

The Geology of Chatsworth House, Derbyshire

Ian Thomas and Mick Cooper



Figure 1. Chatsworth House

Chatsworth is one of Britain's great treasure houses, and it exemplifies perhaps more than any other, the use and display of local and exotic stones and minerals. Like many landed families, the Cavendishes were avid art connoisseurs; more unusually, several members were equally keen mineral collectors. Lady Georgiana Spencer, the 6th Duke and the late 11th Duke (1920–2004) were the most prominent. In particular, the 6th Duke formed strong links with Faustino Corsi, a prominent Italian decorative stone specialist and with Czar Nicholas 1 of Russia; they exchanged not only ideas, but also many materials. These connections, coupled with the ability to source materials from the family's own estates, strongly influenced the probably unique blend of locally derived and exotic stone lithologies at Chatsworth.

The love of stone possesses you like a new sense...
6th Duke on visiting Rome

Most of the building stone and many of the decorative stones at Chatsworth have come either from the estate itself or from Devonshire lands further afield. The main body of the house was built in various stages, all from the Ashover Grit (and not as some have suggested, from the Chatsworth Grit). The stone in the building as it now stands (initially from the late C17th) was sourced from Ball (or Bow) Cross, overlooking Bakewell, and from Whicksop Edge, now known as Bakewell Edge. Many other local quarries

were later employed. An attractive, honey-coloured sandstone with liesegang rings (formed by iron mineral staining) makes up the grand North Gateway (Fig. 2); this and the stone for much of those parts of the house (mainly in the North Wing) remodelled in the 1820s, was quarried at Burntwood high above Beeley. A small amount of much later work drew upon Stancliffe Stone, from Darley Dale, outside the family lands.

The Tour of the House

Within the house, and just inside the main public entrance, the North Front Hall contains turned, cylindrical columns, each 1.2 m tall, of bioturbated black marble. These are conventionally black over most areas, but surprisingly grade into only a mid-grey in others; the grey surfaces are those more exposed to daylight, where it appears that the hydrocarbon colouring in the stone has broken down, and consequently the columns have faded. Indeed, the 6th Duke commented in 1844 that they were already losing their colour and were inferior to stone from the Ashford Rookery Quarry. It has been suggested that the stone may not be Ashford Marble, but could be Rosewood Marble (as used elsewhere in the house), but the latter normally has alternating grey and black veining rather than a graded change in colour.

The substantial balustrades to the stairs here are in pale cream-grey, Derbyshire fossil, crinoidal marble, likely to have been sourced from Once-a-Week Quarry at Sheldon, or possibly One Ash Grange Quarry at



Figure 2. Liesegang rings in the sandstone blocks of the North Gateway.

