

## 201982: gold nugget, 47K Patch prospect (Sholl Terrane, northwest Pilbara Craton)

<b>Sample type</b>	Gold nugget
<b>Total weight</b>	1.4 g
<b>Sample location</b>	47K Patch, about 32 km south of Karratha
<b>Coordinates</b>	MGA Zone 50, 492217E 7676570N
<b>Datum</b>	GDA94
<b>1:250 000 map sheet</b>	YARRALLOOLA (SF 50-6)
<b>1:100 000 map sheet</b>	PINDERI HILLS (2255)
<b>Tenement</b>	E 47/3443; P 47/2039-S
<b>Collector</b>	Artemis Resources Limited



### Location and sampling

The sample was provided by Artemis Resources Limited in January 2019. The gold nugget came from a colluvial/eluvial patch (compiled out of the GSWA 1: 100 000 scale geological series maps; GSWA, 2020) at the 47K Patch prospect in the northwest Pilbara region (Artemis Resources Limited 2019, written comm., 11 January).

### Geological context

The 47K Patch prospect is located about 6 km east of the Maitland Shear Zone, interpreted as a low angle thrust, in the Sholl greenstone belt of the Sholl Terrane in the northwest Pilbara Craton (Hickman, 2016; GSWA, 2020). The local bedrock includes metamorphosed pillow and massive basalt, dolerite sills, and minor felsic tuff, sandstone, shale, and chert of the 3117–3115 Ma Bradley Basalt. Metamorphosed massive hornblende monzogranite and syenogranite of the c. 2930 Ma Yannery Granite are exposed about 0.7 km east-southeast of the sample locality. Northeasterly striking Proterozoic dolerite dykes transect the area (Hickman, 2021, 2022; GSWA, 2020).

Artemis Resources Limited recovered around 6 kg (193 oz) of nuggety and fine-grained gold from colluvial-eluvial scree at the 47K Patch prospect in 2018, during shallow surface rehabilitation work. The gold is believed to have been shed from bedrock conglomerate-hosted mineralization (Artemis Resources Limited, 2018).

The nearest regolith landform — mapped by GSWA at the 1: 100 000 scale — is an alluvial-fluvial unit comprising unconsolidated gravel, sand, silt, and clay in active, but poorly defined drainage channels on floodplains (GSWA, 2020).

### Methodology

The gold sample was photographed and weighed, and its overall morphology and external features, such as colour, roundness, surface relief, coatings, mineral inclusions and mineral assemblages were recorded using visual morphometry. The raw surface of the sample was analysed using scanning electron microscopy with energy dispersive X-ray system (SEM-EDS). The sample was then mounted in epoxy resin, cut and polished, and the gold grain microstructure, inclusions, and silver content were examined using reflected-light microscopy and SEM-EDS. Gold microchemistry was determined by laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), calibrated against certified gold reference materials (CRM; Murray, 2009). The sample was ablated in triplicate along 0.5 mm-long traverses, and average values calculated for elements present in the CRM. The gold surface was repolished after laser ablation, etched with aqua regia, and internal structure examined using reflected-light microscopy. Details of this method are described in Hancock and Beardsmore (2020).

### Morphology

The gold nugget had original dimensions of 11 x 6 x 2 mm, and a perfectly rounded and flattened ('melon seed') shape, with a smooth, shiny, brown-orange surface with dark brown patches of Fe-oxide minerals (Fig. 1).

### SEM-EDS analysis of raw surfaces

The brown-orange colour of the gold nugget surface arises from a fine film of Fe-Al clays. The microsurface of gold is porous and spongy with some scratches (Fig. 2). There is no detectable Ag on the surface.



