

**Serpentinites of Different Tectonic Origin in an Exhumed Subduction Complex  
(New Caledonia, SW Pacific)**

Natalie H. Raia<sup>1</sup>, Donna L. Whitney<sup>1</sup>, Christian Teyssier<sup>1</sup>, Stéphane Lesimple<sup>2</sup>

<sup>1</sup>Department of Earth & Environmental Sciences, University of Minnesota, Minneapolis, MN 55455, USA

<sup>2</sup>Service Géologique de la Nouvelle-Calédonie, Direction de l'Industrie, des Mines et de l'Energie, BP M2 –  
98849 Nouméa CEDEX, New Caledonia.

**Contents of this file**

Text S1

Figures S1 to S6

Tables S1 to S3

**Introduction**

The supporting information includes detailed descriptions of whole rock geochemistry analytical methods and inter-lab comparisons of measured major and trace compositions for two samples. This file also contains representative thin section scans, additional Raman spectra, and a table containing additional mineralogical descriptions and field context.

## **Text S1. Major element preparation methods for Washington State University and Franklin & Marshall College**

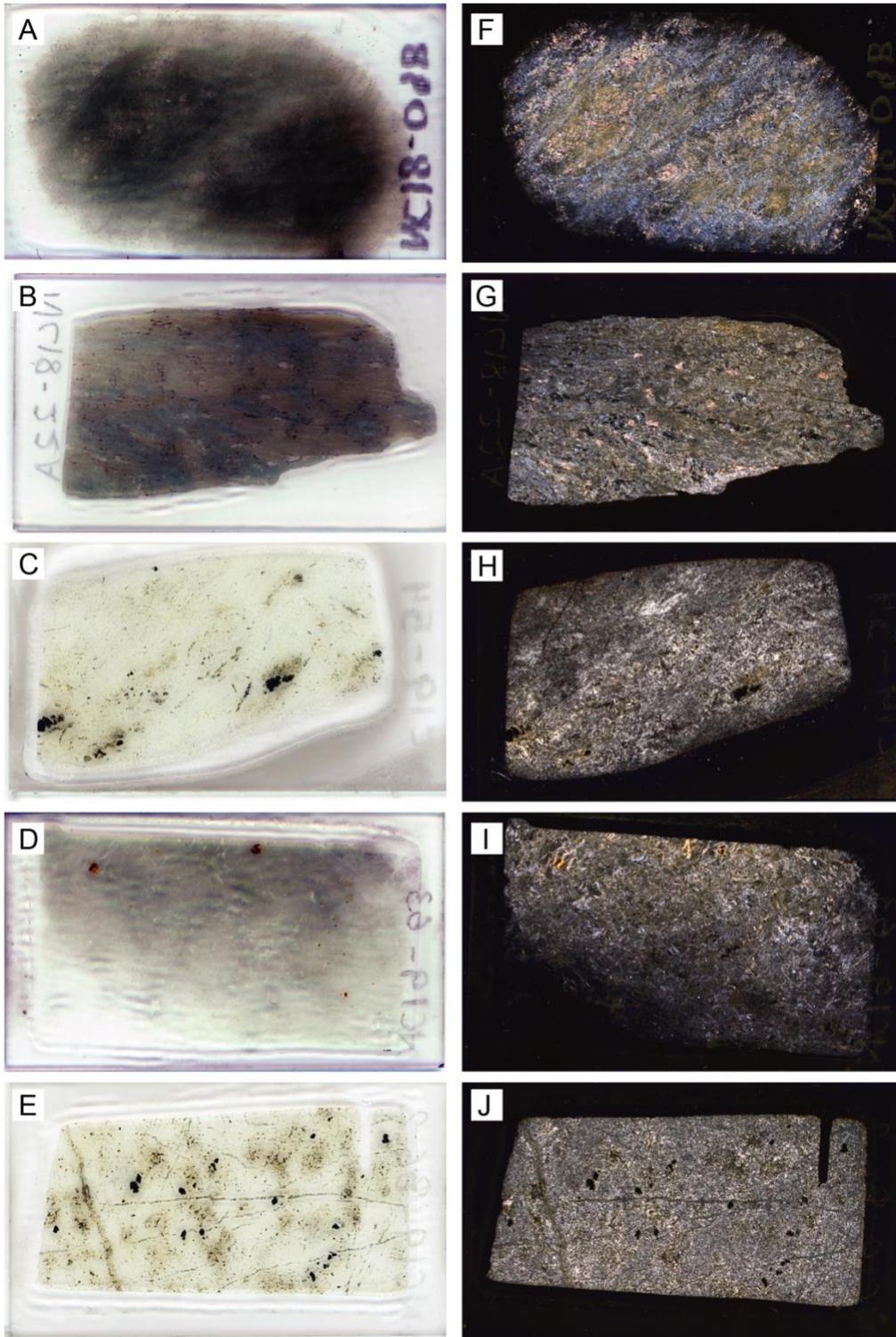
Franklin & Marshall College: Fifty to sixty grams of representative, clean (exterior weathered surfaces removed) whole rock chips for each sample were sent to Franklin & Marshall College for analysis. Samples were further ground in a mullite grinder and then powdered via shatterbox in a ceramic container (to eliminate the possibility of tungsten carbide contamination). Approximately 1 gram of rock powder is weighed into a clean and dry porcelain crucible for each sample, and placed in a muffle furnace for 90 minutes at 950° C. The crucibles are removed and placed immediately in a desiccator. After reaching room temperature, samples are weighed again. Powders are placed in a small vial and stored in the desiccator- this is the starting material for XRF analysis.