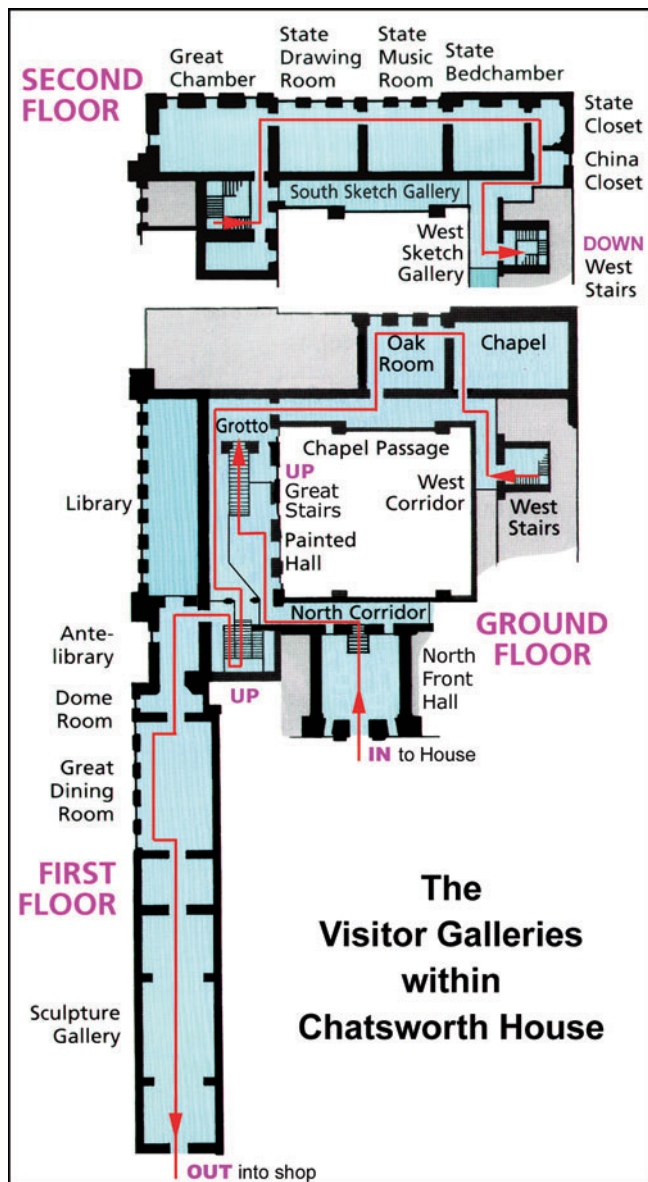


Figure 3. The tour route around Chatsworth House.

Monyash, but not from Ricklow Quarry, which was not on the Estate. This ‘marble’, is not a marble in the geological sense (ie a metamorphosed limestone), but is a hard limestone capable of taking a high polish (and therefore referred to as marble within the trade); it is the only one of a number of Derbyshire marbles still in production. These steps lead to the North Corridor, where the most noticeable feature is a floor of various marbles (Fig. 4) installed by Leonardi, ‘a poor man who lives at the Forum in Rome’. The classical marbles within the star patterns include *diasporo tenero* (brick-coloured, so-called soft jasper from Sicily); the lighter material may be *giallo antico* from Tunisia, though the date of installation, in 1841, does not accord with that of the reopening of those ancient quarries in 1876. The white marble is from the Apuan Alps. Vases standing in this section include red Egyptian porphyry (porphyritic andesitic dacite) and local Ashford Black Marble.

In the Painted Hall, a number of tables and columns supporting classical busts are of various granites, probably Scottish in origin. The black and white chequered floor here and elsewhere in the house comprises local black marble and white Carrara from Italy and was apparently installed by White Watson.

One of the table tops, edged in red Swedish porphyry, is made of a polished anorthosite known as larvikite, similar to the distinctive Finnish variety, specrolite, from Ylämaa (which was only discovered in 1941). Some of the labradorite feldspar crystals within it are up to 100 mm across and show excellent iridescence resulting from the interference effect of alternating twins and exsolution lamellae within the crystals themselves. This table top originates from the 6th Duke’s visit to Russia in 1830. He saw men working on a canal bridge foundation on Nevsky Prospect, in St. Petersburg, when he noticed blocks of larvikite that he speculated had been introduced as ships ballast. He brought them back to Chatsworth, had them made into the table top at the Ashford Marble Mill, and pointed out that it was harder than



Figure 4. Marbles forming the floor of the North Corridor.



Figure 5. A small part of the second-floor doorcase made of alabaster from Tutbury.

larvikite from elsewhere and displayed marked “irridencency”. Although he says no more on the likely source, St. Isaac’s Cathedral was being built at the time in St. Petersburg, and was sourcing “black granite” pillars from Peterlax (now Virolahti), part of the Rapakivi (or Wiborg) granite complex of southern Karelia. Though there appear to be no coastal outcrops of larvikite in this area, gabbroic anorthosite rafts similar to those at Ylämaa have been reported recently on the Russian side of the frontier. St. Isaac’s was later also supplied with larvikite from Zhytomyr, Ukraine.

