

APPENDIX A. METHODS

Thirty-four blueschist blocks were sampled for this study. Of these blocks, 26 were either surrounded on all sides ($n = 16$) by the shale matrix or had at least half their margin in contact ($n = 10$) with the matrix. Eight split-open blocks that were surrounded by sand were also sampled because they provided the opportunity to investigate the interior of large (5+ m) blocks. The distribution of the blocks and their contact relationships with the shale matrix are shown in Figure 1.

The 34 blueschist blocks were collected to ensure all possible variants were discovered and characterized. They ranged in diameter from 10 cm to ~10 m, but most were between 1 and 5 m. Within a block, samples of all mineralogical and textural variants recognized in outcrop were sampled. Most of the blueschist blocks appear very similar macroscopically, but two were distinguished by relatively abundant quartz- and mica-rich layers.

A consistent sample numbering scheme is used throughout this study. All blocks were labeled according to the year collected (04 or 05), the initials of the person who collected the samples (EU), the location (SS), and the block number (4 through 63, with some exclusions). Samples were collected for each block to ensure all compositional varieties were discovered. Each sample was assigned an alphabetical letter corresponding to the order in which it was collected, and if several thin sections were made of the same sample, a number was added to the letter. In this manner, sample 04-EU-SS-45h2 corresponds to the second thin section of the eighth sample collected from block 45 in San Simeon by Estibalitz Ukar in 2004.

Most of the 145 hand samples are extremely fine grained. Mineral assemblages were identified via petrographic analyses of 250 thin sections. Twenty-seven blocks were deemed representative of the suite, and 45 samples from them were selected for study via backscattered

electron (BSE) imaging and energy-dispersive spectrometry (EDS) using a JEOL 8200 Superprobe at The University of Texas at Austin. BSE images were used to select sites for microprobe analysis that appeared homogeneous at the 10+ μm scale. Mineral chemical data for most samples were determined with an automated JEOL 8200 Superprobe at The University of Texas at Austin, with operating conditions of 15 keV accelerating potential and 15 nA beam current. Analyses of three samples were performed with a JEOL 8200 Superprobe at the Marie Curie Research Center in Huelva (Spain) under the same operating conditions. Minerals were analyzed with a focused beam (1 μm), and raw counts were collected for 20 s. X-ray diffraction analyses were obtained for ~60 carbonate veins from 23 blocks using a Bruker D8 Advance X-ray Powder Diffractometer at The University of Texas at Austin.

FeO was determined through titration by SGS Minerals Service in Toronto, Canada. Nomenclature and Fe^{3+} of amphibole contents follow [Leake et al. \(1997\)](#). The Fe^{3+} content of amphiboles was calculated using the method described by J. Schumacher in Appendix 2 of [Leake et al. \(1997\)](#). The Fe^{3+} content was also estimated following the methods described by [Tindle and Webb \(1994\)](#) and [Dale et al. \(2005\)](#). These three approaches gave similar results, which rarely differed by more than 0.02%. Cation formulas of lawsonite have been calculated assuming eight oxygens and all iron to be Fe^{3+} . Epidote formulas were calculated assuming 12.5 oxygens and all iron as Fe^{3+} . Pumpellyite analyses were recalculated to a total of 16 cations. All Fe is assumed to be Fe^{3+} , as concluded from the recalculation of the oxidation state of Fe assuming 49 total cation charges ([Coombs et al., 1976](#)). Mica compositions were calculated on the basis of 11 O atoms. Chlorite analyses were recalculated on the basis of 28 O atoms. The formula of stilpnomelane was calculated on the basis of 192 O atoms.

APPENDIX B. SOLID SOLUTION MODEL FOR PUMPELLYITE

Ideal Solution Model

- pump = pumpellyite-(Mg): $\text{Ca}_2\text{MgAl}_2[(\text{OH})_2|\text{SiO}_4|\text{Si}_2\text{O}_7]\cdot(\text{H}_2\text{O})$
- fpump = pumpellyite-(Fe^{2+}): $\text{Ca}_2\text{Fe}^{2+}\text{Al}_2[(\text{OH})_2|\text{SiO}_4|\text{Si}_2\text{O}_7]\cdot(\text{H}_2\text{O})$

begin_model

Pump | ideal fe-mg pumpellyite

2 | model type: macroscopic

2 | 2 endmembers

pump fpump

0 0 | endmember flags

0. 1. 0.1 0 | imod = 0 -> Cartesian subdivision

ideal

1 | 1 site entropy model

2 1. | 2 species, site multiplicity = 1.

z(Mg) = 1 pump

end_of_model

fpump = 1 pump - 1 di + 1 hed

-19000 0 0

TABLE DR1. CALCULATED BULK COMPOSITION OF FELSIC LENS 45h1

		SiO ₂	Al ₂ O ₃	Total FeO	Fe ²⁺ /Fe total	FeO	Fe ₂ O ₃	MnO	MgO	CaO	Na ₂ O	K ₂ O	Sum	%	Prograde assemblage
45h1 8 14	Amp	56.38	9.17	17.87	0.82	14.60	3.63		6.51	0.30	6.98	0.01	97.58	20%	20%
45h1 1 2	Grt	38.10	21.30	28.73	1.00	28.73	0.00	3.57	0.93	8.74	0.02	0.01	101.38	7%	18%
45h1 phen13 4	Phe	47.07	30.85	3.71	1.00	3.71	0.00		1.78	0.00	1.20	9.64	94.27	20%	20%
45h1 Chl13 2	Chl	26.58	18.92	29.32	1.00	29.32	0.00		13.31	0.03	0.02	0.00	88.16	18%	12%
	Qtz	100.00											100.00	35%	30%
		normalized													
45h1 8 14	Amp	57.78	9.39			14.96	3.72	0.00	6.67	0.31	7.16	0.01	100.00		
45h1 1 2	Grt	37.58	21.01			28.33	0.00	3.52	0.91	8.62	0.02	0.01	100.00		
45h1 phen13 4	Phe	49.94	32.73			3.94	0.00	0.00	1.89	0.00	1.27	10.23	100.00		
45h1 Chl13 2	Chl	30.15	21.46			33.25	0.00	0.00	15.10	0.03	0.02	0.00	100.00		
	Qtz	100.00													
bulk	45h1	61.92	14.78	0.00	0.00	12.87	0.74	0.63	3.69	1.62	1.69	2.05	100.00		m

Units: wt%. Mineral abbreviations as in Table 1.