Mineralogical Magazine (2025), **89**, 717–720
doi:10.1180/mgm.2025.10176

Editorial

Dedication to Edward Sturgis Grew

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Figure 1. Ed Grew receiving the Collins medal for scientific excellence in mineralogy and its applications by Frances Wall, the President of the Mineralogical Society of the UK and Ireland in 2015.

This volume of *Mineralogical Magazine* is dedicated to Edward Sturgis Grew in celebration of his 80th birthday. My colleagues and I are grateful for the chance to honour Ed's long and distinguished career through this collection of contributions. A decade ago, Kristiansen (2015) summarized the storied first half-century of Edward Grew's academic life—a remarkable span that saw many of his seminal contributions to field studies on five continents; to the mineralogy and petrology of lithium, beryllium and boron minerals; and to the education of a generation of students at the University of Maine (Fig. 1). Throughout this distinguished research career Ed has focused on 'petrologic mineralogy'—the meticulous study of minerals in their paragenetic context.

Ed Grew's outsized influence is manifest in more than 250 publications spanning 55 years. Perhaps best known are his numerous contributions to the mineralogy of beryllium, boron, and lithium (e.g. Grew, 1981a, 1982a, 1986, 1988, 1998, 2020; Grew and Hazen, 2014; Grew and Hinthorne, 1983; Grew and Sandiford, 1984; Grew *et al.*, 1990, 1998, 2000, 2001, 2006, 2008a, 2011, 2013a, 2015, 2016, 2017, 2019; Bloodaxe *et al.*, 1999; Buick *et al.*, 2008; Cempirek *et al.*, 2016; Dobrzhinetskaya *et al.*, 2014; Hughes *et al.*, 2000; Tagg *et al.*, 1999), including the encyclopaedic *Boron* (Grew, 1996) and *Beryllium* (Grew, 2002) volumes 33 and 50, respectively, of the *Reviews in Mineralogy and Geochemistry*. Thanks to the collective impact of these and many other publications by Ed Grew, we have a remarkably comprehensive understanding of Be and B minerals.

Edward Grew's mineralogical efforts also included decades of research on the igneous and metamorphic petrologic mineralogy of Antarctica, where he was part of nine research expeditions between 1972 and 2004 (Grew, 1978, 1980, 1981a, 1981b, 1982b, 1982c, 1983, 1998; Grew and Hinthorne, 1983; Grew and Manton, 1979; Grew and Sandiford, 1984; Grew *et al.*, 1984, 1988, 1998, 2000, 2001, 2006, 2007, 2012, 2013a; Asami *et al.*, 2002, 2005; DePaolo *et al.*, 1982; Manton *et al.*, 1992; Fig. 2). Of special interest were Ed's many publications on the high-pressure metamorphism of late Archean and early Proterozoic rocks and associated complex pegmatites—rocks that contained a host of unusual phases.

Added to these publications are fundamental contributions to systematic mineralogy, including the definitive statements regarding nomenclature of the sapphirine and surinamite groups (Grew *et al.*, 2008b) and the garnet supergroup (Grew *et al.*, 2013b). Ed Grew has also been involved in the discovery and characterization of 31 new minerals, including dissakisite-(Ce) [$CaCe(Al_2Mg)(Si_2O_7)(SiO_4)O(OH)$; Grew *et al.*, 1991]; hyttsjöite [$Pb_{18}Ba_2Ca_5Mn_2Fe_2Si_{30}O_{90}Cl{\cdot}6H_2O$; Grew *et al.*, 1996]; boralsilite [$Al_{16}B_6O_{30}(Si_2O_7)$; Grew *et al.*, 1998, 2008a]; khmaralite [$Mg_4(Mg_3Al_9)O_4(Si_5Be_2Al_5O_{36})$; Barbier *et al.*, 1999; Grew *et al.*, 2008b]; ominelite [$(Fe,Mg)Al_3BSiO_9$, Hiroi *et al.*,



Figure 2. Camping at Dallwitz Nunatak during an Australian Antarctic Expedition in January 1978. Site of the first world discovery of an ultra-high temperature sapphirine and quartz assemblage.

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This paper is part of a collection in tribute to the work of Edward Grew at 80
Cite this article: Hazen R.M. (2025) Dedication to Edward Sturgis Grew. *Mineralogical Magazine* **89**, 717–720. https://doi.org/10.1180/mgm.2025.10176

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2001]; chopinite [$Mg_3(PO_4)_2$; Grew *et al.*, 2007]; boromullite [$Al_9BSi_2O_{19}$,; Buick *et al.*, 2008]; menzerite-(Y) [$CaY_2Mg_2(SiO_4)_3$; Grew *et al.*, 2010]; qingsongite [BN; Dobrzhinetskaya *et al.*, 2014]; vránaite [$Al_{16}B_4Si_4O_{38}$; Cempírek *et al.*, 2016]; khesinite [$Ca_4Mg_2Fe^{3+}{}_{10}O_4(Fe^{3+}{}_{10}Si_2)O_{36}$; Galuskina *et al.*, 2017]; and badengzhuite (TiP) and zhiqinite ($TiSi_2$; Xiong *et al.*, 2020).

Ed's past 15 years have been devoted in large measure to new research directions in the fields of mineral evolution, mineral ecology, and mineral informatics—studies undertaken at a time when most scholars would have retired to less demanding pursuits. I had the great good fortune to collaborate with Ed Grew starting in 2010, shortly after a group of us had introduced research on the changing diversity and distribution of minerals through 4.5 billion years of Earth history—a field we called 'mineral evolution'. Ed not only embraced these ideas, but he was instrumental in transforming what were initially qualitative descriptions of several stages of mineral evolution into rigorous, data-driven, quantitative explorations. We joined forces as we tackled new projects on the mineral evolution of lithium, beryllium, boron, mercury, and the Anthropocene epoch (Grew *et al.*, 2011, 2016, 2019; Grew and Hazen, 2014; Hazen *et al.*, 2011, 2012, 2014, 2017a). In every investigation, Ed scrutinized hundreds to thousands of mineral/age/locality data, checking and rechecking every data point. The resulting exacting analyses definitively demonstrated three key aspects of Earth's evolving mineralogy: (1) the episodicity of mineralization correlated with intervals of supercontinent assembly; (2) the explosion of mineral diversity following the Great Oxygenation Event; and (3) the co-evolution of the geosphere and biosphere.

In 2015, Ed Grew played key roles in developing another new data-driven direction—'mineral ecology', or the quantitative investigation of changing mineral associations and distributions through deep time (Grew *et al.*, 2017, 2019; Hazen *et al.*, 2015a, 2015b, 2017b, 2019; Hystad, 2015). An important finding of these studies is that the distribution of known minerals and their localities can be used to predict the number of 'missing minerals'—species that occur on Earth but have yet to be discovered and described. Ed applied these statistical methods to the minerals of his three favourite elements—lithium, beryllium and boron—to demonstrate that hundreds of minerals containing these essential elements are waiting to be characterized.

On a personal note, I owe Ed Grew an immense debt of gratitude. At a time when some prominent Earth scientists rejected the precepts of mineral evolution and questioned the application of informatics to describe and explain complex mineral systems, Ed embraced these alternative approaches. His decades of experience in petrologic mineralogy, his deep understanding of mineral-forming environments, his sustained service to the mineralogical community, and his uncompromising demand for rigor set our nascent studies on a sustainable path of discovery that continues today with a new generation of dynamic mineralogists.

Thank you, Ed!

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