The Second Floor

A series of stairs rise to the second floor, where massive doorcases are of alabaster from Tutbury (Fig 5). The side rooms are normally used for temporary displays that sometimes include a small selection from the Chatsworth Mineral Collection. A nearby pillar, supporting a bust of Charles, Prince of Wales, reveals excellent cross sections of large masses of Carboniferous colonial corals (*Syringopora*), possibly from Millers Dale, and produced in the C19th. Window sills in the Great Chamber are classic, pale-



Figure 6. Crinoidal limestones forming a window sill in the Great Chamber.

grey, Derbyshire, crinoidal limestone (Fig. 6), probably from quarries at Calver, although a ‘gray marble’ from Haddon Fields referred to in C17th accounts, could equally have been the source. Those in the next room, the State Drawing Room, are of a different crinoidal limestone that has fewer and smaller crinoid fragments between patches of darker fine-grained limestone that may represent an auto-brecciated structure, also from one of these sources.

Near the far (west) end of the South Sketch Gallery, a spectacular C19th inlaid table was at the time of the Society visit only accessible by special arrangement, but is likely to be on a modified tour route in the near future (Fig. 7). Nearly all its materials



Figure 7. The beautiful C19th table that stands in the South Sketch Gallery.



Figure 8. Inlaid blocks within the C19th table, (from top left clockwise) baryte and galena, *Syringopora* coral, fluorite, brecciated limestone; each block is 10cm square.

are of local origin. Square segments, each about 10x10 cm (Fig. 8) include representatives of oakstone (Derbyshire banded baryte), a fine Carboniferous colonial coral (*Syringopora*, sometimes then known as madreporite), crinoidal limestone probably from Sheldon (this was known as encrinite), Duke's Red Marble (in samples both with and without white calcite banding), rosewood marble, cross sections of small galena-baryte-calcite veins, purple and green fluorites, vein breccias, 'cockleshell marble' (an iron-rich non-marine lamellibranch bed or mussel band, probably from immediately above the Cockleshell Coal, the upper leaf of the Tupton Coal, and likely to have been from one of the Duke's collieries in the Rother Valley), and a limestone that is probably dolomitic. All these are framed individually and the table is edged in Ashford Black Marble.

The Duke's Red Marble is an almost blood-red, heavily hematized, Carboniferous limestone, capable of taking a high polish (Fig. 9). Its precise source has



Figure 9. A block of the Duke's Red Marble set into the C19th table, adjacent to a block of "cockleshell marble".

been enigmatic, with Alport, Youlgreave and Newhaven all being cited. According to records in the Chatsworth archive, it was produced as a decorative material from small mines around Newhaven, near Hartington, mainly in the 1820s. Various accounts that suggest it came from Alport-by-Youlgreave appear to be based on the use of solidified iron-rich sediments derived from mine drainage channels in that area, which were used for inlay in decorative table tops.

The Ground Floor

Returning to the ground floor, on one of the landings we inspected two scagliola plinths that form square corner columns boxing in services (scagliola is created by applying a mix of plaster and pigment as a covering to a wooden core, giving the appearance of a true marble). Just into the West Corridor, a very fine table is inlaid with a variety of marbles that are mainly of Italian origin. Next to it, a small and slightly bizarre table is decorated with three large stalactites that hang beneath it (Fig. 10); these may have been taken from Water Icicle Close Cavern near Monyash. Beside this, another column of Ashford Black Marble is noticeably faded on its window side.

The Chapel, built between 1688 and 1693, features four black marble columns, each 3 m tall and 350 mm in diameter, turned from monolithic pieces from Sheldon Moor near Bakewell. These, which contrast with a massive ornate altarpiece, are believed to have been carved on site by Samuel Watson, assisted by others from London. As the 1689 accounts testify, the alabaster for the altarpiece itself was from Gotham, Nottinghamshire, but the remainder was drawn from the family lands at Tutbury, Staffordshire. The latter was reputed to be from Castlehayes Mine adjacent to land largely destroyed by the Fauld munitions explosion. Records of the mine's history were also thought to have been lost in that event. Much of the alabaster in the House has been wrongly ascribed to Chellaston, near Derby; but, as far as is known, none of the material is from that source.



