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VALENTIA SLATE, COUNTY KERRY: A HERITAGE STONE

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Abstract

Valentia Slate (Devonian) from Valentia Island in southwest Ireland, is a distinctive dimension stone. A largely purple coloured siltstone, it was affected by low-grade metamorphism and has a well-developed cleavage giving it a slaty fabric. Quarried from 1816 onwards, the Valentia Slate Formation yielded very large slabs that were utilised for building and for a wide range of domestic and decorative purposes, in Ireland, England and further abroad. The stone saw lesser use as a roofing slate. Associated with the quarry were two sawing and finishing mills located on site and close by, and both finished and rough blocks were exported from a purpose-built pier. Extraction reached its peak in the 1830s to 1870s but subsequently declined due to competition from Wales, before eventually ceasing in 1911. Revival in the 1990s and recent investment has resulted in the provision of this quality stone to widespread markets where it is used for a variety of conservation, decorative and construction purposes. Valentia Slate and the quarry where it is extracted are both of significant heritage value.

Introduction

Ireland has a diverse geological foundation that is rich in Paleozoic successions (Holland and Sanders 2009) that have yielded a range of dimension and decorative stones, which have been widely utilised locally and abroad (Wyse Jackson 1993; Caulfield 2019). Earliest exploitation of stone was for local construction projects, but by the 1800s the extent of the stone resource had become more widely appreciated, thanks in part to the primary mapping carried out by the Geological Survey of Ireland. Decorative Carboniferous (Mississippian) limestones came into vogue in the mid-1800s (Caulfield 2019) that were used alongside Connemara Marble. The latter is a distinctive lithology exploited since the very early 1800s that was recently proposed as a Heritage Stone, an accreditation scheme administered by the Subcommission on Heritage Stone of the International Union of Geological Sciences [IUGS] (Wyse Jackson *et al.* 2020). Valentia Slate is a well-known distinctive lithology procured only from Dohilla on Valentia Island in southwest Ireland (Fig. 1). Commercially quarried since the early 1800s, its fabric allowed for the removal of very large slabs of stone that are remarkably strong and enabled the material to be manufactured into a wide assortment of domestic articles as well as being adopted for construction purposes and for roof slates. The quarry has been worked by a series of owner occupiers and leasees for over 200 years and the stone can be found in many buildings across Ireland, Britain and even in the West Indies. Extraction of Valentia Slate continues and is valued for conservation, decorative and construction purposes. Given the longevity of its extraction, its versatility of use, and the extent of the exportation of Valentia Slate it is intended to propose it as an IUGS Heritage Stone in due course.

Fig. 1—Valentia Slate Quarry viewed from the southeast. The Grotto chamber is the triangular opening to the left and the 1911 chamber opening to the right.

Petrological characteristics and geological setting

Formal name
Valentia Slate

Origin of name
Named after Valentia Island in County Kerry, southwest Ireland, where it has been quarried since the early 1800s.

Stratigraphic (or geological) name
Valentia Slate Formation, Iveragh Group, Middle Devonian (Capewell 1975; Pracht 1996).

Commercial designations
Valentia Slate

Area of occurrence
Geokaun Mountain on the north side of Valentia Island, County Kerry, Ireland (Fig. 2).

Principal location of current and former quarries
Dohilla, Valentia Island, County Kerry [National Grid reference: V 390775] (Fig. 2) (active).

Geological age and geological setting
The Valentia Slate Formation crops out in County Kerry and is part of the Iveragh Group of Middle Devonian (Givetian) age (Capewell 1975; Pracht 1996). The Valentia Slate Formation is the oldest lithostratigraphic unit of the terrestrial Old Red Sandstone succession in the Devonian Munster Basin of southwest Ireland. A nearby (geographically, but also stratigraphically) air-fall tuff horizon has been radiometrically dated at 385 Ma, while palynological analysis has demonstrated the presence of what has been termed the Reenagaveen microflora that is assigned to the TCo biozone of Streel *et al.* (1987), which demonstrates a late Givetian to early Frasnian age (Williams *et al.* 2000). The Valentia Slate Formation comprises several lithologies ranging from the purple siltstone (which is

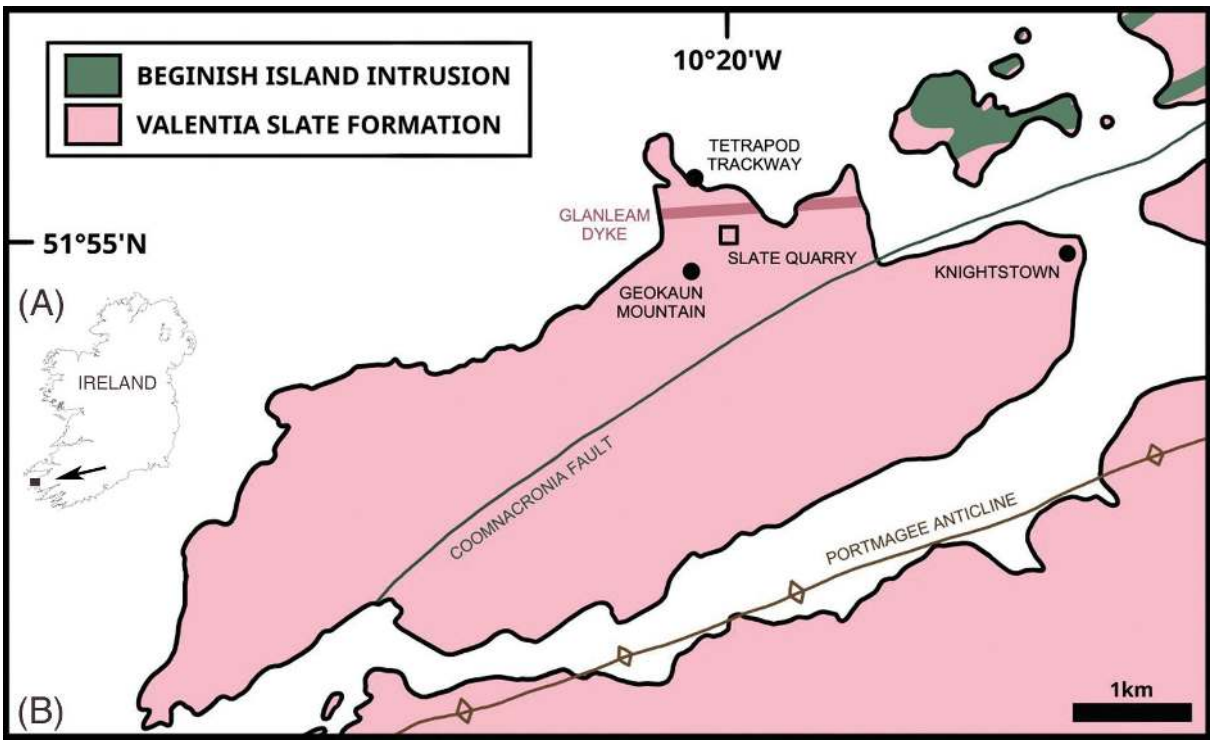

Fig. 2—Geological map of Valentia, Co. Kerry, Ireland showing (A) the postion of Valentia Island in the southwest of Ireland (black rectangle arrowed) and (B) the distribution of the Valentia Slate Formation and Beginish Island intrusives and the Glanleam' dyke (dolerite) and the locations of the Valentia Slate quarry, Geokaun Mountain, the Dohilla tetrapod trackway site and Knightstown (Based on Capewell 1975; Pracht 1995 with permission of the Director of the Geological Survey Ireland; Stössel *et al.* 2016).