**Figure 1. Sample 201982: gold nugget, 47K Patch prospect**

### Optical microscopy of polished surfaces

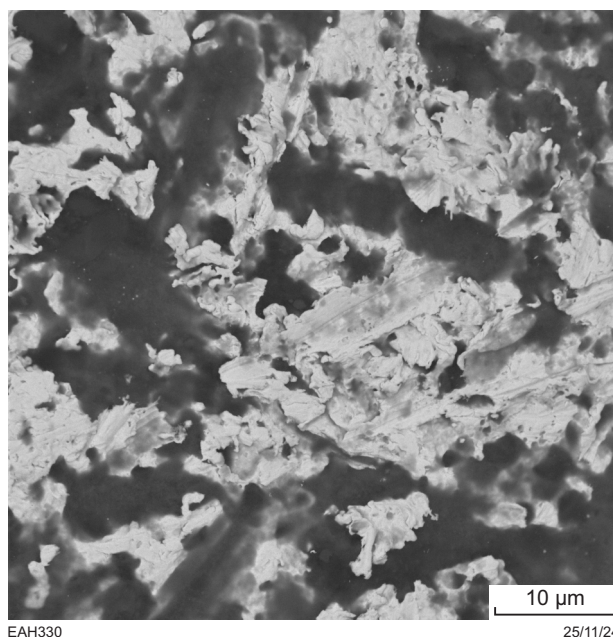
In the polished section, the gold nugget is revealed to be coherent, but with many intergranular veinlets and large voids, now filled with abundant disseminated gold nanoparticles in a matrix of clay and porous Fe-oxide minerals. The latter forming more compacted seals where the voids open to the nugget surface (Fig. 3a,b). Some discontinuous rims of Ag depletion up to 100  $\mu\text{m}$  thick are observed along veinlets and the nugget outer rim (Fig. 3a,b).

### SEM-EDS analysis of polished surfaces

The bulk of the gold nugget contains 6% Ag. Gold nanoparticles are evenly disseminated through the clay and Fe-oxide-filled voids but are less abundant and finer grained in the compacted Fe-oxides close to the nugget surface (Fig. 4a). The analysed Fe-oxides are amorphous Fe–Al–Si mix. A single rounded pit detected on the polished gold surface probably contained an air bubble or fluid inclusion (Fig. 4b).

### LA-ICP-MS analysis

Ag, Cu and Hg were consistently detected within the gold nugget in concentrations higher than the instrument detection limit, and probably occur as limited solid solutions in the gold. The gold contains 6% Ag, and variable amounts of Cu (381–488 ppm) and Hg (177–303 ppm) (Table 1). Mg, Al, Ti, Cr, Mn, Ni, Zn, Sr, and Pd were also consistently detected at low (in sub-ppm) concentrations (Table 2), possibly occurring in micro- and nano-inclusions. High abundances of lithophile elements (e.g. Mg, Al, and Si) were detected in the ablation Traverse 1, suggesting the presence of a silicate mineral micro-inclusion.



