0.03	<DL	<DL	8	9	0.2	<DL	10
	1093.00–1093.19	17	53	10		12	8	37	8	2	56	17	5	3	0.2		<DL	10	<DL	39		
	2263.61–2263.77	0.09	29	0.6	8	32		16	0.4	0.3	48	5	0.2	1	<DL	<DL	0.3	0.7	<DL	<DL	<DL	18
West Moonie 1	2267.05–2267.23	0.07	23	0.6	7	33	11	15	0.7	1	33	7	0.2	2	0.05	<DL	<DL	4	6		<DL	17
	2267.71–2267.84	0.4	12	6	11	40	22	38	0.3	1	17	2	0.06	0.3	<DL	<DL	0.1	0.6	<DL	1	<DL	37
	2274.10–2274.18	0.1	23	0.6	7	54		13	0.3	0.3	43	3	0.2	0.7	<DL	<DL	0.04	<DL	<DL	<DL	<DL	11
	2281.82–2281.92	0.08	27	2	17	48	27	34	0.1	1	22	0.6	0.06	0.3	<DL	<DL	0.9	0.5	<DL	7	<DL	36
	2284.13–2284.24	0.1	43	2	15	23		21	0.3	0.8	11	1	0.1	0.8	<DL	<DL	1	<DL	<DL	8	<DL	27
	2288.49–2288.61	0.1	44	1	11	48		32	0.3	0.5	60	0.8	0.09	0.7	<DL	<DL	0.2	<DL	<DL	<DL		31
	2294.83–2294.98	0.2	18	1	9	19		28	0.4	<DL	38		0.2	<DL	<DL	<DL	<DL	<DL	<DL		19	
	2297.19–2297.37	0.1	11	8	9	14	52	31	0.1	4	14	0.3	0.02	0.4	<DL	<DL	1	1	<DL	5	<DL	20
	2298.73–2298.82	0.2	20	1	4	20		16	0.2	4	44		0.2	<DL	<DL	<DL	<DL	<DL	<DL		17	
	2303.99–2304.14	0.2	19	2	4	19		52	5	4	62	42	0.3	4	<DL		<DL	15	27			36
	2311.19–2311.25	0.2	12	0.5	4			16	2	<DL	19	38	0.3	1	<DL		<DL	14	28			21
	2314.05–2314.17	0.7	26	2	5		2	21	2	<DL	54		0.5	<DL	<DL		<DL	9	<DL			36
	2319.26–2319.37	0.5	22	3	6			43	2	<DL	55		0.5	<DL	<DL		<DL	7	<DL			25
	2322.61–2322.73	0.2	15	3	7	16		20	0.6	0.5	61	11	0.3	2	<DL	<DL	3	2	<DL		<DL	10
	2323.76–2323.95	0.1	18	1	7	20		26	0.4	6	52	12	0.2	<DL	<DL	<DL	<DL	2	<DL			23
	2325.88–2326.00	0.1	6	2	8	41		32	0.4	2	45		0.1	0.4	<DL	<DL	<DL	3	14	22		24
	2328.54–2328.59	0.2	16	8	15	59	38	35	0.3	4	31	0.9	0.08	0.4	<DL	<DL	1	1	<DL	0.9	<DL	25
	2330.41–2330.55	0.1	19	2	5	17	3	17	0.5	0.4	69	<DL	0.2	1	<DL		0.4	<DL	<DL		<DL	22
	2333.23–2333.30	0.4	6	1	3			40	0.1	<DL	56		0.5	<DL	<DL		<DL	<DL	<DL			29
	2338.75–2338.85	0.1	19	2	14	71		17	0.3	1	69	<DL	0.2	1	<DL	<DL	2	<DL	<DL	<DL	<DL	11
	1165.57–1165.65	10		7			2	33	16	6	52	11	2	31	<DL	<DL			<DL	11	<DL	58
	1174.24–1174.33	11		10			8	33	4	3	60	10	3	4	<DL	<DL		4	<DL	11	<DL	24
	1197.76–1197.84	7		6			9	45	20	12	64	23	10	22	<DL	<DL		2	<DL	15	<DL	48
	1207.61–1207.68	0.2	19	3	14	33	20	29	0.4	3	24	3	0.1	2	0.009	<DL	0.2	2	<DL	4	<DL	21
	1225.70–1225.80	3		6			4	43	4	<DL	63	25	4	6	<DL	<DL			<DL	21	<DL	31
	1229.43–1229.50	1		8			0.5	46	19	29	41	17	6	9	<DL	<DL			<DL	13	<DL	42