Figure 10. The table with stalactites, in the West Corridor.

Figure 11. A small part of a beautifully inlaid table in the Oak Room, with its leaves of green Florentine limestone.



The Oak Room exhibits large vases and tables, again of Ashford Black Marble; these are so uniformly black that they appear to be of ebony or factory-made in ceramic or plastic. The inlaid work is superb and includes lapis lazuli, Duke's Red and Florentine green (i.e. Alberese limestone from along the Arno Valley); the latter produces extremely realistic leaves (Fig. 11). These pieces were probably by Thomas Woodruff, and one or both are thought to have been included in the 1851 Great Exhibition. Back in the Chapel Passage, the statue from the Temple of Mut at Karnak, Egypt, is of a green metagabbro, widely known as verde antico.

The Grotto lies at the end of Chapel Passage, and contains a noisy water fountain with a black marble basin surmounted with swags of flowers in Roche Abbey stone (Permian Cadeby Formation from South Yorkshire) reputed to have been carved by Samuel Watson. Standing by a window, a columnar plinth 1.2 m tall was turned out of luxullianite (Fig. 12). This remarkable rock has almost perfectly regular large pink orthoclase phenocrysts set in a dense mosaic of



Figure 12. The luxullianite column in the Grotto, with its feldspars in a matrix of black tourmaline.

black schorl (a variety of tourmaline) and derived from Luxulyan in West Cornwall. Nearby is an inlaid table surfaced in an oakstone veneer. Tucked beneath the Great Stairs is a large tazza (a large flat vase or basin, supported by a pedestal) of the classic *fior di pesco* (peach blossom) marble from Euboea, Greece. Along the route back through the Painted Hall, columns of various pink granites, probably of Scottish origins, support white marble busts.

The First Floor

Up the Oak Stairs, the landing has a table with a top of stunning garnet amphibolite (Fig. 13), and also a large amethyst geode from southern Brazil (Fig. 14). The final section of the tour encompasses the suite of rooms in the long 1820s North Wing on the first floor.

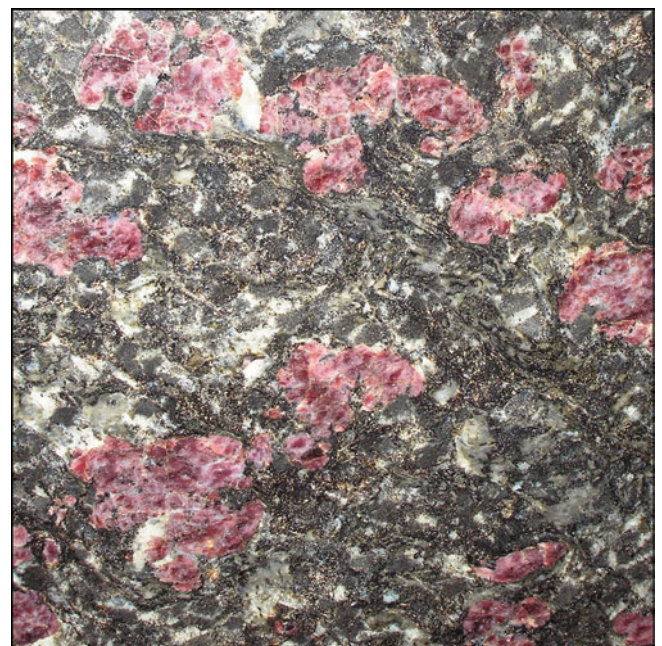


Figure 13. Red garnets in the amphibolite of the table on the Oak Stairs landing.



Figure 14. The amethyst geode from Brazil, standing at the top of the Oak Stairs.