most commonly occurring) to fine-grained sandstones that vary from purple to pale green in colour. These sedimentary rocks represent an alluvial floodplain setting with the fine silts being deposited following sheet floods and the coarser sands deposited in ephemeral shallow channels that migrated across the flood plain (Graham *et al.* 1992; Stössel *et al.* 2016). The Valentia Slate Formation has an observed thickness of 1560m (Russell 1984; Graham *et al.* 1992; Williams *et al.* 2000) and not 3200m, as stated by Capewell (1975) and Pracht (1996). The quarried lithology is a cleaved homogenous siltstone (Fig. 3A-B). Strong deformation and low-grade metamorphism affected the formation during the Variscan orogeny, which produced its slaty fabric and a pervasive tectonic cleavage (Cooper *et al.* 1986; Meere 1995; Stössel 1995) (Figs 3C, D, 4).

Some of the earliest confirmed tetrapod trackways globally occur in the Valentia Slate Formation, close to the quarry at Dohilla. This is the second oldest evidence for the colonisation of terrestrial environments by vertebrates (Stössel 1995; Parkes 2004; Stössel *et al.* 2016) after the trackway at Zachełmie in Poland, which is *c*. 5 Myr older (Niedzwiedzki *et al.* 2010; Narkiewicz and Narkiewicz 2015).

Petrographic name and mineralogy

Valentia Slate is a penetratively cleaved bioturbated siltstone composed mainly of silt- and clay-grade quartz, phyllosilicates and traces of chlorite and calcite (Fig. 3).

Primary colour(s) and aesthetics of stone

The slate is a very consistent purple colour (Munsell 10R1/2) (Fig. 3A). It takes a very good honed polish and develops an excellent patina in areas of heavy use, such as shop or bar counters. Valentia Slate is remarkably strong and is five times stronger than many limestones and granites available on the Irish market (Sandberg PPL 2020). It exhibits very low porosity and so the effect of freezing, and salt crystallisation on the surface is minimal. This durability is demonstrated through examination of memorials erected in graveyards in coastal areas from the 1840s that maintain their crisp hand-cut lettering, whereas inscriptions cut in various crystalline igneous rocks and native limestones are often badly decayed and indecipherable.

Natural variability of stone

Little variability.

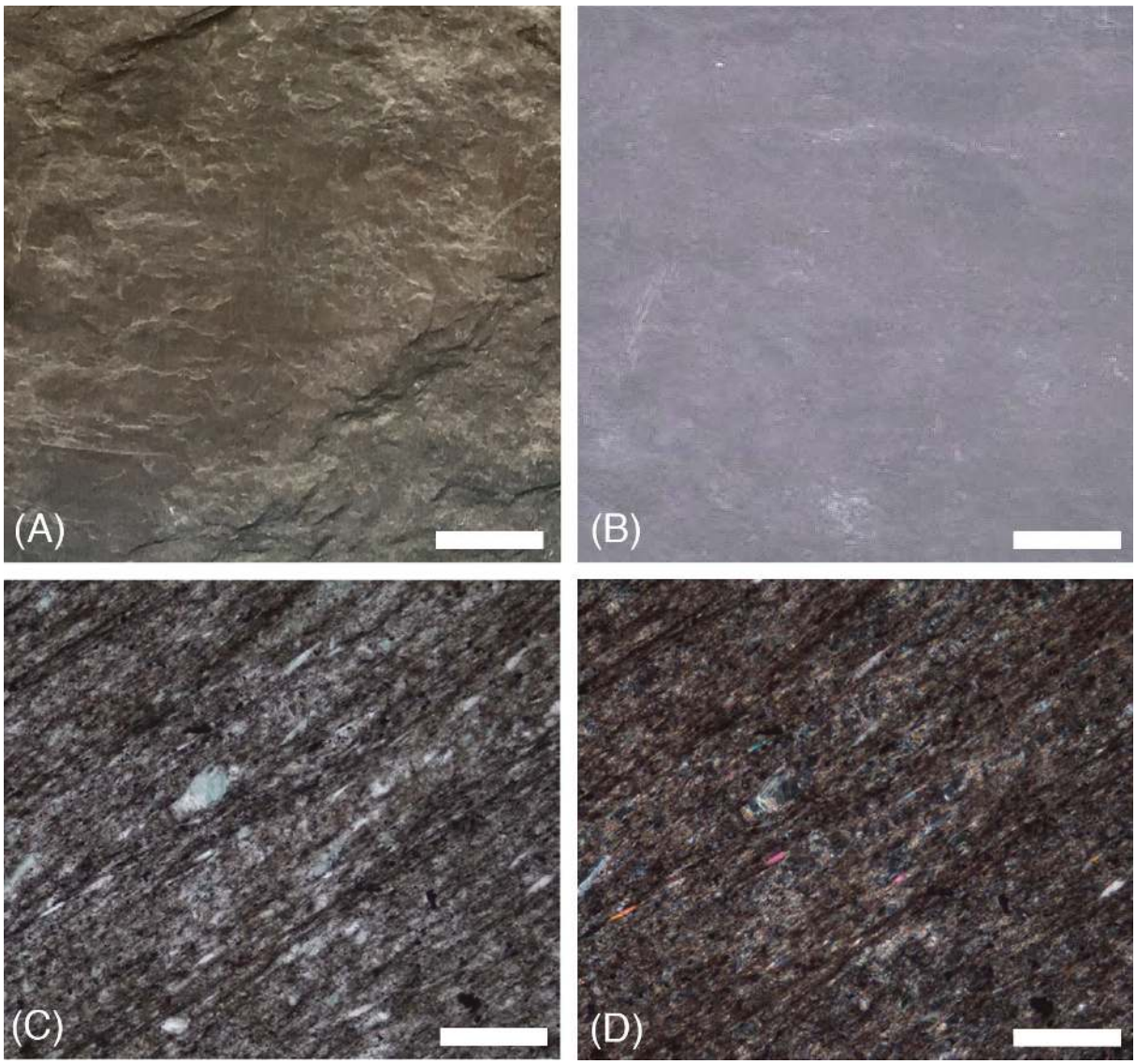

Fig. 3—(A) Valentia Slate hand specimen with natural broken surface; (B) hand specimen with sawn surface; (C) Thin section of Valentia Slate in transmitted light displaying millimetric layers of quartz and mica with lesser chlorite and calcite; (D) Same in crossed polarised light (XPL). (A Geological Museum, Trinity College Dublin specimen; B-D from Sandberg 2020 report). Scale bars = 1 mm (A-B), 200 μm (C-D).