Table A22. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Woleebee Creek GWB 4	1552.63–1553.00	12	71	17		37	4	50	10	2	53	16	4	6	<DL		<DL	7	<DL		<DL	
	1570.46–1570.52	0.8	47	9		50	3	37	2	1	31	10	0.6	2	<DL		<DL	<DL	<DL	17	<DL	
Median	All (n = 36)	0.2	18	3	7	19	3	31	0.5	2	44	3	0.2	1	<DL	<DL	<DL	2	<DL	0.2	<DL	21
	Sandstones (n = 30)	0.3	19	2	5	19	1	30	2	1	50	7	0.3	1	<DL	<DL	<DL	2	<DL	<DL	<DL	21
	Interbedded (n = 6)	0.2	13	4	12	35	25	33	0.3	3	20	0.8	0.09	0.4	0.004	<DL	0.6	1	<DL	3	<DL	20
Standard Deviation	All (n = 36)	0.9	<DL	<DL	2	5	6	4	12	3	5	2	2	2	9	2	<DL	0.04	0.03	6	6	8
	Sandstones (n = 30)	0.9	<DL	<DL	2	5	6	5	7	3	5	2	2	2	10	2	<DL	0.05	0.04	6	7	9
	Interbedded (n = 6)	0.6	<DL	<DL	0.4	0.9	3	0.4	12	3	2	0.05	0.3	0.6	1	0.2	<DL	0.01	0.007	0.4	0.1	2

Shading indicates element was below detection limit in given rock samples.

Table A23. Sum of acid steps extraction of elements P–Zr (%) relative to whole rock element abundance.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	16	3	5	7	2	11	0.1	1	11	6	<DL	19	9	2	6	22	0.07
	1218.02–1218.10	<DL	16	0.4	0.2	6	3	0.9	<DL	0.2	3	0.3	<DL	4	2	0.07	0.4	7	0.03
	1032.35–1032.48	<DL	39	1	2	<DL	14	6	0.05	2	10	2	<DL	12	3	8	2	39	0.09
Tipton 153	1033.88–1034.00	<DL	41	1	0.7	<DL	5	3	0.1	0.3	5	1	<DL	8	3	2	0.7	31	0.02
	1066.00–1066.24	<DL	46	0.9	0.1	<DL	7	1	0.09	0.1	11	0.8	<DL	3	1	0.7	0.2	25	0.02
	1067.92–1068.00	<DL	14	0.3	0.1		3	6	<DL	0.6	2	0.3	<DL	0.4	1	3	0.4	8	0.04
	1093.00–1093.19	<DL	23	2	1		7	5	0.06	5	4	2	<DL	5	4	9	2	26	0.2
	2263.61–2263.77	<DL	35	0.08	0.9	<DL	9	1	<DL	4	1	3	<DL	0.3	2	0.5	1	11	<DL
West Moonie 1	2267.05–2267.23		15	0.05	0.5	<DL	7	3	<DL	3	0.8	2	<DL	0.04	0.8	1	1	7	0.02
	2267.71–2267.84	<DL	41	0.007	0.2	<DL	0.4	1	0.09	0.09	10	0.6	<DL	<DL	1	0.2	0.4	7	0.02
	2274.10–2274.18	<DL	22	0.06	0.6	4	14	0.3	<DL	3	0.6	1	<DL	0.06	2	0.3	1	7	<DL
	2281.82–2281.92	<DL	38	0.2	0.08	<DL	12	0.5	<DL	<DL	4	0.1	<DL	1	1	0.2	0.1	20	<DL
	2284.13–2284.24	<DL	63	0.2	0.2	<DL	11	0.2	<DL	0.5	0.8	<DL	<DL	<DL	2	0.4	0.3	14	<DL
	2288.49–2288.61	<DL	44	0.2	0.2	<DL	8	0.2	<DL	3	0.8	<DL	<DL	<DL	1	0.5	0.2	9	<DL
	2294.83–2294.98		33	0.2	0.1	<DL	11	3	<DL	11	0.6	0.2	<DL	<DL	2	1	0.2	2	0.008
	2297.19–2297.37	<DL	25	1	0.05	3	9	0.7	<DL	<DL	8	0.1	<DL	7	0.8	0.1	0.2	14	<DL
	2298.73–2298.82		40	0.1	0.2	<DL	6	4	<DL	10	0.6	0.2	<DL	<DL	2	0.7	0.3	5	0.01
	2303.99–2304.14		29	<DL	0.3	<DL	7	13	<DL	26	1	0.2	<DL	<DL	0.7	5	0.9	8	0.01
	2311.19–2311.25		21	0.5	0.2		1	5	<DL	8	0.8	0.07	<DL		1	2	0.4	2	0.005
	2314.05–2314.17		26	0.5	0.7	<DL	14	17	<DL	23	1	0.4	<DL		1	1	1	16	0.02
	2319.26–2319.37		26	<DL	0.6			11	<DL	53	1	0.2	<DL	<DL	0.8	2	1	12	0.01

