Table A3. Fuzzy analysis for gold prospectivity

Critical processes	*Appendix figure number*	*Input predictors map*	*Fuzzy-membership value map weight*	*Confidence factor*	*Rationale for expert-knowledge based weight (fuzzy membership values)*	*Rationale for confidence factor*
Gold deposits are widely distributed in Archean, Proterozoic and Phanerozoic terranes. Gold deposits show a spatial and temporal association with orogensis, and are considered to have formed in response to deformation and regional metamorphic events (Groves et al. 1998). Orogenic gold deposits are characteristically associated with deformed and metamorphosed mid-crustal blocks, often occurring adjacent to major crustal structures. Most major orogenic events in Australia (excluding granulite terranes) have generated gold occurrences and/or deposits. The distinguishing differences between productive and non-productive metamorphic terranes appear to relate largely to the structural capacity to focus deep fluids and the efficacy of traps.						
Source predictor maps						
Mineralizing fluids could be derived granitic intrusions.						
	A37	Distance to granitic rock	7	8	Possible source	Interpreted bed rock geology used (GSWA, 2010); 25 km buffer
Predictor maps for active pathways						
The most likely critical pathways for transporting mineralization fluids are faults. The ore fluids are widely leached from crustal rocks and deposited by large-scale hydrothermal systems involving extensive plumbing systems at or above the brittle–ductile transition (Groves & Phillips 1987; Groves 1993; Phillips & Powell 1993; Groves et al. 1998).						
	A4	Distance to crustal-scale fault	9	8.5	These crustal-scale faults were probably active during Giles events. Crustal scale faults are the most important as they drive most of the mineralized fluid (McCuaig et al., 2010; Joly et al., 2010)	Crustal-scale faults were extracted from the interpreted structural geology data and buffered to 10 km. They were identified by 2D gravity and magnetic modeling
	A38	Distance to late Giles (LGE2 and LGE2_MP) Event 2 + syn-Alcurra (SA) structures	9	9	Permeable structures for gold fluid movement. The hydrothermal breccia at the known Handpump gold deposit is associated with late Giles 2 Events.	Large-scale faults were extracted from the interpreted structural geology data and buffered to 5 km.
	A39	Distance to early + mid + late Giles (other than LGE2 and LGE2_MP) Event structures	8.5	9	Permeable structures for gold fluid movement. Gold deposits in the region are hydrothermal in origin; all structures are considered potential fluid conduits	Large-scale faults were extracted from the interpreted structural geology data and buffered to 5 km.
	A7	Distance to Petermann Orogeny (PO) + Alice Springs Orogeny (ASO) structures	8.5	9	Permeable structures for gold fluid movement. Long-lived structures are very good proxies for gold mineralization.	Large-scale faults were extracted from the interpreted structural geology data and buffered to 5 km.
	A8	Distance to Mount West Orogeny (MWO) + Musgrave Orogeny (MO) structures	8	9	Permeable structures for gold fluid movement. However, Mount West Orogeny and Musgrave Orogeny predate the Handpump deposit	Large-scale faults were extracted from the interpreted structural geology data and buffered to 5 km.
	A40	Gold content over all faults	9	6	Pathways associated with anomolously high Au values indicate fluid movement	Au values interpolation from GSWA geochemical dataset. Main issues are data coverage and correlation of gold content correctly with a structure and some values are not known.
Predictor maps for physical traps						
The favoured traps for deposition of orogenic gold occured in brittle–ductile shear zones, stockworks and breccias (Groves et al. 1998; Groves et al. 2000; Hagemann & Cassidy 2000). Physical throttles are localities into which the mineralization fluids are focused, and, in the presence of favourable geochemical environment, precipitate the metal. Potential barriers to fluid flow, such as regional seals (stratigraphic, unconformities), regional anticlines, etc., where these zones have been breached, and localized damage zones on regional faults are essential ingredient.						
	A41	Competency contrast across geological contact	8	7	Related to fracturing and opening up of spaces for fluid in-flow and ponding	Interpreted relative values from Grove's (1993) chart, not directly measured + interpreted bed rock geology (GSWA, 2010b)
	A42	Geological contact density	7	8	More geological contacts means more lithological contrasts. Multilayer competency differences strongly influence fracture sizes and density distributions. Higher geological contact densities means that there is an increased probability of competency differences, and hence increased fault/fracture densities and dilation features	Geological units were extracted using spatial query from GSWA (2010b). The CF is higher than both of the competency contrast maps as tha data are coming from the geolocal map.
	A43	Geological contact density weighted by competency contrast	9	7	See above - higher certainty regarding the existence of competency contrasts; i.e. each geological contact was then attributed with the difference in the rheology of the lithological units on each side.	Interpreted relative values from Grove's (1993) chart, not directly measured + interpreted mapped geology (GSWA, 2010b).
	A11	Fault density	7.5	9	Conceptually should have a good correlation with mineralisation. Increased fault density implies greater structural complexity and more space, leading to fluid ponding	All faults were extracted from the interpreted bed rock strcutural data (interpreted magnetic dataset) and buffered to 4 km.
	A12	Distance to fault intersection	7.5	9	Good sites for fluid ponding	All faults were extracted from the interpreted bed rock strcutural data (interpreted magnetic dataset) and buffered to 4 km.