**Figure 2. Backscattered electron image of surface of part of sample 201982: gold nugget, 47K Patch prospect**

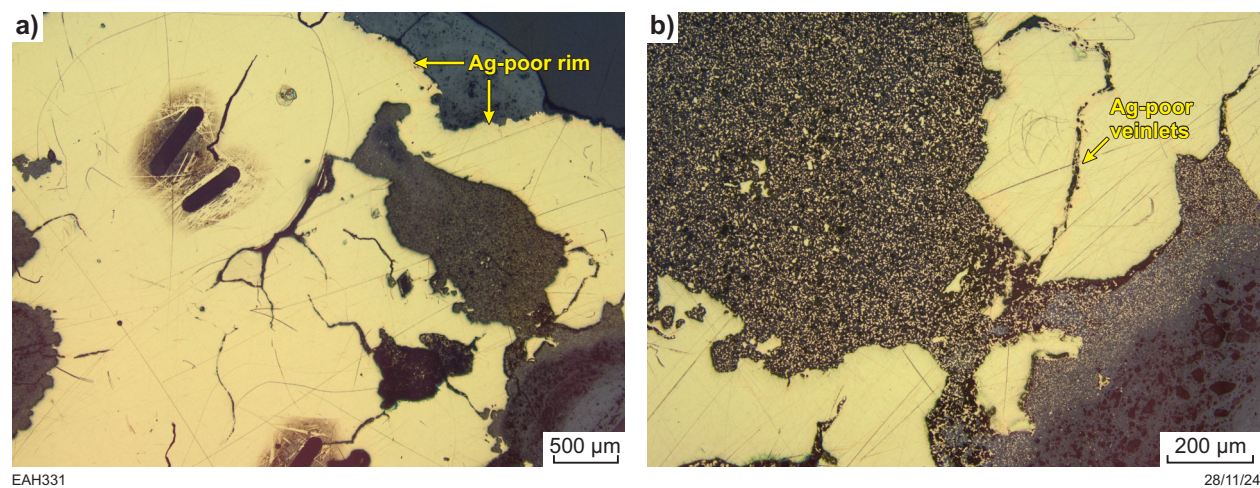
### Acid etching

The gold nugget microstructure is polycrystalline with irregular crystals size and shape (Fig. 5a). The interior of the nugget comprises relatively large crystals with irregular and curved edges and incoherent twin planes (Fig. 5a,b). Some crystals are partly granulated. The outermost part of the nugget comprises a completely recrystallized rim up to 150  $\mu\text{m}$  thick of much smaller crystals (Fig. 5b). All these characteristics are typical for deformed and recrystallized gold.

### Interpretation

The gold nugget is mostly coherent, polycrystalline, and contains 6% Ag and moderate amounts of Cu and Hg, suggesting primary crystallization from hydrothermal fluids. Subsequent deformation and hydrothermal and diagenetic/supergene alterations removed Ag by dissolution along intergranular veinlets, recrystallized gold along its rim, and created voids that subsequently filled with ferruginous clay and gold nanoparticles. The surficial film of Fe–Al-clays and clusters of Fe-oxide minerals formed during the latest period of transformation in the regolith.

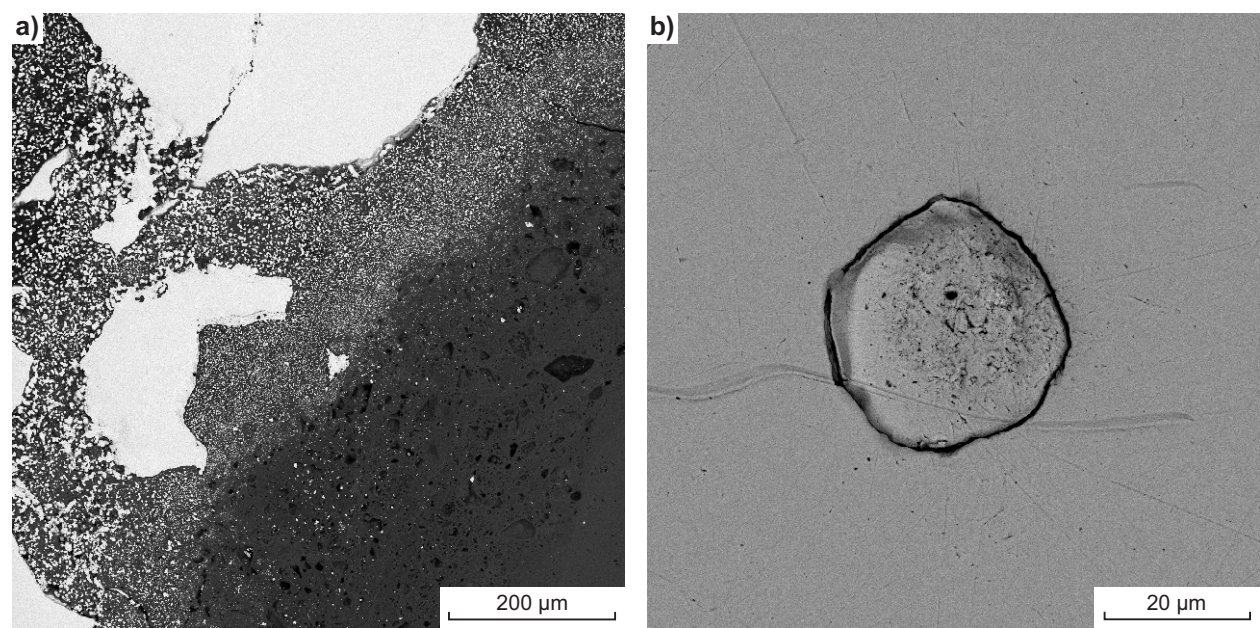




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**Figure 3.** Reflected-light photomicrographs of polished surface of sample 201982: gold nugget, 47K Patch prospect. Dark, elongate lines are laser ablation tracks produced during LA-ICP-MS analyses