Table A23. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
West Moonie 1	2322.61–2322.73		32	0.2	0.4		6	0.2	<DL	11	1	0.3	<DL	<DL	2	0.9	0.6	7	<DL
	2323.76–2323.95		42	0.2	0.2	<DL	6	5	<DL	10	0.7	0.1	<DL	<DL	2	1	0.4	7	0.007
	2325.88–2326.00		38	0.09	0.1	<DL	18	2	<DL	4	0.5	0.2	<DL	<DL	1	2	0.3	5	0.003
	2328.54–2328.59	<DL	27	1	0.1	5	16	1	0.1	0.2	8	0.2	<DL	5	2	0.3	0.3	13	<DL
	2330.41–2330.55	<DL	25	0.2	0.2	<DL	5	0.2	<DL	19	0.8	<DL	<DL	<DL	2	0.6	0.4	3	<DL
	2333.23–2333.30		34	0.1	0.5		<DL	5	<DL	17	0.7	0.3	<DL		1	1	1	2	<DL
	2338.75–2338.85	<DL	39	0.5	0.3	<DL	8	0.3	<DL	5	0.9	0.2	<DL	<DL	3	0.8	0.4	24	<DL
West Wandoan 1	1165.57–1165.65		40	2	3	2	7	42	0.07	3	2	4	<DL	4	5	24	2	27	0.07
	1174.24–1174.33		36	2	3	3	6	3	0.1	1	3	4	<DL	6	5	4	2	17	0.02
	1197.76–1197.84		59	6	7	0.7	17	33	0.05	2	5	8	<DL	19	11	21	9	51	0.1
	1207.61–1207.68	<DL	17	0.5	0.2	4	4	4	0.02	0.1	3	0.3	<DL	7	3	1	0.8	22	0.01
	1225.70–1225.80		44	1	4	<DL	32	3	<DL	8	2	4	<DL	9	6	5	2	29	0.05
	1229.43–1229.50		70	13	3	<DL	27	21	<DL	8	4	4	<DL	19	3	16	3	74	0.05
Woleebee Creek GWB 4	1552.63–1553.00	<DL	36	1	5	<DL	9	5	0.02	4	5	5	<DL	9	5	9	5	40	0.05
	1570.46–1570.52	<DL	34	0.6	1	<DL	18	2	<DL	2	1	0.7	<DL	5	2	2	1	40	0.04
Median	All (n = 36)	<DL	35	0.5	0.4	<DL	7	3	<DL	3	2	0.3	<DL	0.4	2	1	0.8	13	0.01
	Sandstones (n = 30)	<DL	35	0.3	0.6	<DL	8	4	<DL	4	1	0.4	<DL	0.05	2	2	1	13	0.01
	Interbedded (n = 6)	<DL	26	0.7	0.2	4	6	1	0.05	0.1	8	0.3	<DL	5	2	0.3	0.3	13	0.01
Standard Deviation	All (n = 36)	7	10	12	14	18	16	5	2	6	10	13	20	0.04	6	17	7	<DL	2
	Sandstones (n = 30)	7	11	13	14	16	17	5	2	6	11	13	20	0.03	7	18	7	<DL	2
	Interbedded (n = 6)	1	0.9	12	10	10	7	0.1	0.03	2	0.05	11	16	0.05	0.8	6	5	<DL	2

Shading indicates element was below detection limit in given rock samples.

Table A24. Sum of all three steps extraction of elements Al–Ni (%) relative to whole rock element abundance.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
Chinchilla 4	1215.47–1215.59	13	1	29		<DL	20	15	25	18	44	9	4	15	<DL		7	30	13	0.2	<DL	
	1218.02–1218.10	0.1	1	5	7	14	52	3	0.2	5	10	0.4	0.1	0.2	0.02	<DL	0.5	7	5	0.09	<DL	3
Tipton 153	1032.35–1032.48	8	41	13	19	7	35	43	7	9	41	18	3	2	<DL		3	19	<DL	10	<DL	15
	1033.88–1034.00	2	17	8	22	36	40	19	3	9	23	3	0.6	1	<DL	4	4	6	<DL	2	100	13
	1066.00–1066.24	0.4	14	4	13	37	50	40	0.4	5	38	0.6	0.1	0.2	0.008	1	2	3	<DL	10	36	16
	1067.92–1068.00	0.5	1	2	9	19	26	8	2	4	11	8	0.3	6	0.03	<DL	<DL	11	9	0.2	<DL	10
	1093.00–1093.19	17	56	25		12	34	38	8	9	56	17	5	3	0.2		<DL	20	<DL	40		

Table A24. Cont.