Critical processes	*Appendix figure number*	*Input predictors map*	*Fuzzy-membership value map weight*	*Confidence factor*	*Rationale for expert-knowledge based weight (fuzzy membership values)*	*Rationale for confidence factor*
	A13	Fault intersection density	8	9	Indicate greater structural complexity; fluid focusing	All faults were extracted from the interpreted bed rock strcutural data (interpreted magnetic dataset) and buffered to 4 km.
	A44	Distance to fold axis	8	9	Good sites for fluid ponding	Folds were extracted from the interpreted bed rock strcutural data (interpreted magnetic dataset) and buffered to 4 km.
Predictor maps for chemical traps						
The favoured traps for deposition of orogenic gold are Fe-rich or graphite-rich (reduced) rocks. Gold deposition is inferred to result from catastrophic changes in physical conditions, abrupt changes in chemical gradient, phase separation and/or fluid mixing.						
	A46	Presence of Fe-rich rocks (magnetite presence in P_-WKg1-am unit)	9	8	Higher reactivity across Fe-rich sediment contacts. Desulfidation of hydrothermal fluids as a result of reactions with iron oxides in the wall rocks; breakdown of gold sulfide complexes, precipitation of gold and Fe sulfides.	Iron rich units were extracted using spatial query from GSWA (2010b)
	A45	Presence of felsic volcanic rocks, Mount Palgrave Group: P_-BE; P_-CA; P_-PG; P_-PU; P_-TL	9	8	Contrasting lithology in the Palgrave Group due to alternating iron-rich sediments/felsic and volcanic rock could have provided the perfect chemical host. Handpump is only known depsoit – in a hydrothermal breccia located at the base of a volcanic unit.	Gold host units were extracted using spatial query from GSWA (2010b)
	A47	Chemical reactivity	9	7	Rocks with high Mg/(Mg+Fe+Ca) ratio are more prone to sulfidation reactions	All units using Groves (1993) chart with values of 4 and 5 (10 km buffer zone)
	A48	Chemical reactivity contrast	7	7	Conceptually a good predictor in terms of Fe for sulfidation reactions - see above. The problem with this map is it shows chemical contrast, NOT reactivity.	Interpreted relative values from Grove's chart, not directly measured
	A49	Chemical contact density weighted by reactivity contrast	7	7	Conceptually a good predictor in terms of Fe for sulfidation reactions - see above for contact density weighted by competency contrast	Interpreted relative values from Grove's (1993) chart, not directly measured
	A9	Distance to dyke	9	8	Higher reactivity across dolerite contacts - higher iron contents and reactivity	Query from interpreted magnetic dataset + GSWA dataset. 1 km buffer
	A50	Au content	9	6	Direct indicator of gold presence	Au values from the GSWA state geochemistry (GSWA, 2010a) and GA Ozchem (GA, 2007) datasets were transformed to standardized Z scores (Singer and Kouda, 2001) and interpolated. The Z scores at which studentized contrast maximized were used as the anomaly thresholds (see Cheng, 2007 for details). CF low because we have interpolated the data in the whole study and some values are not known.
	A51	As content	7	6	Indicator of gold presence	As values from the GSWA state geochemistry (GSWA, 2010a) and GA Ozchem (GA, 2007) datasets were transformed to standardized Z scores (Singer and Kouda, 2001) and interpolated. The Z scores at which studentized contrast maximized were used as the anomaly thresholds (see Cheng, 2007 for details). CF low because we have interpolated the data in the whole study and some values are not known.
	A52	Sb content	7	6	Indicator of gold presence	Sb values from the GSWA state geochemistry (GSWA, 2010a) and GA Ozchem (GA, 2007) datasets were transformed to standardized Z scores (Singer and Kouda, 2001) and interpolated. The Z scores at which studentized contrast maximized were used as the anomaly thresholds (see Cheng, 2007 for details). CF low because we have interpolated the data in the whole study and some values are not known.
	A53	Fe content	8	6	For desulfidation and breaking down gold complexes due to fluid-wall rock reactions	Fe values from the GSWA state geochemistry (GSWA, 2010a) and GA Ozchem (GA, 2007) datasets were transformed to standardized Z scores (Singer and Kouda, 2001) and interpolated. The Z scores at which studentized contrast maximized were used as the anomaly thresholds (see Cheng, 2007 for details). CF low because we have interpolated the data in the whole study and some values are not known.

Critical processes	*Appendix figure number*	*Input predictors map*	*Fuzzy-membership value map weight*	*Confidence factor*	*Rationale for expert-knowledge based weight (fuzzy membership values)*	*Rationale for confidence factor*
Undefinable predictor maps						
		Alkaline rocks	8	8	There is a growing evidence for link to previously melt-metasomatised mantle source. These rocks could be indicator of trans-lithospheric faults (Mutschler and Mooney, 1993).	Alkaline rocks were extracted using spatial query from GSWA (2010b). Alkaline rocks include lamprophyres, lamproites, kimberlites, syenites, carbonatites, phonolite.
		Hydrothermal breccia	9	9	An indicator of potential fluid pathway, as observed at Handpump.	Only one tourmaline breccia (on the Mount Eveline geological map) and few minuscule fault breccias have been described in the GSWA database, which are not sufficient to create a useful predictor map.