Technical properties
Density: 2790–2810 kg/m^3
Open porosity: 0.2%
Water absorption: 0.1 by weight %
Flexural strength: 49.9–67 MPa. This is outstanding.
Data from report by Sandberg (2020) commissioned by Valentia Slate Company Limited.

Vulnerability and maintenance of supply
There is presently an ample supply of stone. The quarry company owns the deposit and recent investment in the quarry has safeguarded its future and it is anticipated that provision of stone will be guaranteed in the long term.

Historic use and geographic area of utilisation

Valentia Slate has been exploited since the early 1800s, but larger-scale quarrying was not developed until 1816. The quarry at Dohilla was opened by the landlord Maurice Fitzgerald (the Knight of Kerry) and has been owner-operated or leased to several companies intermittently since that time. For much of the twentieth century, between 1911 and 1998, the quarries

were idle but since then extraction has recommenced (see Table 1). The material has largely been utilised in the form of slabs for a wide variety of uses in Ireland, Britain and further afield (see listing in the next section).

The earliest workings of Valentia Slate were probably small surface workings on the north side of the island at Geokaun Mountain that procured stone for local building enterprises, but in 1816 activity was increased at the present site in the townland of Dohilla and investment by the Knight of Kerry led to increased yields of stone. Between 2 and 3km southwest of this principal quarry lay two smaller surface workings in the townlands of Tinnies Upper and Cool East, which are marked on early nineteenth century Ordnance Survey maps, but little is known of their history and they were never extensively exploited. The historic account that follows exclusively discusses the quarry at Dohilla (Figs 1, 3).

The surface quarry at Dohilla was worked until approximately 1840 and has been an underground operation ever since. Compared to most slate quarries in Ireland this is unusual, although some workings in the Welsh slate district of Blaenau Ffestiniog were also underground. This has advantages in that the landscape remains relatively undisturbed adjacent to the quarry site. Two entrances open to underground chambers, both of which worked stone along strike. The eastern opening referred to here as the Grotto chamber penetrates some 150m into the hillside and is 20m high and 20m wide (Fig. 5A-C) and was the first of the two underground chambers to be opened up. The second, referred to as the '1911 chamber' on account of a disastrous rock fall of that particular year, was opened in 1900 (Lyne 2003) and is located immediately to the west (Fig. 1). Both chambers are now connected by a small tunnel opened in the

Table 1—Ownership and/or operators of the Valentia Slate Quarry.

1816–1911: The Knight of Kerry (owner). He opened the quarry and operated it at various times when it was not leased; these included the years 1816–24, 1832–39, 1900–11.
1824–32: leased to Hibernian Mining Company.
1839–59: Bewicke Blackburn, Manager for Knight of Kerry.
1855–63: Robert John Lecky, Manager.
1864–76: Valencia Slate Slab Co. (Ltd.) Managing Director: George Eugene Magnus of the Pimlico Slate Co., London; Directors: Henry Bayly Garling, Frederick Charles Jones, William Lobb, Samuel Magnus, Gerald Ralston (Consul-General of Liberia).
1876–77: Valentia Slate Slab Co. (Grover and Maynes, 8 Old Jewry, London).
1900–11: Quarry reopened by Knight of Kerry and in 1903 was being operated by his agent Daniel Evans.
1998–2016: Micheál Lyne, Patrick O'Driscoll and Michael O'Donoghue trading as Valentia Slate Ltd.
2019–date: Aidan Forde and Gerard Teahan trading as Valentia Slate Company Ltd.

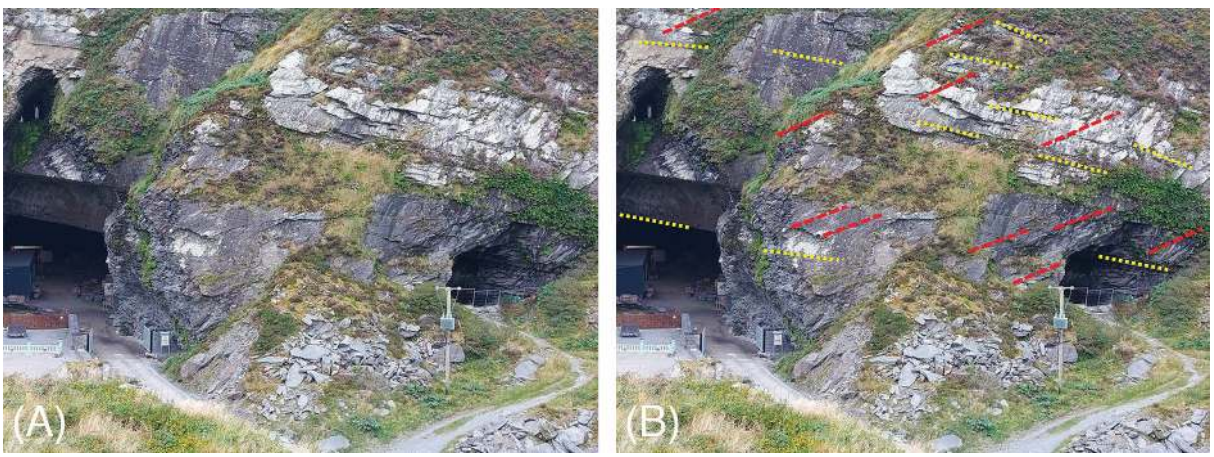

Fig. 4—(A) Exterior of Valentia Slate quarry; (B) Bedding marked by yellow dashed lines and cleavage direction by red dashed lines (from Primavori 2021, unpublished report).