To prepare the XRF disc ("bead"), 3.6000 ± 0.0002 g of lithium tetraborate is weighed into a clean glass bottle. Next, 0.4000 ± 0.0001 g of anhydrous rock powder are added. The bottle is gently mixed by hand for 20-30 seconds and then the bottle is mixed for an additional 10 minutes in a Spex Mixer Mill. The homogenized powder is transferred to a 25 cc. 95% Pt-5% Au crucible and 3-4 drops of a 2% solution of Lithium Iodide are added. The crucible is mounted on a standard ring stand and covered with a 95% Pt-5% Au lid with a flat and polished bottom. The crucible is heated over a Meeker burner for 12-15 minutes (sample is vigorously stirred at the 5-minute and 10-minute marks, and once again before pouring). Once the sample is fully convecting, the Pt lid is removed and heated over a second Meeker burner until it is red hot. The crucible is removed from the ring stand and rapidly emptied onto the hot Pt lid. Immediately after, the crucible is dropped into a warm beaker containing 4N HCl (enough to cover the crucible). The Pt lid is set on a flat slab of polished granite, left to cool (3-5 min), labeled on the side of the disc that is exposed to air, and stored in a desiccator to await analysis.

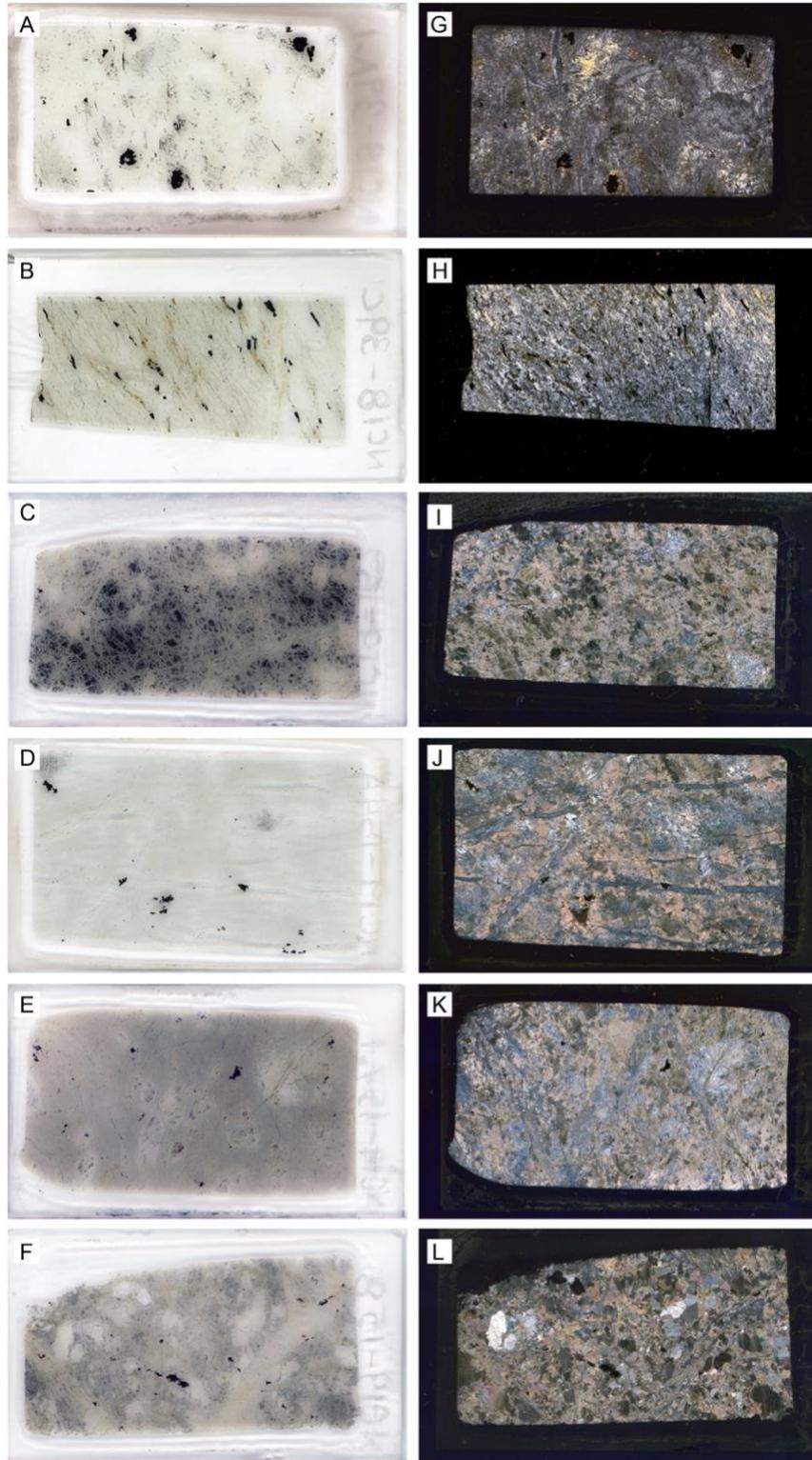
Washington State University: The following description summarizes preparation details most relevant for this paper. The full method is outlined in Johnson et al. (1999). Approximately 50 grams of representative, clean (exterior weathered surfaces removed) whole rock chips for each sample were transported to Washington State University. A standard volume of chips (enough to fit in a 2 oz Solo clear plastic soufflé cup; ~30 g) was ground in a swing mill with tungsten carbide surfaces for 2 minutes. The contamination of W and Co in the Rock Labs WC ring mills is well-documented, and these elements were not measured. Contamination of Nb and Ta, which is typically of the same order of magnitude as the precision of the method, is discussed in the procedures of Johnson et al. (1999). Next, 3.5 g of sample powder was weighted into a plastic mixing jar with 7.0 g of pure dilithium tetraborate and mixed using a vortex mixer until homogenized. For serpentinites, a high-purity silica powder was added at the weighing stage to prevent crystallization of the bead and to bring the Mg concentration within the lab's calibration range. The result is back calculated to remove the known amount of silica.