Well	Depth (mRT)	Al	As	Ba	Be	Bi	Ca	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	K	Li	Mg	Mn	Mo	Na	Ni
West Moonie 1	2263.61–2263.77	0.09	29	2	8	32		41	0.4	2	59	5	0.2	1	<DL	1	0.8	3	7	2	12	49
	2267.05–2267.23	0.07	23	2	7	33	17	24	0.7	2	35	7	0.2	2	0.05	1	<DL	5	6		<DL	25
	2267.71–2267.84	0.4	12	8	11	40	52	44	0.3	3	17	2	0.06	0.4	0.02	2	0.8	2	<DL	15	61	42
	2274.10–2274.18	0.1	23	2	8	54		36	0.3	1	52	3	0.2	0.8	<DL	1	0.4	2	4	0.4	<DL	32
	2281.82–2281.92	0.08	28	5	17	48	83	50	0.1	4	23	0.6	0.06	0.4	<DL	0.9	2	2	<DL	21	23	47
	2284.13–2284.24	0.1	45	8	15	23		32	0.3	4	11	1	0.2	1	<DL	8	2	0.9	<DL	15	32	34
	2288.49–2288.61	0.1	46	6	11	48		43	0.3	3	65	0.8	0.1	0.8	<DL	8	0.8	0.5	<DL	9		40
	2294.83–2294.98	0.6	24	3	9	19		41	1	6	58		0.6	<DL	<DL	34	<DL	5	<DL			27
	2297.19–2297.37	0.1	11	9	9	14	96	43	0.2	5	14	0.3	0.03	0.6	<DL	2	3	3	<DL	10	53	26
	2298.73–2298.82	0.3	24	3	4	20		23	0.5	8	53		0.5	<DL	<DL	16	<DL	2	<DL			22
	2303.99–2304.14	0.4	19	4	4	19		60	5	9	75	42	0.3	4	<DL		<DL	18	27			41
	2311.19–2311.25	0.3	15	3	4			24	2	5	31	38	0.4	1	<DL		<DL	19	28			27
	2314.05–2314.17	0.8	31	5	5		23	27	2	5	74		0.5	<DL	<DL		<DL	17	<DL			42
	2319.26–2319.37	0.5	27	7	6			48	2	4	66		0.5	<DL	<DL		<DL	12	<DL			29
	2322.61–2322.73	0.2	20	9	7	16		52	0.8	3	74	11	0.5	2	<DL	32	4	5	3		64	14
	2323.76–2323.95	0.3	24	3	7	20		33	0.9	10	60	12	0.6	<DL	<DL	20	<DL	6	<DL			29
	2325.88–2326.00	0.2	8	4	8	41		46	0.5	6	51		0.2	0.4	<DL	16	<DL	6	14	40		31
	2328.54–2328.59	0.2	17	11	15	59	71	36	0.3	5	31	0.9	0.08	0.5	<DL	1	2	2	<DL	9	35	26
	2330.41–2330.55	0.1	23	6	5	17	12	37	0.5	2	93	<DL	0.3	1	<DL		1	2	<DL		21	29
	2333.23–2333.30	0.7	12	4	3			50	0.5	4	94		1	<DL	<DL		<DL	8	<DL			38
	2338.75–2338.85	0.1	20	7	14	71		28	0.3	5	78	<DL	0.2	1	<DL	14	2	1	<DL	16	41	14
West Wandoan 1	1165.57–1165.65	10		10			8	56	16	14	57	11	2	31	<DL	67			<DL	30	81	70
	1174.24–1174.33	11		12			30	36	4	11	61	10	3	4	<DL	61		13	<DL	28	58	27
	1197.76–1197.84	7		7			54	60	20	20	68	23	10	22	<DL	80		8	<DL	45	78	56
	1207.61–1207.68	0.2	19	4	14	33	55	70	0.4	4	24	3	0.1	2	0.009	1	0.6	5	12	6	36	41
	1225.70–1225.80	3		8			10	55	4	7	76	25	4	6	<DL	63			<DL	46	51	39
	1229.43–1229.50	1		10			2	59	20	34	53	17	6	9	0.2	69			<DL	36	57	56
Woleebee Creek GWB 4	1552.63–1553.00	12	77	25		37	11	59	10	11	54	16	4	6	<DL		<DL	24	<DL		99	
	1570.46–1570.52	0.8	48	18		50	10	57	2	5	31	10	0.6	2	<DL		<DL	4	<DL	36	<DL	
Median	All (n = 36)	0.4	20	6	7	19	11	41	0.8	5	53	3	0.4	1	<DL	1	<DL	5	<DL	4	6	28
	Sandstones (n = 30)	0.5	23	6	5	19	5	41	2	6	57	7	0.5	1	<DL	1	<DL	6	<DL	1	<DL	29
	Interbedded (n = 6)	0.2	13	7	12	35	54	42	0.3	5	20	0.8	0.09	0.5	0.008	1	1	3	<DL	10	36	26
Standard Deviation	All (n = 36)	2	31	23	8	6	6	8	26	7	7	2	2	2	9	2	0.02	0.05	0.04	6	6	15
	Sandstones (n = 30)	2	33	25	8	7	6	8	19	6	7	2	2	2	10	2	0.02	0.05	0.05	6	7	16
	Interbedded (n = 6)	1	19	0.7	0.6	0.9	3	2	16	7	3	0.05	0.3	0.6	1	0.2	<DL	0.01	0.007	0.4	0.1	4

Shading indicates element was below detection limit in given rock samples.