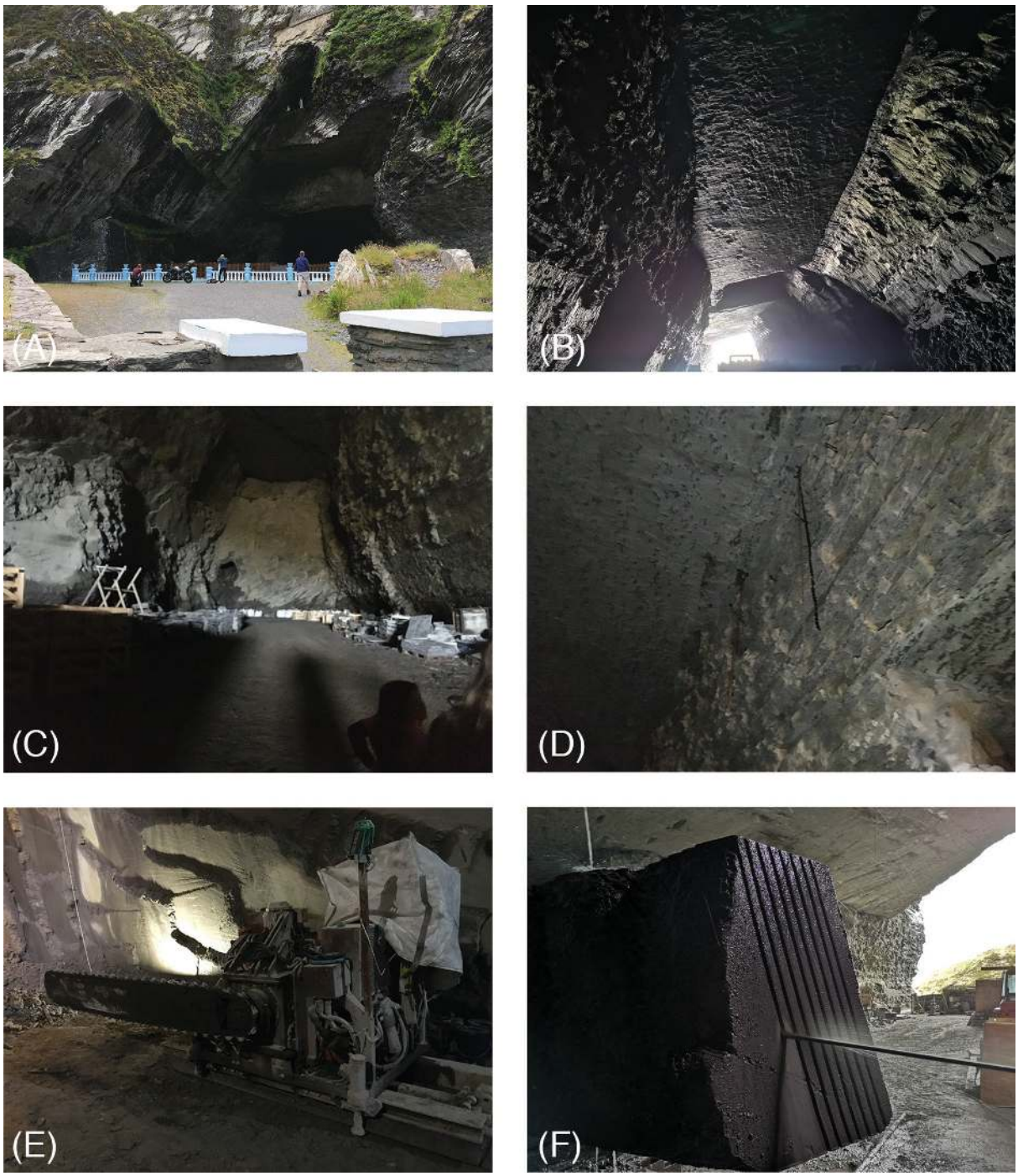

Fig. 5—(A) Exterior of Valentia Slate quarry; (B) Grotto chamber towards exterior; (C) Grotto chamber towards interior; (D) Chains hanging from chamber roof that supported gantry crane; (E) Chainsaw used from 1990s until early 2022 to extract blocks of slate; (F) Sawing slate block.

1990s. The working face in both openings is about 20m in height with the roof of both chambers being marked by a distinctive bedding plane.

Working the faces was achieved by extracting stone at its highest level and then working downwards in a series of benches. While the workings are broadly parallel sided in the Grotto chamber, a small opening was excavated in the west wall of the chamber that has left a small amphitheatre. Why this was carried out remains unclear. The remains of a gantry slung from the roof

runs along the length of the Grotto chamber (Fig. 5D). This comprised a series of chains along which a movable platform was used to carry excavated blocks outside to the squaring house for initial working, before being transported via a tram to what was called the Slate Yard in Knightstown 3km to the east (Fig. 2). This was probably the earliest such tramway laid in Europe for the transportation of stone. Some portions of the trackway and the axle of a bogie are kept in storage in the local Heritage Centre in Knightstown (Gwyn 1991). It is unclear when this tramway ceased operation, but by 1852 15-ton blocks of stone were being transported by cart to Knightstown (Martineau 1853).

In 1823, or early 1824, the Hibernian Mining Company (HMC) engaged Richard Griffith (1784–1878), the noted Mining Engineer of the Royal Dublin Society, to report on the prospect (Griffith 1824; McArdle 2018, p. 159). Although he may not have visited the island, he returned a positive report, noting that its situation promoted easy of transportation and export of slate. An agreement was reached between the Knight of Kerry and the HMC who employed William Edgeworth to oversee operations (Wilkins 2009). In the following year this operation attracted a trade delegation of builders to visit from London (Anon. 1825) and slate was available, possibly from the first of two underground chambers/galleries that eventually would penetrate the hillside of Dohilla to a depth of approximately 200m. By 1826 the quarry was in profit, and slates, ranging in size from Duchess (24 inches by 12 inches) to Singles (12 inches by 6 inches) and sizes in between, were being advertised for sale in 1829 from the HMC through their depots at Tralee and Castlemaine. However, by 1831 the HMC withdrew on account of debts run up by the quarry supervisor (Anon. 1832; McArdle 2018). The Knight of Kerry again resumed direct responsibility for the quarry and invested a sum of £16,000 (the equivalent of €2 million in 2022) and built steam mills at the quarry entrance (Gwyn 1991, p. 42), the erection of which was celebrated with a dinner for the workers (Anon. 1838a). The chimney of this complex is the only remnant of these buildings remaining today (Fig. 6). Flint sand was fed into the

Fig. 6—Chimney at quarry site. It was attached to the squaring house to its immediate north; this was demolished in 1939.

flat non-serrated blades which cut the slabs. As local sand was not suitable for this purpose, material had to be imported by ship (Anon. 1851a) from Bridport in Devon (Gwyn 1991).

In 1830 the Knight of Kerry engaged Alexander Nimmo, a noted Scottish engineer and surveyor who was responsible for the design of many harbours in western districts in Ireland (Wilkins 2009), to lay out the town of Knightstown. Ostensibly this largely consisted of the Slate Yard where slabs that had been first squared in the quarry sawmill (Anon. 1863) were worked (Fig. 7A). The slate yard contained a gantry crane, various boilers to drive a frame saw, a planer for polishing slabs, and a building for hand-working the stone (Gwyn 1991, plan of yard, p. 46). The bulk of the construction was in slate brought from the Dohilla quarry. Little survives of the fabric of the Slate Yard, except for flooring slabs with indentations cut into them to house machinery (Fig. 7B), and some roofless buildings, the most important of which became known as the First Message Building (Fig. 7C, D). The Knight of Kerry also had a pier for the export of slate built on the eastern side of the island that faced the mainland (Fig. 8A, B), a weighing station for the stone (Fig. 8C), a clock tower (Fig. 8D), and a terrace of houses for workers (Fig. 9). Over time the town expanded and dwellings, a school, church and hotel were erected, and a meteorological station was built outside town. Probably at the same time a short terrace of six cottages for workers was erected close to the quarry and the roadway became known as the White Street (Hayward 1946, p. 187); the origins of this appellation are unknown.