Homogenized sample-flux mixtures are placed into graphite crucibles placed on a silica tray and loaded into a muffle furnace (the furnace is just large enough to contain the tray). After the preheated furnace returns to 1000° C after loading, fusion takes five minutes. The silica plate with graphite crucibles is removed from the oven and allowed to

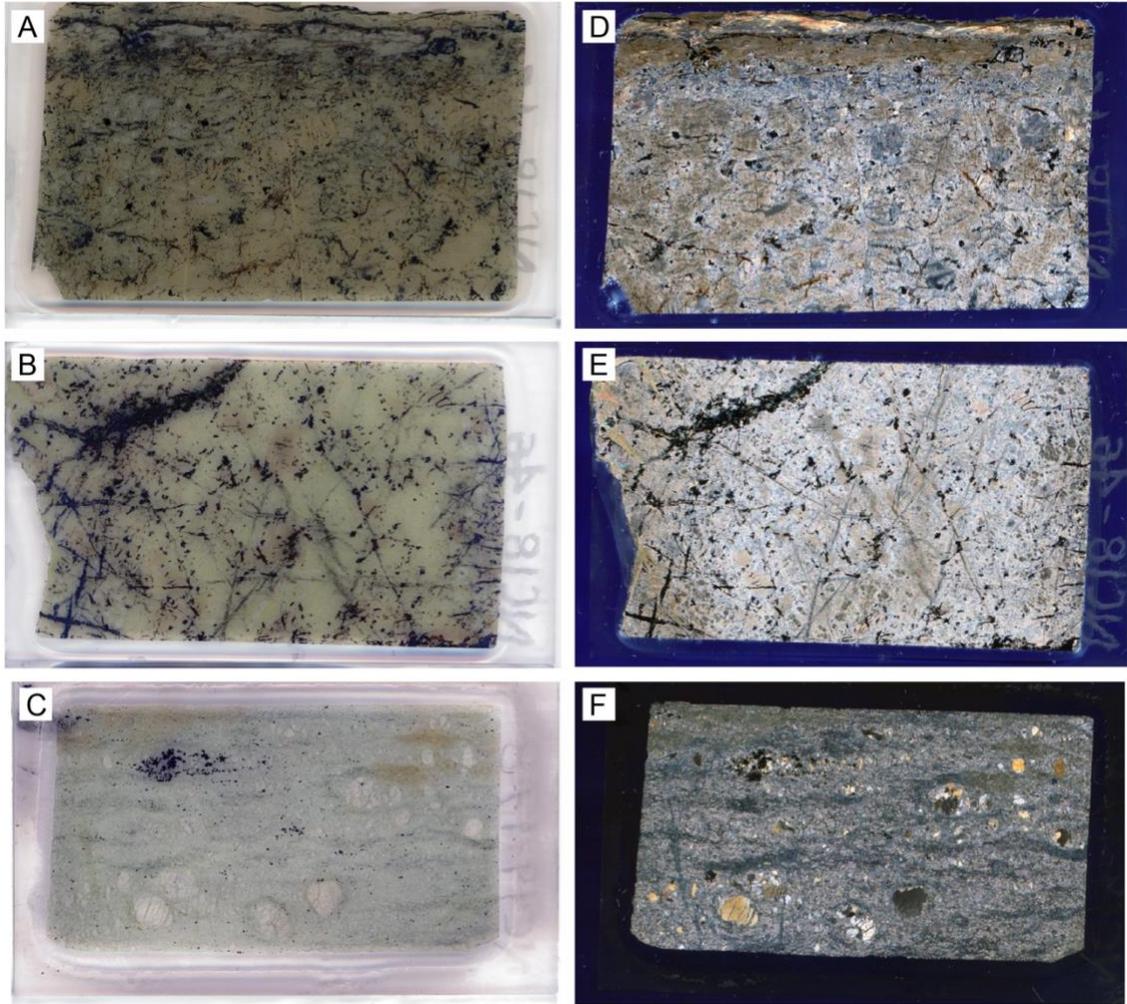
cool. Each beach is reground in the swing mill for 35 seconds. This glass powder is put back into the crucibles and refused for five minutes. After the second fusion, the beads are labeled with an engraver, and the lower flat surface is ground on 600 silicon carbide grit and finished briefly on a glass plate with 600 grit and alcohol (to remove any metal from the grinding wheel). The bead is then washed in an ultrasonic cleaner, rinsed in alcohol and wiped dry.