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**Figure 4.** Backscattered electron images of polished surfaces of selected areas of sample 201982: gold nugget, 47K Patch prospect

**Table 1.** LA-ICP-MS data for main elements (above detection limit) in three traverses for sample GSWA 201982: gold nugget, 47K Patch prospect

Ag (%)	Cu (ppm)	Hg (ppm)	Other elements (ppm <sup>1</sup> ) <sup>2</sup>
6.2	437	303	Ca
5.7	381	232	
6.0	488	177	

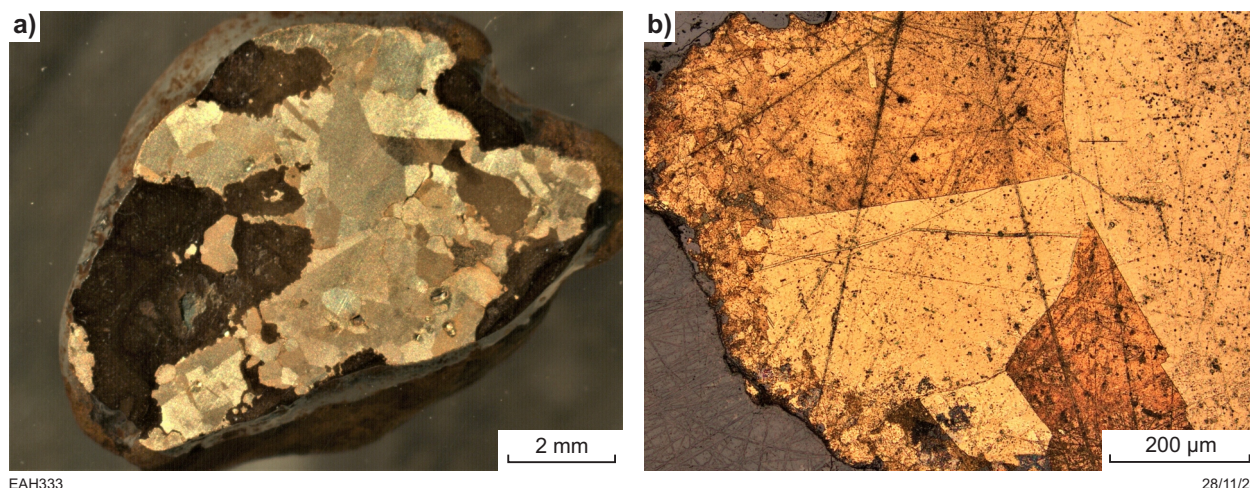
**NOTES:** 1 See Table 2 for concentrations and detection limit  
2 Results are only shown where standards are available for the element

Table 2. LA-ICP-MS compositional data for sample GSWA 201982: gold nugget, 47K Patch prospect