During that period, the operators and owners of Valentia Slate were attempting to capture a share of the slate market with material from Ireland, but they were in competition with the Imperial Slate Company who

Fig. 7—Valentia Slate Yard. (A) Entrance; (B) Slab floor of demolished engine room with carved recesses for machinery; (C) The First Message building used for hand cutting slate or as a store; (D) Interior of the First Message building showing construction style in Valentia Slate.

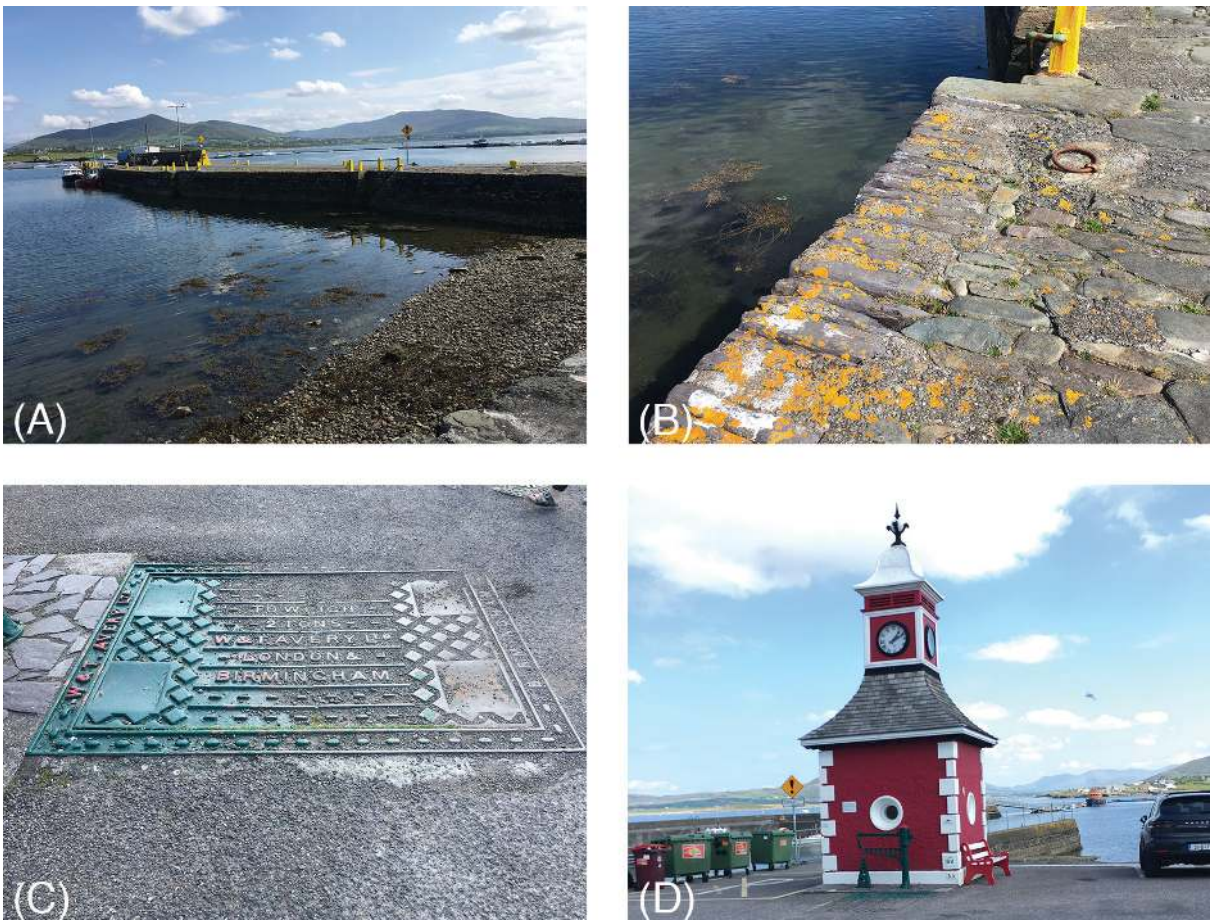

Fig. 8—(A) Slate Pier; (B) Use of Valentia Slate for pier coping; (C) Weighing Station for slate; (D) Knightstown Clock.

Fig. 9—Slate workers cottages at Knightstown. Note the use of slate slabs traversing street gutter at gate entrances.

were extracting Killaloe Slate from Portroe, County Tipperary. The latter, an olive to dark green slate, was more easily split into thin sheets and were therefore more suitable for roofing than the former. However, Valentia Slate found favour for other uses on account of being able to be extracted in slabs of large size.

The heyday of slate quarrying was probably the period 1839 to 1877, when at times as many as 200 men were directly employed in the quarry and others in the cutting mill. Production provided stone for many uses (see list above) and in 1839 the Committee of the Council for Education recommended that the slate was used in the flooring of toilets and walls of urinals in all future school buildings (Anon. 1839–40, p. 130). For twenty years from 1839 Bewicke Blackburn (1811–97), a civil engineer, managed the quarry for the Knight of Kerry. Blackburn is better known for his later design of a steam car. At the Great Exhibition in London in 1851 he received a prize medal for exhibiting Valentia Slate products. These items included sash bars for glazing, a table, a garden seat and a roof ridge designed by the noted architect Tullamore-born Benjamin Woodward (1816–61) who was centrally involved in the design of the Museum Building, Trinity College Dublin and the Oxford Museum of Natural History (Anon. 1851a). The company then known as the Valencia Slate Company (note the variant spelling from that used today for both the island and stone) issued a share option on 13 November 1846 in an attempt to raise 100,000 guineas (Anon. 1846a; Morris 2010). Proudly an advertisement reported that slate could be utilised for factory floors, maltings, hospitals, prisons, ceiling, and roofs amongst others, and had been used at Pentonville Prison and for flooring at the railway station in Birmingham and for coffee drying floors and sugar houses in the colonies, the latter most likely being in Jamaica (Anon. 1846a, Morris 2010). The following year, on 17 June 1847, the Company received a Royal Charter. Availing of the new capital injection in 1848 Robert John Lecky (1809–97), owner of a shipbuilding company was commissioned to install steam mills at the quarry (Anon. 1848) and in due course in 1855 he took over managing the quarry. In 1864 a new group of investors headed up by George Eugene Magnus (1801–73) of the Pimlico Slate Company, London established the Valencia Slate Company. Advertising in *The Mining Journal* (7 May 1864, p. 331) they sought to raise the considerable sum of £50,000 in capital in 5,000 shares of £10 each. To further promote this floatation, they issued a four-page prospectus in May 1864 that guaranteed investors a 10% dividend in the first year. It noted that wages at Valentia were half that paid to comparable quarry workers in Wales. Magus was an entrepreneur, who in 1840 patented a methodology of enamelling slate (Newton 1841). This allowed for the manufacture of ornate chimneypieces, but also led to commissions to produce decorative billiard tables for which he is best known. Fine examples were manufactured from Valentia Slate for Prince Albert the Consort of Queen Victoria, the Duke of Wellington, and other individuals. The slate continued to be used for at least 40 years for the beds of wooden tables (Blackburn 1881). Another fine example of Valentia craftsmanship are the two garden benches, formerly at Colles Sandes House in Tralee, which are now on display at the Kerry County Library in the town (Pochin Mould 1996; Browne 2003) (Fig. 10E). By 1876 the quarry was in the hands of another London-consortium, Grover and Maynes, that oversaw production of 1,644 tons of slate in 1876. The most remarkable use of Valentia Slate was undoubtedly its use for railway sleepers in San Salvador, which were shipped in 1870. While known to be one of the strongest stone types, it remained unreported as to how the sleepers performed and for how long. However, we can be sure that they were indeed termite proof.