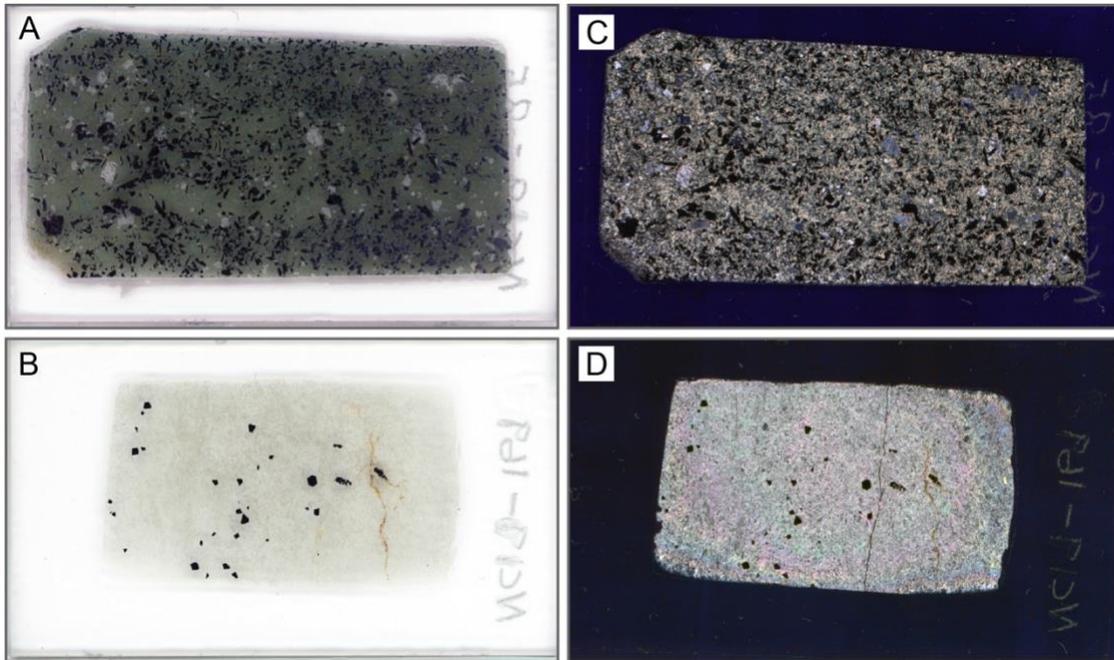
**Figure S1.** Representative plane-polarized (A-E) and cross-polarized (F-J) thin section scans of serpentinites from the northeastern portion of the HP terrane. NC18-09B (A, F). NC18-22A (B, G). NC19-54 (C, H). NC19-63 (D, I). NC19-86 (E, J).