Table A25. Sum of all three steps extraction of elements P–Zr (%) relative to whole rock element abundance.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Chinchilla 4	1215.47–1215.59	<DL	16	16	5	29	2	11	0.1	1	23	6	<DL	52	9	2	6	22	0.07
	1218.02–1218.10	<DL	16	1	0.2	33	3	0.9	<DL	0.3	9	0.3	<DL	11	2	0.07	0.4	8	0.03
Tipton 153	1032.35–1032.48	<DL	39	9	2	<DL	19	6	0.05	2	26	2	<DL	24	3	8	2	39	0.09
	1033.88–1034.00	<DL	41	4	0.7	9	6	3	0.1	0.3	12	1	<DL	14	3	2	0.7	32	0.02
	1066.00–1066.24	<DL	46	2	0.1	11	8	1	0.09	0.1	20	0.8	<DL	7	1	0.7	0.2	25	0.02
	1067.92–1068.00	<DL	14	1	0.1		3	6	<DL	0.6	5	0.3	<DL	3	1	3	0.4	8	0.04
	1093.00–1093.19	<DL	23	10	1		8	5	0.06	5	23	2	<DL	29	4	9	2	26	0.2
	2263.61–2263.77	<DL	36	0.4	0.9	23	10	1	<DL	4	4	3	<DL	6	2	0.5	1	31	<DL
West Moonie 1	2267.05–2267.23		15	0.3	0.5	14	8	3	<DL	3	3	2	<DL	4	0.8	1	1	12	0.03
	2267.71–2267.84	<DL	41	2	0.2	<DL	3	1	0.09	0.09	29	0.6	<DL	3	1	0.2	0.4	7	0.02
	2274.10–2274.18	<DL	22	0.3	0.6	7	16	0.3	<DL	3	2	1	<DL	3	2	0.3	1	21	<DL
	2281.82–2281.92	<DL	38	1	0.08	14	14	0.5	0.004	<DL	12	0.1	<DL	5	1	0.2	0.1	25	<DL
	2284.13–2284.24	<DL	65	2	0.2	11	15	0.3	0.002	0.5	4	<DL	<DL	10	2	0.4	0.3	24	<DL
	2288.49–2288.61	<DL	45	1	0.2	9	12	0.2	<DL	3	4	<DL	<DL	4	1	0.5	0.2	16	<DL
	2294.83–2294.98		34	4	0.3	<DL	19	3	<DL	12	6	0.4	<DL	0.5	3	2	0.3	4	0.07
	2297.19–2297.37	<DL	25	3	0.05	17	13	0.7	<DL	<DL	15	0.1	<DL	14	0.8	0.1	0.3	15	<DL
	2298.73–2298.82		41	1	0.4	<DL	10	4	<DL	10	4	0.4	<DL	1	2	1	0.4	7	0.05
	2303.99–2304.14		29	2	0.4	<DL	7	13	<DL	27	8	0.3	<DL	<DL	0.9	6	0.9	12	0.04
	2311.19–2311.25		22	4	0.2		1	5	<DL	8	6	0.07	<DL		1	3	0.5	4	0.02
	2314.05–2314.17		27	5	0.8	<DL	19	17	<DL	23	9	0.4	<DL		1	2	1	34	0.08
	2319.26–2319.37		26	2	0.6			11	<DL	53	7	0.2	<DL	<DL	0.9	2	1	19	0.01
	2322.61–2322.73		34	4	0.7		10	0.5	0.004	11	8	0.7	0.1	4	2	1	0.7	14	0.05
	2323.76–2323.95		43	3	0.4	<DL	10	5	<DL	10	6	0.4	<DL	<DL	2	2	0.6	12	0.1
	2325.88–2326.00		38	1	0.1	<DL	27	2	<DL	4	3	0.3	<DL	9	2	2	0.3	8	0.01
	2328.54–2328.59	<DL	27	3	0.1	11	24	1	0.1	0.2	14	0.2	<DL	8	2	0.3	0.3	13	<DL
	2330.41–2330.55	<DL	26	2	0.3	11	8	0.4	0.002	20	5	0.09	<DL	4	2	1	0.4	6	0.04
	2333.23–2333.30		37	6	0.7		<DL	5	<DL	18	11	0.7	<DL		2	3	1	6	0.1
	2338.75–2338.85	<DL	39	3	0.3	27	11	0.4	<DL	5	4	0.2	<DL	6	3	0.9	0.4	47	<DL
	1165.57–1165.65		40	14	3	69	11	42	0.07	3	7	4	<DL	19	6	24	2	30	0.07
	1174.24–1174.33		36	21	3	87	9	3	0.1	1	8	4	<DL	17	6	4	2	17	0.02
	1197.76–1197.84		59	33	7	89	27	33	0.05	2	14	8	<DL	51	11	22	9	56	0.1
	1207.61–1207.68	<DL	17	2	0.2	31	5	4	0.02	0.1	8	0.3	<DL	17	3	1	0.8	30	0.01
	1225.70–1225.80		44	10	4	99	44	3	<DL	8	8	4	<DL	39	6	5	2	31	0.05
	1229.43–1229.50		71	32	3	91	40	21	<DL	9	10	4	<DL	48	3	17	3	77	0.1

Table A25. Cont.