During this period the stone had a high reputation and as has been documented was valued for the export market, especially in Britain where in 1864 agents in London, Bristol and Southampton stocked the stone (Anon. 1864). In Britain its versatility was exploited to great effect. The fact that Valentia Slate was used for flooring in the Houses of Parliament in London is testament to the high regard in which it was considered at the time. In the 1830s Valentia Slate was exported to Sydney, where slabs were advertised in local newspapers for sale and noted as being ideal for manufacturing water tanks and reservoirs (Anon. 1838c, 1839). It was also exported to Melbourne as pre-assembled water tanks, window sills and tables (Anon. 1855). Stone was also exported to the island of Mauritius in the Indian Ocean (Anon. 1846). Nevertheless, the various companies that ran the Valentia Slate quarry grappled continuously with issues relating to the high transportation costs from western Ireland. All the stone was shipped from the local purpose-built pier and continued even after the establishment of the railway in 1893 close by from the mainland. There is no evidence for this line being used for slate freight. Despite the popularity of the stone, transportation costs made sustained commercial viability difficult, yet when one company ceased trading another group of investors was ready to take up the challenge. This demonstrates the lure of the stone on account of its versatility and uniqueness.

Sir Robert Kane (1809–90), a Dublin-born chemist and Director of the Museum of Irish Industry at St Stephen's Green in Dublin, published *The*

Fig. 10—Uses of Valentia Slate: (A) Modern construction stone; (B) Window sill; (C) Gate piers, Knightstown; (D) Wall Stile, Ardfert; (E) Steps and roofing slates, St John's Church, Knightstown.

at the quarry into lengths of 4 to 5 feet and then transported to the mill at Knightstown where they were further cut into thinner slabs of half to one inch in thickness.

In 1877 the Valencia Slate Slab Company withdrew, and no quarrying was undertaken until 1900 when the Knight of Kerry reopened the quarry. As noted previously, the western '1911 chamber' was first opened at this time. This provided employment for his tenants, but the large 1911 rock fall blocked the entrance to the workings and quarrying again ceased. Even though there was interest expressed in the Irish parliament in 1930 about the possibility of the quarries reopening nothing came of this (Anon. 1928). Seventy years later a partnership of three local men, Micheál Lyne, Patrick O'Driscoll and Micheal O'Donoghue, reopened the workings in 1998, having purchased the quarry from the Knight of Kerry, and they managed a successful, albeit small-scale

Applications of use

Information on the use of Valentia Slate in buildings and other domestic applications since its earliest extraction can be found in a range of published sources. These include trade journals such as *The Dublin Builder* and its successor *The Irish Builder*, *The Builder* and in others, or in specific volumes or papers on the use of stone in particular locations, i.e. Tralee, County Kerry, for highly ornate garden benches (Pochin Mould 1996; Browne 2003) and Dublin (Wyse Jackson 1993). Information on the operations and aspects of the history of the quarry itself may be found in accounts such as that by Gwyn (1991) and O'Cleirigh (1992), in national newspapers, in *The Mining Journal* and in prospectuses issued by the operators of which that on the 1864 share issue is particularly informative (Anon. 1864).

Valentia Slate is very workable, durable and strong stone that has been put to many uses. These include the following, some of which were advertised as being available for order from the quarry in the 1830s (Anon. 1835; 1838b): Split or sawn building stone (Fig. 10A); window sills (Fig. 10B); entrance piers (Fig. 10C); stiles in walls (Fig 10D); roofing slate (Fig. 10E); steps (Fig. 10E); roof or building cladding; cladding for bonded warehouses; headstones (Fig. 11A, B), footstones and grave surrounds; box tombs (Fig. 11C); flooring, exterior and interior (Fig. 7B, 11D, E); flooring for balconies; skirting lintels; setts and cobbles; kerb stones; signs; chimneypieces; sofas and chairs for sitting rooms; countertops in public houses (Fig. 11D) and kitchens; bathroom fittings; water cisterns; wine bins; toilet flooring and urinal walls in schools; flooring for malting houses in breweries; sugar houses and coffee drying floors (Anon. 1846b); flooring in railway stations; butter prints; cattle and pig troughs; melon frames; baptismal fonts; decorative items such as candlesticks and lamps; furniture including bookshelves; shelving; picture frames; garden benches (Fig. 11F); chimney flues (Anon. 1841); railway sleepers; billiard tables (entire structure) or just for the flat bed; novelty items (e.g. bird houses) and sundials (Fig. 11G). Perhaps the most unusual use of the stone was for small ties that were drilled with a small hole to hold lightening conductor rods to buildings. As the stone is non-conductive the building masonry is not damaged by a strike as it would be if the ties were metallic.

Fig. 11—Uses of Valentia Slate: (A) Headstone c. 1847, Caherciveen, Co. Kerry; (B) Headstones, Kilmore graveyard, Valentia Island, Co, Kerry, the large example dated 1862 in the foreground carries the inscription 'Erected by the Valencia Slab Co.'; (C) Box tomb, Kiltallagh, near Milltown, Co. Kerry; (D) Modern flooring and bar counter, Ardfert, Co. Kerry; (E) Palace of Westminster conserved flooring; (F) Colles Sandes garden bench at the County Library, Tralee; (G) Sundial and stand craved by Patrick Roche in 1845 for the Knight of Kerry (now on display in the Valentia Heritage Centre).