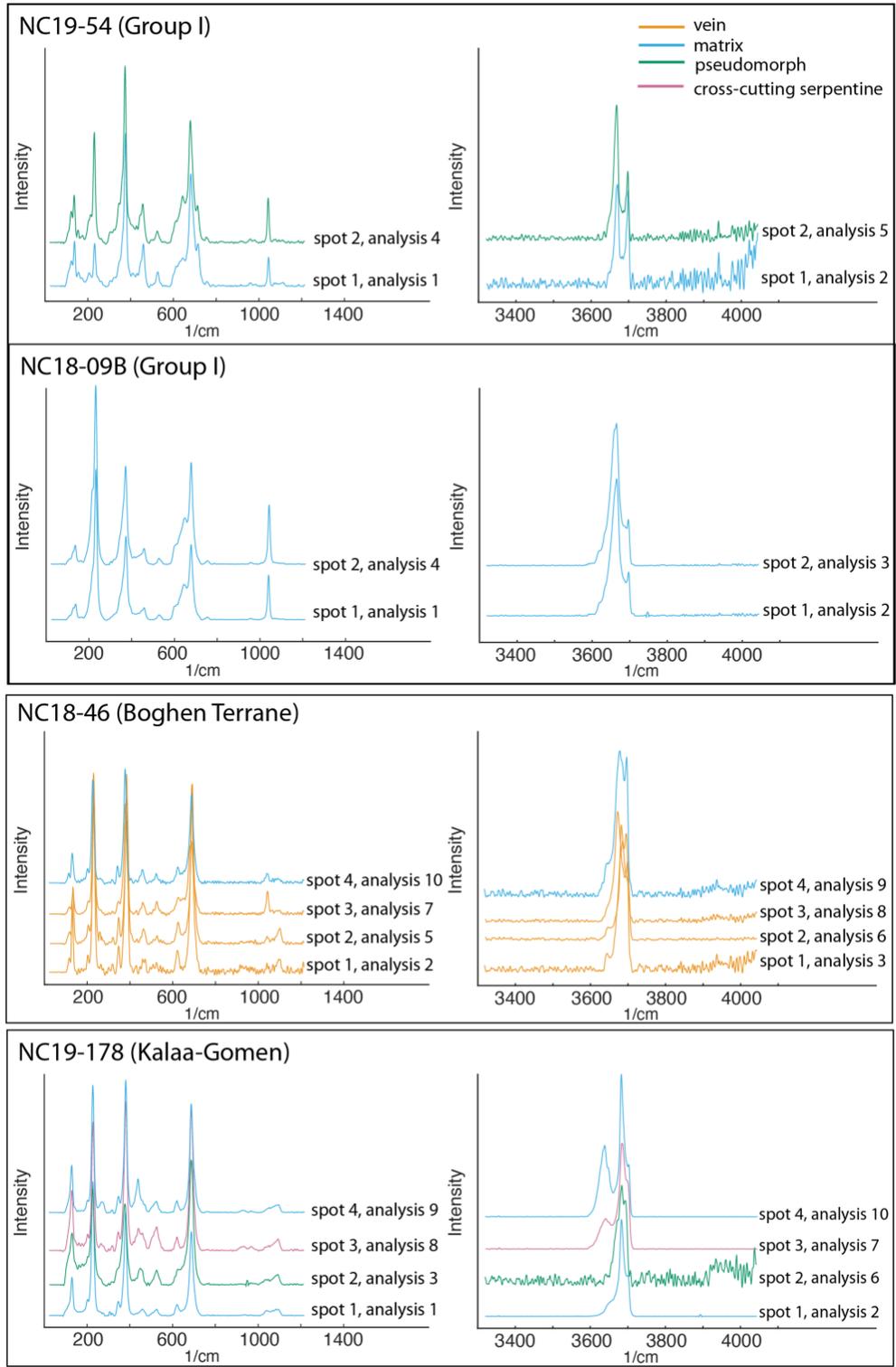
**Figure S2.** Representative plane-polarized (A-F) and cross-polarized (G-L) thin section scans of serpentinites from the southeastern portion of the HP terrane. NC18-39A (A, G); NC18-39C (B, H); NC19-152 (C, I); NC19-154A (D, J); NC19-157 (E, K); NC19-158 (F, L).