Well	Depth (mRT)	P	Pb	Rb	REE	S	Sb	Sc	Si	Sn	Sr	Th	Ti	Tl	U	V	Y	Zn	Zr
Woleebee Creek GWB 4	1552.63–1553.00	<DL	36	11	5	22	15	5	0.02	4	17	5	<DL	37	5	10	5	43	0.05
	1570.46–1570.52	<DL	34	4	1	26	23	2	<DL	2	5	0.7	<DL	23	2	2	1	52	0.04
Median	All (n = 36)	<DL	36	3	0.5	11	10	3	<DL	3	8	0.5	<DL	7	2	2	0.8	20	0.03
	Sandstones (n = 30)	<DL	36	4	0.6	9	11	4	<DL	4	7	0.7	<DL	5	2	2	1	22	0.04
	Interbedded (n = 6)	<DL	26	2	0.2	14	7	1	0.05	0.1	15	0.3	<DL	9	2	0.3	0.3	14	0.01
Standard Deviation	All (n = 36)	7	10	15	17	23	16	4	2	15	10	13	20	0.04	6	17	10	<DL	29
	Sandstones (n = 30)	7	11	14	17	21	17	5	2	16	11	13	20	0.03	7	18	10	<DL	31
	Interbedded (n = 6)	4	0.9	20	14	10	9	0.1	0.03	4	0.09	11	16	0.05	0.8	6	7	<DL	12

Shading indicates element was below detection limit in given rock samples.