Uses in buildings and other installations

Ireland (Fig. 12)

- Skellig Lighthouse – coping on walls and cladding on lighthouse.
- Knightstown Pier, Valentia Island 1825 (still in use).
- First Message (Cable Station) building and others in Slate Yard, Knightstown, Valentia Island – cut stone scraps for building, 1830s (Fig. 7C, D).
- Headstones, footstones and occasionally box tombs – frequently found in Co. Kerry graveyards but rarer in other cemeteries further away. The earliest example currently known is that in Ardfert graveyard for Thomas Sheehy who died in 1801; the headstone may have been erected somewhat later. Good examples dating from the 1840s can be found in Co. Kerry at Caherciveen (Fig. 11A), Killegy, Kilmore on Valentia Island (Fig. 11B), Ardfert, Dingle and Camp on the Dingle Peninsula, Muckross Abbey graveyard near Killarney and Kiltallagh near Milltown (Fig. 11C), Fine examples of headstones and box tombs are also in the large metropolitan cemetery at Mount Jerome, Harold's Cross, Dublin. The fine-grained structure of the slate allowed for fine carving and lettering to be cut into its surface and examples over 200 years old show no to little deterioration. The names of stone carvers are often unknown but a headstone in Aglish graveyard, Co. Kerry carries the name of the Valentia carver I. Millane (Mytum 2012) He is sometimes given on other headstones elsewhere as John Mullane. Tombstones in Killegy Graveyard in Killarney carry inscriptions from the Carrick Brothers of Valencia while at Ardfert graveyard the fine assembly consisting of a headstone, footstone and grave slab carries the inscription 'J. Carrick' on the latter.
- Glanleam House, Valentia, residence of the Knight of Kerry – decorative mantle pieces, garden seats and tables, wash stands, steps.
- Muckross House, Herbert Estate, Killarney 1842 – Flooring slabs.
- Colles Sandes House, Tralee – Garden benches (Fig. 11F).
- Tralee Courthouse – Exterior paving of plinth.
- Glena Cottage, Kenmare Estate Killarney, 1860 – Window sills.
- Slate Butter Print (example from Cappagh, Co. Kerry. National Museum of Ireland on display in Kerry County Museum, Tralee).
- Daniel O'Connell Memorial Church, Caherciveen – cross, fabricated from one of the largest slabs to be extracted (Anon. 1863).
- Shelbourne Hotel, Dublin – decorative chimneypieces, 1867.
- St John the Baptist Church of Ireland, Knightstown – steps, roof slate (Fig. 10E).
- Ardfert Cathedral stile.
- Knightstown – stiles.
- Kilgobban Church, Camp, Co. Kerry – baptismal font.
- Skellig Michael – conservation of coping on roadside, 2000s.
- European Union Food and Veterinary Headquarters, Co. Meath, 2000s.
- National State Laboratory, Co. Dublin 2000s.
- Marine Institute, Galway, 2000s.
- South Pole Inn, Annascaul, Co. Kerry – paving of area in front of public house, *c*. 2020.
- Trinity College, Dublin – reroofing of the residential block 'The Rubrics', 2022.

United Kingdom (Fig. 12)

- Pentonville Prison – flooring, 1840s.
- Osborne House, Isle of Wight – enamelled Billiard Table belonging to Prince Albert, Prince Consort to Queen Victoria, 1847.
- Stratfield Saye, Hampshire, the residence of Arthur Wellesley, 1st Duke of Wellington who advocated for the use of Valentia Slate – dairy shelving, enamelled Billiard Table, *c*. 1850s.
- Palace of Westminster (Houses of Parliament), London – roof slabs, interior flooring original building (1850) and recent conservation (2015) (Fig. 11E), and for storage vats. These are known as 'Valentia Vats' and held 100 gallons of Scotch whisky and 30 gallons of Irish whiskey.
- Public Record Office [PRO], London – 26 miles of shelving, 1850 used in conjunction with cast iron construction as a fire preventative. The PRO moved to Kew in the 20th Century and King's College London occupied the building. The main reading room of the Maughan Library still uses the original slate shelving.
- Bedfordshire and Herefordshire breweries, 1852 – malting floors.
- Brighton racetrack, 1852 – used in the Stand.
- St Paul's Cathedral, London – interior, *c*. 1860.
- Bethlem (Bethlehem) Royal Hospital, Southwark, London.
- Portsmouth Barracks.
- British Museum, London.
- National Gallery, London.

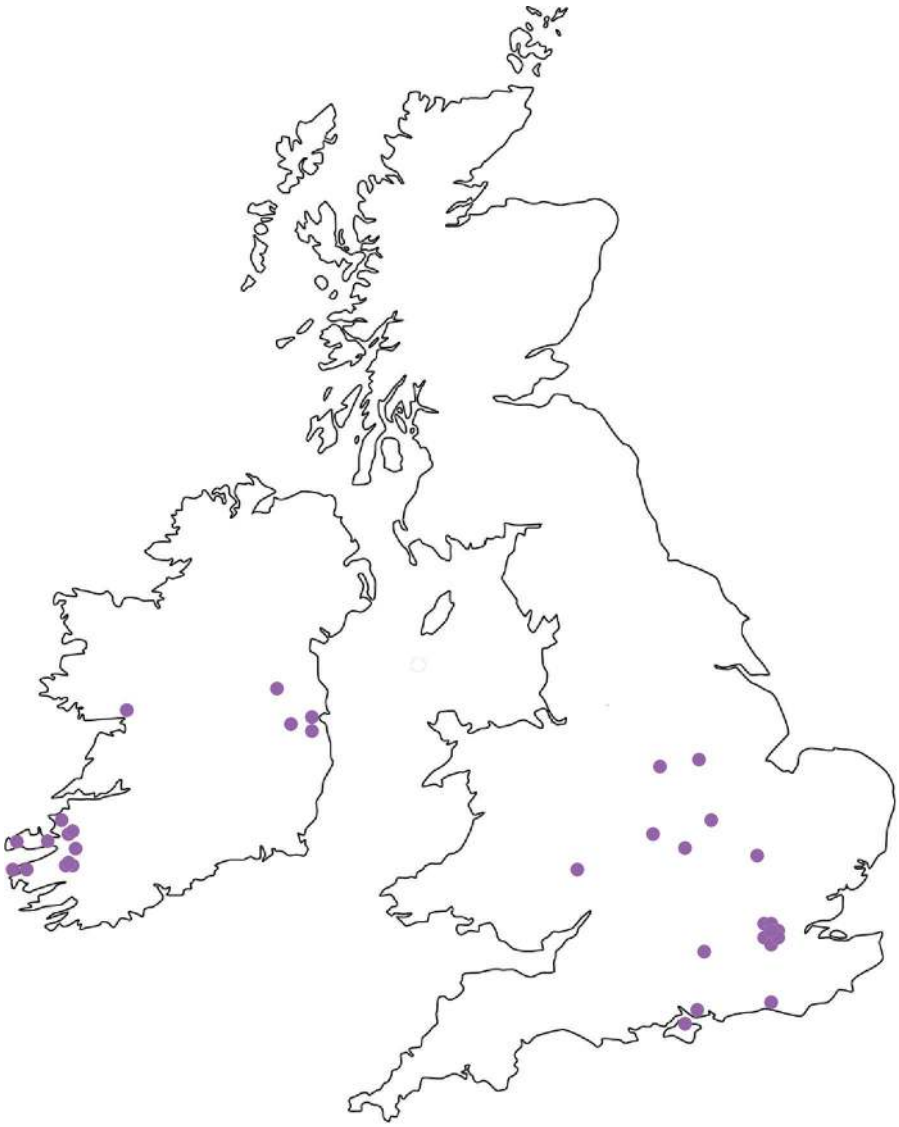

Fig. 12—Map showing the distribution of Valentia Slate usage in Ireland and Britain.