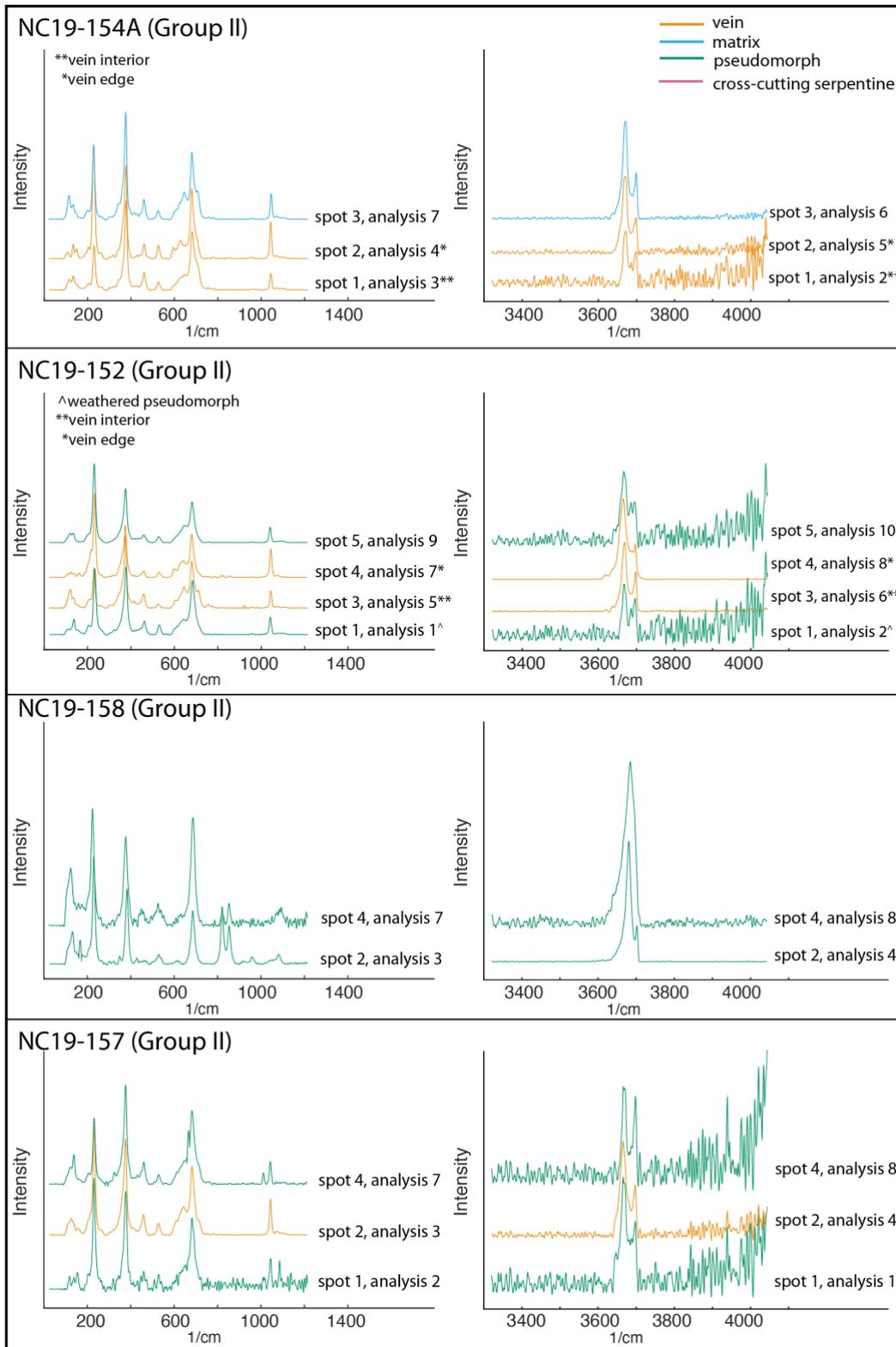
**Figure S3.** Representative plane-polarized (A-C) and cross-polarized (D-F) thin section scans of serpentinites from the Boghen Terrane and Kalaa-Gomen. NC18-45 (A, D); NC18-46 (B, E); NC19-178 (C, F).



**Figure S4.** Plane-polarized (A, B) and cross-polarized (C, D) thin section scans of hybrid rocks. NC19-85 (A, B) is a chlorite schist consisting of chlorite, ilmenite, titanomagnetite, and inclusion-rich apatite. NC19-169 (C, D) is a foliated talc-magnetite schist consisting of talc and magnetite with minor serpentine and ilmenite.



**Figure S5.** Raman spectra acquired on a representative suite of Group I samples (NC19-54, NC18-09B), a Boghen Terrane sample (NC18-46), and the Kalaa-Gomen sample (NC19-178).