References

1. Working Group III of the Intergovernmental Panel on Climate Change (IPCC). *Special Report on Carbon Dioxide Capture and Storage*; Metz, B., Davidson, O., de Coninck, H., Loos, M., Meyer, L., Eds.; Cambridge University Press: New York, NY, USA, 2005; 442p.
2. Bachu, S. CO₂ storage in geological media: Role, means, status and barriers to deployment. *Prog. Energy Combust. Sci.* **2008**, *34*, 254–273. [\[CrossRef\]](#)
3. IEA. *Energy Technology Perspectives 2012: Pathways to a Clean Energy System*; International Energy Agency: Paris, France, 2012; 686p, ISBN 978-92-64-17488-7.
4. Dawson, G.K.W.; Pearce, J.K.; Biddle, D.; Golding, S.D. Experimental mineral dissolution in Berea Sandstone reacted with CO₂ or SO₂–CO₂ in NaCl brine under CO₂ sequestration conditions. *Chem. Geol.* **2015**, *399*, 87–97. [\[CrossRef\]](#)
5. Pearce, J.K.; Kirste, D.; Dawson, G.K.W.; Farquhar, S.M.; Biddle, D.; Golding, S.D.; Rudolph, V. SO₂ impurity impacts on experimental and simulated CO₂–water–reservoir rock reactions at carbon storage conditions. *Chem. Geol.* **2015**, *399*, 65–86. [\[CrossRef\]](#)
6. Pearce, J.K.; Dawson, G.W.; Brink, F.; Southam, G.; Paterson, D.; Hall, N.; Heath, R.; Greer, D.; Kirste, D.; Golding, S.D. Impure CO₂ storage reactions of sandstone, mudstone and carbonate cemented cores: Experimental CO₂SO₂NO_xO₂ reaction metal mobilization and fate. *Int. J. Coal Geol.* **2023**, *277*, 104352. [\[CrossRef\]](#)
7. Licbinska, M.; Labus, K.; Klempa, M.; Matysek, D.; Vasek, M. Laboratory experiments and geochemical modeling of gas–water–rock interactions for a CO₂ storage pilot project in a carbonate reservoir in the Czech Republic. *Minerals* **2024**, *14*, 602. [\[CrossRef\]](#)
8. Pearce, J.K.; Kirste, D.; Dawson, G.K.W.; Rudolph, V.; Southam, G.; Brink, F.; Paterson, D.J.; Hall, N.; Sommacal, S.; Golding, S.D. Pure CO₂ and impure CO₂–SO₂–NO–O₂ reactions with carbon storage site underlying seals: Coaly mudstones and carbonate cemented sandstones. *Sci. Total Environ.* **2025**, *963*, 178391. [\[CrossRef\]](#)
9. Golding, S.D.; Pearce, J.K.; Dawson, G.K.W.; Kirste, D.M. *Mobilisation and Fate of Heavy Metals Released by the GHG Stream: ANLEC Project 7-1115-0236 Final Report*; ANLEC R&D: Canberra, ACT, Australia, 2019; 160p. Available online: <https://espace.library.uq.edu.au/view/UQ:f6e01dd> (accessed on 12 January 2026).
10. Dawson, G.K.W.; Kirste, D.M.; Pearce, J.K.; Golding, S.D. *South Surat Metal Mobilisation and Fate of Heavy Metals Released: ANLEC Project 7-0320-C323 Final Report*; ANLEC R&D: Canberra, ACT, Australia, 2023; 158p. Available online: <https://espace.library.uq.edu.au/view/UQ:003c0d2> (accessed on 12 January 2026).
11. Dai, Z.; Viswanathan, V.; Xiao, T.; Hakala, A.; Lopano, C.; Guthrie, G.; McPherson, B. Chapter 5—Reactive transport modeling of geological carbon storage associated with CO₂ and brine leakage. In *Science of Carbon Storage in Deep Saline Formations: Process Coupling Across Time and Spatial Scales*; Newell, P., Ilgen, A.G., Eds.; Elsevier: Amsterdam, The Netherlands, 2019; pp. 89–116. ISBN 978-0-12-812752-0. [\[CrossRef\]](#)
12. Filgueiras, A.V.; Lavilla, I.; Bendicho, C. Chemical sequential extraction for metal partitioning in environmental solid samples. *J. Environ. Monit.* **2002**, *4*, 823–857. [\[CrossRef\]](#) [\[PubMed\]](#)
13. Rao, C.R.M.; Sahuquillo, A.; Lopez Sanchez, J.F. A review of the different methods applied in environmental geochemistry for single and sequential extraction of trace elements in soils and related materials. *Water Air Soil Pollut.* **2008**, *189*, 291–333. [\[CrossRef\]](#)
14. Sahuquillo, A.; López-Sánchez, J.F.; Rubio, R.; Rauret, G.; Thomas, R.P.; Davidson, C.M.; Ure, A.M. Use of a certified reference material for extractable trace metals to assess sources of uncertainty in the BCR three-stage sequential extraction procedure. *Anal. Chim. Acta* **1999**, *382*, 317–327. [\[CrossRef\]](#)
15. Pueyo, M.; Mateu, J.; Rigol, A.; Vidal, M.; López-Sánchez, J.F.; Rauret, G. Use of the modified BCR three-step sequential extraction procedure for the study of trace element dynamics in contaminated soils. *Environ. Pollut.* **2008**, *152*, 330–341. [\[CrossRef\]](#)
16. Xiangdong, L.; Coles, B.J.; Ramsey, M.H.; Thronton, L. Sequential extraction of soils for multielement analysis by ICP-AES. *Chem. Geol.* **1995**, *124*, 109–123. [\[CrossRef\]](#)
17. Tessier, A.; Campbell, P.G.C.; Bisson, M. Sequential extraction procedure for the speciation of particulate trace metals. *Anal. Chem.* **1979**, *51*, 844–851. [\[CrossRef\]](#)
18. Gupta, S.K.; Chen, K.Y. Partitioning of trace metals in selective chemical fractions of nearshore sediments. *Environ. Lett.* **1975**, *10*, 129–158. [\[CrossRef\]](#) [\[PubMed\]](#)
19. Rapin, F.; Förstner, U. Sequential leaching techniques for particulate metal speciation: The selectivity of various extractants. In *Proceedings of the 4th International Conference on Heavy Metals in the Environment, Heidelberg, Germany, 6–9 September 1983*; CEP Consultants Ltd.: Edinburgh, UK, 1983; pp. 1074–1077.
20. Ahnstrom, Z.S.; Parker, D.R. Development and assessment of a sequential extraction procedure for the fractionation of soil cadmium. *Soil Sci. Soc. Am. J.* **1999**, *63*, 1650–1658. [\[CrossRef\]](#)
21. Almond, C.A. *GSQ Record 1985/34: GSQ Chinchilla 4, Preliminary Lithological Log and Composite Log, CR041858*; GSQ Open Data Portal, Queensland Government: Brisbane, QLD, Australia, 1985. Available online: <https://geoscience.data.qld.gov.au/data/report/cr041858> (accessed on 12 January 2026).

