QUARTZ VAR. COTTERITE: A PERSONAL ODYSSEY; A UNIQUE MYSTERY

By: **Patrick Roycroft**[1]

It's 2013. I'm unemployed. It's winter, and it's raining. I'm in a freezing, filthy, leaky shipping container on the grounds of University College Dublin (UCD, Ireland), and I'm in amongst the partially randomised remains of a huge historic mineral collection looking for the rarest variety of quartz on Earth: cotterite. After four cold hours of searching—during which I am partially covered in pyrite disease, which burns several holes in my jumper—I emerge successful. I *knew* one was in there!

And so, what began as a search for a rare mineral would soon become a career-defining odyssey.

I had finished my second post-doc, an EU Marie Curie Fellowship Return Grant to UCD, back in the late 1990s, but academic geology jobs were hard to find. So, I ended up writing abstracts for 11.5 years until the company for which I worked folded. There followed several years as a science tour guide, until my wonderful boss, Mary Mulvihill, passed away at far too young an age, which left me unemployed again. But I am, at heart, a geologist; have been since I was seven years old. To fill time between jobs, I got it into my head to write a short note on cotterite. So, what is cotterite?

> **Cotterite** (n.). A variety of quartz displaying a characteristic pearly metallic (but not vitreous) lustre on its pyramidal faces (FIG. 1).

FIGURE 1 The largest cotterite held in the National Museum of Ireland: NG:G333 (120 × 85 × 60 mm). Note the contrast in quartz lustres. PHOTO: HANNAH PRESTON.

Cotterite was discovered around 1875 by a 'Miss Cotter' in the rural Irish townland of Rockforest East in County Cork. Only two, short, 19th century papers were written on the subject: one in 1877 by Richard Moss of the Royal Dublin Society, and the other in 1878 by Robert Harkness, a geology professor at Queen's College Cork, who named it 'cotterite' in honour of its discoverer, Miss Cotter. Who Miss Cotter was, however, was never stated. Harkness noted that, even by 1878, no additional cotterite samples were to be found in Rockforest—which is the way things were to stay for a very long time. Only about three dozen specimens exist of this very rare variety of quartz, all found around 1875–1876, and all from just one small (now lost) quarry in Rockforest East, north-central County Cork.

I had a feeling that UCD might have a cotterite in its (abandoned) historic mineral collection, then stored in that old shipping container. I knew Trinity College Dublin had one; I knew University College Cork had (the biggest) one; and I knew the Natural History Museum in London (UK) had several. My intention was to find all known specimens and write a short note updating why cotterite quartz has this unique metallic-like sheen. In the process, I discovered that a large historic mineral collection—hitherto unknown even to most Irish geologists—was in dire need of rescue. The damp, the fragile labels, the chaos, the scary amount of mould covering everything—something had to be done. So, I contacted Matthew Parkes and Nigel Monaghan of the National Museum of Ireland (NMI), and we hatched a plan: I would apply to the Heritage Council of Ireland for a grant, and the NMI would help me, with UCD's permission, rescue this wonderful, but neglected, mineral collection. It worked! In fact, I even got a second grant from the Heritage Council. While working with Matthew and Nigel, I gained valuable museum experience and would eventually write a 34-page paper on cotterite (Roycroft 2016).

But Heritage Council grants come to an end. Back to looking for jobs again. This time, however, a veritable slew came my way. I became a genealogist (yes!) at the Irish Family History Centre in Dublin; I became the editor of the online genealogy magazine *Irish Lives Remembered*; and I got the magnificent job as copyeditor and proofreader with *Elements* (see the *Elements* Heritage column in the October 2025 issue (vol. 21, no. 5)). I also wrote the popular geology book *648 Billion Sunrises: A Geological Miscellany of Ireland* in which I used my genealogy skills to find, at long last, who Miss Cotter really was: Grace Elizabeth Cotter (1830–1879), niece to Sir Lawrence Cotter, 3rd Baronet of Rockforest. In 2021, to the great shock of all, my museum colleague and friend, Matthew Parkes, suddenly died. Following his passing, the position of geologist at the National Museum of Ireland became available. I applied. I got it! This was a dream job, and I was (and am) deeply honoured to follow in Matthew's footsteps. Thus, via a circuitous route, cotterite had brought back my career as a pure geologist (FIG. 2).