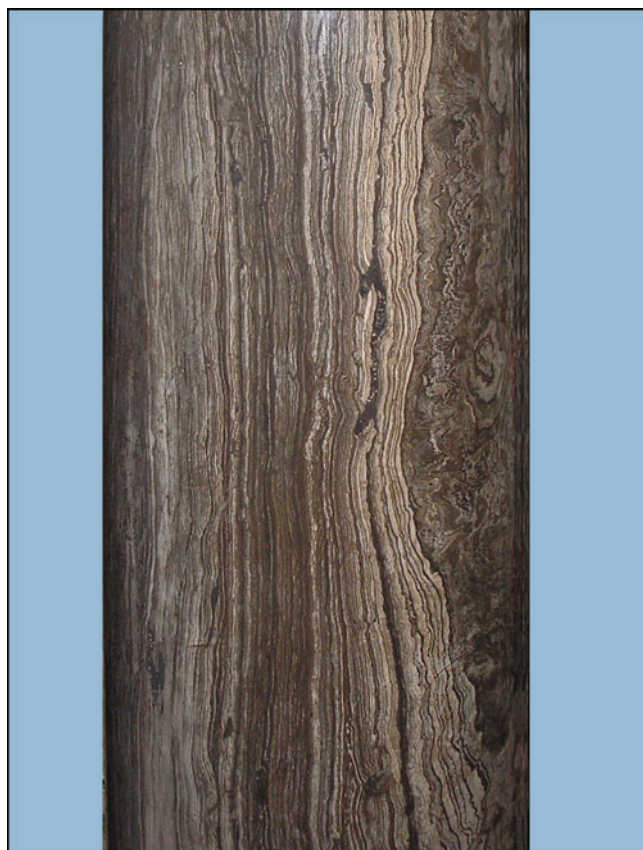


Figure 15. One Rosewood Marble columns in the library.



Figure 16. The giant quartz crystal from the Simplon Pass, now in the ante-library.

Standing in the private library, there is a unique set of columnar plinths, each 2 m tall, of Rosewood Marble, distinguished by its wavy bedding and mined from Nettle Dale, near Ashford in the Water (Fig. 15). The ante-library contains an exhibit of Henry Cavendish's scientific instruments, including a full range of crystal forms modelled in wood, and also a quartz crystal a metre tall that came from the Simplon Pass in Switzerland (Fig. 16)

A number of exotic marbles feature in the Dome Room and Great Dining Room as linings, pillars, urns and doorcases. The former room includes two oversized vases in peach coloured *occhio di pavone* marble, a Late Cretaceous shelly limestone from Turkey. A pair of columns is of so called 'oriental alabaster', which is a banded calcite from hot springs or cave deposits and probably from an Italian source. A second pair of supporting columns is of *pavonazetto* (brecciated marble). The grand columns on entering the Great Dining Room are of Porta Santa marble, quarried on Chios, Greece. Those of the exit are of Africano Breccia, and the source of this stone, widely used in classical times, had been lost or ascribed to a dozen possible localities, but has recently been confirmed as Teos (now Siğacik), Izmir in Turkey. Among the table tops in the Dining Room, the rich red ones are of Swedish porphyry that the 6th Duke commented as being finer (presumably in terms of the size of phenocrysts) than the material from

Figure 17. The spectacular tazza, 500 mm across, carved in Blue John fluorite and displayed in the Great Dining Room



Älvdalen (as in the Sculpture Gallery). The unusual grey top is of a phyllite (metamorphically between slate and schist), which the 6th Duke recorded as Siberian Jasper, a present from Czar Nicholas I.

A table on the left at the far end of the Great Dining Room supports three excellent items carved in Castleton Blue John fluorite. Two vases each 420 mm tall have low-heat lights inside them, which show they were turned from slabs of Blue John joined together (Fig. 18); the central tazza has a shallow bowl 500 mm across on a small stand and is the largest piece of Blue John carved by William Adam, for the princely sum of £120 in the mid-1800s (Fig. 17).