22. Nightingale, J. PL 198, AEL Tipton 153, Well Completion Report, CR070191; GSQ Open Data Portal, Queensland Government: Brisbane, QLD, Australia, 2012. Available online: <https://geoscience.data.qld.gov.au/data/report/cr070191> (accessed on 12 January 2026).
23. Heath, R.; Hall, N. EPQ10—West Moonie-1 Well Completion Report, CR121956; GSQ Open Data Portal, Queensland Government: Brisbane, QLD, Australia, 2020. Available online: <https://geoscience.data.qld.gov.au/data/report/cr121956> (accessed on 12 January 2026).
24. CTSCo. EPQ 7—West Wandoan-1 Well Completion Report, CR098874; GSQ Open Data Portal, Queensland Government: Brisbane, QLD, Australia, 2020. Available online: <https://geoscience.data.qld.gov.au/data/report/cr098874> (accessed on 12 January 2026).
25. Mountford, A. PL 276, QGC Woleebee Creek GW 4, Well Completion Report, CR103564; GSQ Open Data Portal, Queensland Government: Brisbane, QLD, Australia, 2017. Available online: <https://geoscience.data.qld.gov.au/data/report/cr103564> (accessed on 12 January 2026).
26. File: Australia States Blank.png. Available online: https://commons.wikimedia.org/wiki/File:Australia_states_blank.png (accessed on 12 November 2025).
27. Australian Stratigraphic Units Database. Geoscience Australia. Available online: <https://www.ga.gov.au/data-pubs/datastandards/stratigraphic-units> (accessed on 12 January 2026).
28. Wainman, C.C.; McCabe, P.J.; Crowley, J.L.; Nicoll, R.S. U-Pb zircon age of the Walloon Coal Measures in the Surat Basin, southeast Queensland: Implications for paleogeography and basin subsidence. *Aust. J. Earth Sci.* **2015**, *62*, 807–816. [\[CrossRef\]](#)
29. Gu, Y. Automated scanning electron microscope based mineral liberation analysis – an introduction to JKMRC/FEI mineral liberation analyser. *JMMCE* **2003**, *2*, 33–41. [\[CrossRef\]](#)
30. Miller, P.R.; Reid, A.F.; Zuiderwyk, M.A. QEM*SEM image analysis in the determination of modal assays, mineral association and mineral liberation. In Proceedings of the XIV International Mineral Processing Congress, Toronto, ON, Canada, 17–23 October 1982; CIM: Montreal, QC, Canada, 1983; pp. VIII.3.1–VIII.3.20.
31. Quevauviller, P.; Rauret, G.; Griepink, B. Single and sequential extraction in sediments and soils. *Int. J. Anal. Chem.* **1992**, *51*, 231–235. [\[CrossRef\]](#)
32. Zeyen, N.; Wang, B.; Wilson, S.; Paulo, C.; Stubbs, A.R.; Power, I.M.; Steele-MacInnis, M.; Lanzirrotti, A.; Newville, M.; Paterson, D.J.; et al. Cation exchange in smectites as a new approach to mineral carbonation. *Front. Clim.* **2022**, *4*, 913632. [\[CrossRef\]](#)
33. Davies, M.; Figueroa, L.; Wildeman, T.; Bucknam, C. The oxidative precipitation of thallium at alkaline pH for treatment of mining influenced water. *Mine Water Environ.* **2016**, *35*, 77–85. [\[CrossRef\]](#)
34. Migaszewski, Z.M.; Gałuszka, A. Abundance and fate of thallium and its stable isotopes in the environment. *Rev. Environ. Sci. Biotechnol.* **2021**, *20*, 5–30. [\[CrossRef\]](#)
35. Xu, H.; Luo, Y.; Wang, P.; Zhu, J.; Yang, Z.; Liu, Z. Removal of thallium in water/wastewater: A review. *Water Res.* **2019**, *165*, 114981. [\[CrossRef\]](#)
36. Medlin, W.L. Thermoluminescent properties of calcite. *J. Chem. Phys.* **1959**, *30*, 451–458. [\[CrossRef\]](#)
37. Deer, W.A.; Howie, R.A.; Zussman, J. Carbonates. In *Rock-Forming Minerals. Vol. 5 Non-Silicates*, 5th ed.; Longmans, Green and Co., Ltd.: London, UK, 1967; pp. 226–227.
38. Shaw, D. Mobility of arsenic in saturated, laboratory test sediments under varying pH conditions. *Eng. Geol.* **2006**, *85*, 158–164. [\[CrossRef\]](#)
39. Ahrens, L.H. The unique association of thallium and rubidium in minerals. *J. Geol.* **1948**, *56*, 578–590. Available online: <https://www.jstor.org/stable/30080849> (accessed on 12 January 2026). [\[CrossRef\]](#)
40. Ellis, B.R.; Crandell, L.E.; Peters, C.A. Limitations for brine acidification due to SO₂ co-injection in geologic carbon sequestration. *Int. J. Greenh. Gas Control* **2010**, *40*, 575–582. [\[CrossRef\]](#)
41. Spycher, N.F.; Llanos, E.M.; Vu, H.P.; Haese, R.R. Reservoir scale reactive-transport modeling of a buoyancy-controlled CO₂ plume with impurities (SO₂, NO₂, O₂). *Int. J. Greenh. Gas Control* **2019**, *89*, 40–51. [\[CrossRef\]](#)
42. Crandell, L.E.; Ellis, B.R.; Peters, C.A. Dissolution potential of SO₂ Co-injected with CO₂ in geologic sequestration. *Environ. Sci. Technol.* **2010**, *44*, 349–355. [\[CrossRef\]](#)

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