FIGURE 2 Patrick Roycroft cradles the UCD cotterite, now housed in the National Museum of Ireland (NG:U392). PHOTO: JAMIE MAXWELL.

But the cotterite odyssey played on. I was contacted in the winter of 2024 by a Melanie O'Driscoll, of Rockforest, saying that her seven-year-old son, Ben, had found a cotterite loose in the field behind their house (FIG. 3A). Sceptical, I had to see it in person. To my utter amazement, the entire family drove 240 km though snow and sleet, all the way from Rockforest to Dublin, just to show me Ben's find. I took one look, and it was obvious: this was the first new specimen of cotterite found in 150 years! Yelps, hugs, handshakes, and smiles that made one's face ache. This discovery subsequently featured in Irish newspapers and on national television, and made a splash across social media and news sites. Odyssey over yet? No! In March 2026, *while writing this piece*, I took on school student Sarah Nugent (FIG. 3B) for museum-based work experience ... and it turns out she is Grace Elizabeth Cotter's third cousin five times removed!

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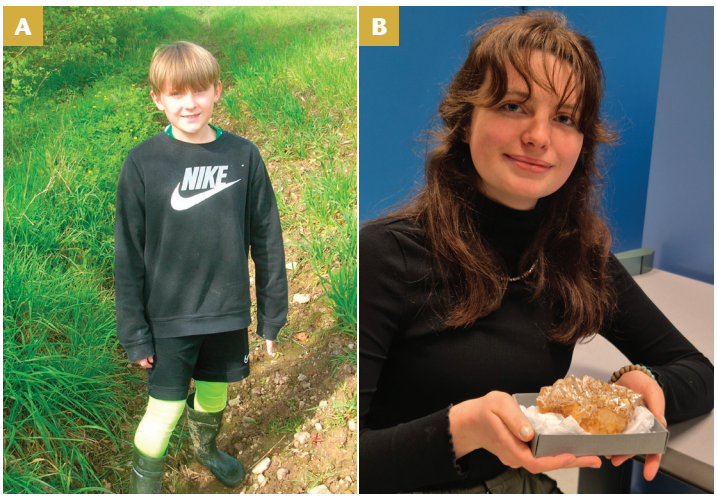

Figure 3 (**A**) Young Ben O'Driscoll points to the spot in a Rockforest field (Co. Cork, Ireland) where he found the first new cotterite specimen in 150 years. Photo: Patrick Roycroft. (**B**) School student Sarah Nugent (holding cotterite NG:G333) during a work placement at the National Museum of Ireland. She is cotterite discoverer Grace Elizabeth Cotter's third cousin five times removed. Photo: Jamie Maxwell.

Yet behind all this excitement lies the unresolved mystery that first drew me to cotterite. We know that the cause of the cotterite lustre is the partial delamination of multiple micron-thick layers of quartz developed on the last-grown quartz pyramidal faces (the only faces developed on the Rockforest specimens). The reflection of light from the micron-rough interface between these very thin sheets is somewhat analogous to light reflecting off the silvering on a mirror. Thus, a metallic silvery (not vitreous) sheen is seen. But how, and why, did this particular quartz, to date at this one locality only, grow like this? What is actually defining the boundary between the thin quartz sheets, which can even be split and peeled off (Fig. 4A)? There is nothing obviously 'foreign' between them (Fig. 4B). This is separable 2-D growth, not structurally interconnected normal 3-D growth as a result of standard growth spirals. Why do some layers delaminate and not others? One can observe 'windows' of clear quartz amongst the cotterite lustre: these are sections of layers that have not yet delaminated. What is forcing the layers to part? Contraction of some sort? Original temperature/cooling differences? The ~35 original cotterite specimens all have, or had, a red encasing mud on, or in, them. What role did this play in the formation of cotterite? Are the different quartz layers twinned? Although I have not read the quartz literature in its entirety, I have yet to read of examples of separate/separable (not 3-D fused) layer-upon-layer growth at the last phase of crystal growth. Is the cotterite lustre (in principle) an effect only confined to pyramidal faces, or might it exist (in theory) on prism faces also?