Laser ablation track	Unit	<sup>7</sup> Li	<sup>9</sup> Be	<sup>11</sup> B	<sup>23</sup> Na	<sup>25</sup> Mg	<sup>27</sup> Al	<sup>29</sup> Si	<sup>44</sup> Ca	<sup>45</sup> Sc	<sup>49</sup> Ti	<sup>51</sup> V	<sup>53</sup> Cr	<sup>55</sup> Mn	<sup>57</sup> Fe	<sup>59</sup> Co	<sup>60</sup> Ni	<sup>65</sup> Cu
1	cps					267	318	376	47		8	5	4	13		4	6	30435
2	cps					93	163	49	6	1	6		13	30		3	11	26531
3	cps					94	221				8		3	4		7	6	34029
1	ppm					2.60	0.43		6.18		0.14		0.07	0.04			0.10	437
2	ppm					0.91	0.22		0.93		0.12		0.21	0.08			0.17	381
3	ppm					0.92	0.30				0.14		0.06	0.01			0.10	488
DL*	ppm					3.3	1.3		2.6		1.5		1.7	1.1	3.4		2.9	1.5
Laser ablation track	Unit	<sup>66</sup> Zn	<sup>69</sup> Ga	<sup>72</sup> Ge	<sup>75</sup> As	<sup>82</sup> Se	<sup>85</sup> Rb	<sup>88</sup> Sr	<sup>89</sup> Y	<sup>90</sup> Zr	<sup>93</sup> Nb	<sup>98</sup> Mo	<sup>101</sup> Ru	<sup>103</sup> Rh	<sup>108</sup> Pd	<sup>109</sup> Ag	<sup>111</sup> Cd	<sup>115</sup> In
1	cps	29	2			3		13						2	6	7425808	3	2
2	cps	24					9	4						1	5	6837231	3	1
3	cps	18				3		3						2	9	7155393	2	3
1	ppm	0.74				0.87									0.10	62200		
2	ppm	0.63													0.09	57300		
3	ppm	0.47				0.87									0.13	59900		0.02
DL*	ppm	5.3			2	3.1								1.5	1.8	2.4		
Laser ablation track	Unit	<sup>120</sup> Sn	<sup>121</sup> Sb	<sup>126</sup> Te	<sup>133</sup> Cs	<sup>138</sup> Ba	<sup>139</sup> La	<sup>140</sup> Ce	<sup>141</sup> Pr	<sup>145</sup> Nd	<sup>151</sup> Eu	<sup>157</sup> Gd	<sup>159</sup> Tb	<sup>162</sup> Dy	<sup>165</sup> Ho	<sup>167</sup> Er	<sup>169</sup> Tm	<sup>172</sup> Yb
1	cps	58	4	1	4	10		1										
2	cps		4		2	4							1					
3	cps	5		1	3	1		2							1			
1	ppm	0.42	0.04															
2	ppm		0.04															
3	ppm	0.04																
DL*	ppm	1.6	2.8	5.6														
Laser ablation track	Unit	<sup>175</sup> Lu	<sup>178</sup> Hf	<sup>181</sup> Ta	<sup>182</sup> W	<sup>185</sup> Re	<sup>189</sup> Os	<sup>193</sup> Ir	<sup>195</sup> Pt	<sup>202</sup> Hg	<sup>205</sup> Tl	<sup>208</sup> Pb	<sup>209</sup> Bi	<sup>232</sup> Th	<sup>238</sup> U			
1	cps									81928			4					
2	cps			1			2			62606			4					
3	cps			1						47729		2						
1	ppm									303			0.03					
2	ppm									232			0.03					
3	ppm									177		0.02						
DL*	ppm								2.5	2.5		1.5	2.2					

NOTES: cps, count per second; ppm, parts per million; DL, detection limit

\*Detection limits have been determined using AuRM Reference Gold Standards (London Bullion Market Association). Standards were analysed nine times each and an average 2σ (95% Confidence Interval) Limit of Detection determined. Some results given in the text are quoted as values that are below the detection limit for these analytes. These values must be considered as "for information" only.



**Figure 5.** Reflected-light photomicrographs, after repolishing and acid etching, of sample and part of sample 201982: gold nugget, 47K Patch prospect

## Acknowledgements

The authors gratefully acknowledge Michael Verrall (CSIRO) for his help with the SEM-EDS operation and data interpretation. We thank Professor John Watling for discussions to improve the LA-ICP-MS data interpretation.

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## Recommended reference for this publication

Hancock, EA, Blay, OA and Beardsmore, TJ 2025, 201982: gold nugget, 47K Patch prospect; GSWA Mineralogy Record 16: Geological Survey of Western Australia, 5p.