- St Thomas's Hospital, London.
- Several London railway stations including St Pancras, Charing Cross and midland stations at Birmingham (1840s), Derby, Leicester, Nottingham and Rugby (1860s) – flooring.
- Several London Underground Stations including Liverpool Street, Charing Cross, Waterloo, and Blackfriars, *c*. 1890.
- Westminster Cathedral, London – interior, 1900.

El Salvador
- San Salvador city – railway sleepers, 1870.

France
- Opera House, Paris – interior, 1870.

Jamaica
- Sugar houses, *c*. 1840s (Anon. 1846b).

Australia
- Sydney – water tanks, reservoirs 1830s.
- Melbourne – Tables and window sills 1850s.

Mauritius
- Unspecified use, 1846.

Related and other heritage issues

Valentia Island (Fig. 2) has several natural and historical aspects congregated in a small geographical area that provides significant cultural interest (as is

demonstrated in the diversity of sites and specialist interest discussed below). The island has had a long 6,000-year history of habitation and subsistence farming activities (Mitchell 1989). The slate quarry and ancillary historical buildings adjacent to it, plus the former slate yard, provide geological elements of heritage appreciation. The international palaeontological importance of tetrapod trackway in the Valentia Slate Formation is acknowledged by its designation as a proposed National Heritage Area (NHA) now in the care of the National Parks and Wildlife Service, an Irish Government agency (Parkes 2004). The Valentia Island Geoheritage Association (https://valentiaslate.com/valentia-island-geoheritage-association/) was established in 2020 to promote awareness of the rich geological heritage of the island. Appreciation of the work of the local naturalist Maude Delap (1866–1953), who specialised in the study of jellyfish, has also garnered increased attention (Byrne 1997). Further activities such as the development of the greenway on a 27km section of the track bed of the former Farranfore to Valencia Harbour Railway that ran from 1893 until 1960 (O'Sullivan 2003) will add to the cultural lure of the island. This railway line served the island, albeit from the Valentia Harbour station on the mainland opposite Knightstown, which could only be reached by ferry from the terminus. On the island the Valentia Heritage Centre in Knightstown contains many artifacts of natural history, land ownership, slate and geology, and the trans-Atlantic cable and provides interpretative resources that explains their cultural significance (https://vhc.cablehistory.org).

In 1857 the first trans-Atlantic cable was laid with Valentia selected as the westernmost point in Europe and Newfoundland the starting point on the North American side (Gordon 2002; Stanton 2008), and in the following decades further cables were laid out from its shores. That year the proprietor of the Valentia Slate quarry leased part of its slate yard in Knightstown to a company led by the American entrepreneur Cyrus Field (1819–92) for the purpose of developing the technology for and operating the European end of the first trans-Atlantic telegraph cable. The Belfast-born physicist William Thomson (1824–1907), who was later elevated to the peerage as Lord Kelvin, was closely involved in the scientific work that resulted in the laying of the cable (Crossland 2008) and his mirror galvanometer which was used to detect currents during the transmission of signals along the cable was set up in a Slate Yard building. This instrument, which is now in the Science Museum in London, was important in allowing the first cable message to be sent in August 1858 from the slate company building which is now known as the 'First Message Building' and is a protected structure. Unfortunately the first cable subsequently failed, and it was not until 1866 that a commercially viable cable was operational. The First Message Building is now a focus of Irish-Canadian efforts to have the cable stations and associated infrastructure on both sides of the Atlantic designated as an UNESCO World Heritage Site (https://valentiacable.com/unesco-world-heritage-application/). It is proposed that the refurbished slate yard will form a central part of the site (Kelly 2021).

The island was the site of an important meteorological station as well as a communications centre developed in 1914 by Guglielmo Marconi (1874–1937). Locally an Altazimuth Trail has been laid out to celebrate the 1862 experiment to confirm lines of longitude (Airy 1862) that had been delineated in an earlier experiment on the island in 1844 and since 1954 the Marian Shrine situated high above the entrance to the quarry has also drawn visitors (Anon. 2015).

The proposed designation of Valentia Slate as a HSR is allied to and adds potential status information that could enhance impetus to the current application for the whole of Valentia Island to be accorded UNESCO World Heritage Site status (www.valentiacable.com). Ireland currently has three World Heritage Sites: the Giant's Causeway in northeast Ireland, the Boyne Valley Neolithic monuments in central Ireland and Skellig Michael. The latter which comprises a collection of early Christian drystone monastic buildings is nearly 12km offshore from Valentia Island; these buildings are largely constructed of St Finan's Sandstone, a unit that overlies the Valentia Slate, with the window and door lintels in St Michael's Church of conglomerates from Valentia Island. Ongoing repairs to access walls to the lighthouse utilise Valentia Slate from the quarry on Valentia Island and follow careful and modern conservation standards.

Related dimension stone

No other slates closely resemble Valentia Slate; it is unique in terms of its pale purple colour and its lithological characteristics that readily yield slabs as well as it having the capability of being split into thinner slates. In Ireland other slates were extracted in the nineteenth century in large quantities from the Victoria Slate Quarries near Carrick-on-Suir and from the Killaloe Slate Quarries at Portroe, County Tipperary and from the Ormond Quarries

in County Kilkenny. These all produced better quality dark green to grey coloured roofing slates (Wilkinson 1845; Kinahan 1888) but were incapable of providing slate slabs for which Valentia held eminence. Valentia Slate is Ireland's only remaining slate quarry, its only underground dimension stone quarry and the most westerly quarry in Europe.

Within the suite of currently accepted and potential candidate Heritage Stones, Valentia Slate is one of several slates. Compared to other lithologies such as marble, granite or limestone, the number of slates under consideration is low. Chamba Slate from India is used for roofing and paving (Kaur *et al.* 2020) while Penrhyn Slate from North Wales is highly ranked for producing high quality roofing slate (Hughes *et al.* 2016). Bernardos Slate from central Spain (Cárdenes *et al.* 2021) and slate from Pennsylvania in the United States. Mintaro Slate from South Australia (Cooper 2019) show some similarities to Valentia Slate in being able to yield slabs that allow for a range of utilisations. However, the Irish variety is also fabricated into roofing slates.

Conclusions

The Valentia Slate is a very versatile stone that has been promoted and utilised since it was first extracted in the early 1800s. It has been used for many purposes, especially in Ireland and Britain, some of which were culturally significant. Its lithological characteristics make it ideal for dimension stone, construction, paving, domestic fittings and monumental headstones. The original quarry on Valentia Island is still in operation and recent investment heralds continued confidence in the material. Its future proposal as an IUGS Heritage Stone is warranted on the basis of the factors outlined in this paper.

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Dedication

This paper is warmly dedicated to our close friend and colleague Matthew Parkes who tirelessly advanced the awareness of the value and importance of geoheritage in his adopted homeland. His greatest legacy was to ensure the protection of many geological sites of cultural and scientific value, which included the Valentia tetrapod trackway site that he personally championed. These sites will be enjoyed by generations to come.

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