I have a hunch. I have looked at many quartz crystals under the binocular microscope, including the prism faces when present, and I have begun to suspect that something more general may be going on. There may be an aspect of quartz crystal growth that is not especially rare, but that is developed to a uniquely extreme degree in cotterite. Could there be a more general aspect to quartz growth that has been underappreciated? Could Rockforest cotterite be an extreme end-member manifestation of an otherwise not especially unusual growth process? Perhaps more observations of quartz crystals of all kinds will tell.

To end with the big question: Does genuine cotterite exist anywhere else on Earth? Readers of this "Quartz" issue of *Elements* are encouraged to search museum and university collections and to visit more field outcrops and quartz pockets. If you find anything remotely 'cotteritic' ... please get in contact.

FURTHER READING AND RESOURCES

Harkness R (1878) On cotterite, a new variety of quartz. Mineralogical Magazine 2: 82-84, doi: 10.1180/minmag.1878.002.9.03

Moss RJ (1877) On quartz with a pearly lustre. Scientific Proceedings of the Royal Dublin Society 1: 49-50

Roycroft PD (2015) 648 Billion Sunrises: A Geological Miscellany of Ireland. Orpen Press, 212 pp

Roycroft PD (2016) Cotterite: historical review; extant specimens; etymology of 'cotterite' and the genealogy of 'Miss Cotter'; new observations on the cotterite texture. Irish Journal of Earth Sciences 34: 45-78, doi: 10.3318/ijes.2016.34.45_

Roycroft PD (2026) The Ben O'Driscoll Cotterite: the first example of the mineral in nearly 150 years. Irish Naturalist's Journal 42: 158-160 [N.B. *Includes checklist of cotterite characteristics*]

Watch a video on cotterite by the National Museum of Ireland: Cotterite - The World's Rarest form of Quartz (https://www.youtube.com/watch?v=hGQtDe60pXg&t=1297s).

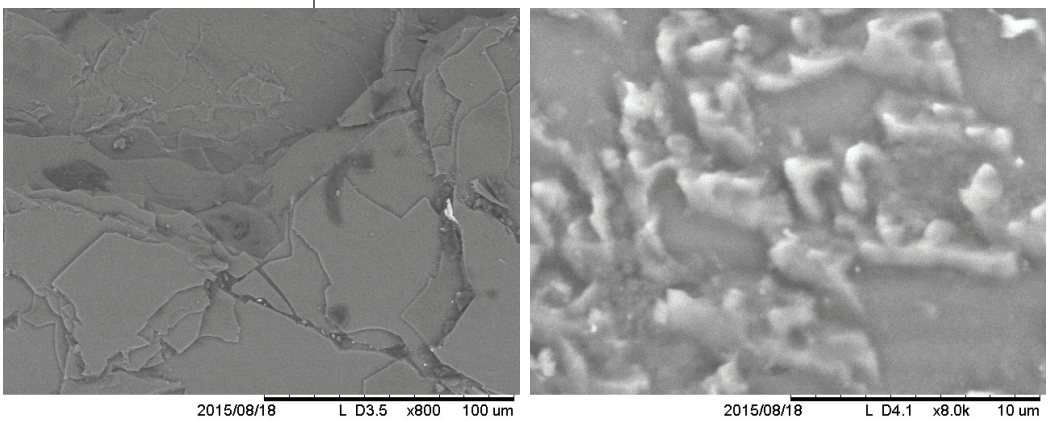

Figure 4 (**A**) Scanning electron microscope (SEM) image of cotterite's separable growth layers. (**B**) SEM image of the micron-scale rough interface between partially delaminating quartz layers: the highest-resolution image obtained to date. Both images are of NG:U392. Photos: Patrick Roycroft.

ABOUT THE AUTHOR

Patrick Roycroft is the curator of geology at the National Museum of Ireland. He holds a BA Moderator degree from Trinity College Dublin and a PhD in geology from University College Dublin (thesis on zoned muscovite in granites and other rocks). He was awarded a Marie Curie Fellowship to study crystal growth with Prof. Alain Baronnet in Marseille (France) and then a Marie Curie Return Grant back to University College Dublin. There followed a long and winding career path over some 25 years until back to full-time geology: this included forays into genealogy, tour guiding, journal editing, and book writing.