**Figure S6.** Raman spectra acquired on a representative suite of Group II samples (NC19-154A, NC19-152, NC19-158, NC19-157).

**Table S1.** Raia-ds02.xlsx: Sample localities and descriptions.

Major elements (wt%)	NC18-15D			NC18-49		
	WSU XRF	F&M XRF	URI ICP-MS	WSU XRF	F&M XRF	URI ICP-MS
SiO <sub>2</sub>	42.25	42.74		41.03	42.04	
TiO <sub>2</sub>	0.02	0.01	0.0115	<0.01	<0.01	0.00211
Al <sub>2</sub> O <sub>3</sub>	1.73	1.84		0.39	0.51	
Fe <sub>2</sub> O <sub>3(T)</sub>	7.50	7.36		7.09	7.86	
MnO	0.10	0.10		0.06	0.06	
MgO	36.22	36.89		36.51	37.51	
CaO	<0.01	0.02		<0.01	0.04	
Na <sub>2</sub> O	<0.01	0.03		<0.01	0.03	
K <sub>2</sub> O	<0.01	<0.01	bdl	<0.01	<0.01	bdl
P <sub>2</sub> O <sub>5</sub>	<0.01	<0.01	bdl	<0.01	<0.01	0.00246
LOI	11.67	11.72		14.49	13.67	
Total	99.50	100.72		99.57	100.77	

**Table S2.** Duplicate major element analyses of NC18-15D and NC18-49 acquired at Washington State University and Franklin & Marshall College. These analyses incorporate all analytical variations and errors (from preparation through data acquisition and reduction) and sample heterogeneity, as separate aliquots of hand-picked chips from each sample were sent to each lab.

Trace elements (ppm)	NC18-15D			NC18-49		
	WSU ICP-MS	URI ICP-MS	F&M XRF	WSU ICP-MS	URI ICP-MS	F&M XRF
Li		0.0464			1.91	
Be		0.110			0.0109	
Sc	8.03	7.97		5.68	5.60	
V		37.3			19.7	
Cr		2252	2312		2314	2933
Co		94.8			95.5	
Ni		2384			2563	
Cu		1.89			2.55	
Zn		29.4			25.3	
Ga		2.73			0.645	
Rb	0.176	bdl		0.110	0.0067	
Sr	0.990	0.274		1.09	0.677	
Y	0.781	0.637		0.906	1.08	
Zr	2.30	0.938		2.76	0.497	
Nb	0.124	0.0356		0.137	0.00694	
Cs	0.00965	0.00551		0.0105	0.00578	
Ba	0.378	0.168		0.688	0.709	
La	0.281	0.131		0.335	0.202	
Ce	0.680	0.285		0.502	0.170	
Pr	0.0855	0.0526		0.0933	0.0701	
Nd	0.377	0.253		0.388	0.330	
Sm	0.115	0.0761		0.103	0.100	
Eu	0.0228	0.0144		0.0283	0.0264	
Tb	0.0216	0.0168		0.0183	0.0199	
Gd	0.119	0.101		0.121	0.143	
Dy	0.144	0.100		0.109	0.110	
Ho	0.0310	0.0244		0.0244	0.0273	
Er	0.0953	0.0742		0.0626	0.0752	
Tm	0.0154	0.0122		0.00801	0.00983	
Yb	0.0968	0.0843		0.0577	0.0544	
Lu	0.0195	0.0152		0.00949	0.0109	
Hf	0.0622	0.0538		0.0588	0.0437	
Ta	0.0512	0.0443		0.0828	0.0525	
Pb	0.0702	0.00955		0.313	0.260	
Th	0.299	0.163		0.121	0.0165	
U	0.0582	0.0180		0.0420	0.00565	

**Table S3.** Duplicate trace element analyses of NC18-15D and NC18-49 acquired at Washington State University and University of Rhode Island. These analyses incorporate

all analytical variations and errors (from preparation through data acquisition and reduction) and sample heterogeneity, as separate aliquots of hand-picked chips from each sample were sent to each lab.