Beyond the Great Dining Room, the linking Vestibule displays two spectacular inlaid tables, each framed in Ashford Black Marble. One illustrates a

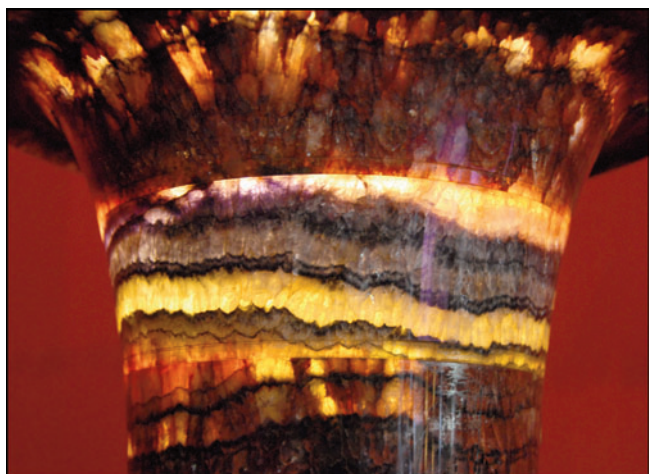


Figure 18. One of the Blue John Vases with internal lighting, in the Great Dining Room.

variety of flowers in exotic stones that include numerous sectioned agate pebbles (Fig. 20). The other features a beautiful blue bird with wings of lapis lazuli, within a frame of Duke's Red Marble (Fig. 19),

The Sculpture Gallery itself is entered through a door surround comprising truly magnificent monolithic slabs of Derbyshire crinoidal limestone from Sheldon – among the largest examples ever shaped. Most other elements are of exceptional size – Carrara marble statues by Canova, Gibson, Thorvaldsen and others, resting on plinths or columns of a considerable range of igneous rocks – porphyries,



Figure 19. Inlay of various agates in Ashford black marble, forming a table top in the Vestibule.



Figure 20. The beautiful inlay on a second table top in the Vestibule, featuring a bird of lapis lazuli.

granites and serpentines as well as breccias. The red porphyry is almost certainly Swedish (and is not the classical Egyptian) from the operation at Älvdalen, in the north of Dalarna county, which at the time was the only quality source of porphyry in Europe and found its way into many of the royal houses of Europe and Russia; its texture appears to show magma mixing (Fig. 21). A stunning green table top of malachite from the central Urals, is 2 m x 1 m, but has only a veneer 2 mm thick of malachite in pieces each about 100 mm across and cut to fit together; along with a malachite framed clock (Fig. 22), both were presented to the 6th Duke by Czar Nicholas 1. Other exhibits include a fossil silicified tree trunk. The last marble but one on the left stands on a plinth with a base of crinoidal limestone with the slightly pink colour characteristic of stone extracted from the Monyash area.

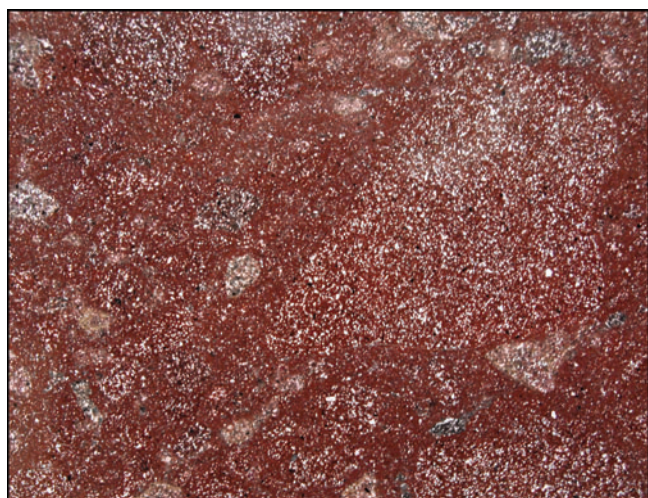


Figure 21. Textural variation created by magma mixing in a red porphyry forming a plinth in the Sculpture Gallery.

The floors in the Gallery are of a fine, grey-buff sandstone of unrecorded source, but the stone generally being employed at this period was coming from Beeley Moor. Elsewhere (and in most of the private quarters), Hopton Wood Stone, much in vogue in the C19th, is the main flooring stone. This was also used extensively for flooring and staircases in grand buildings through the British Isles.

After breakfast we all flocked to the North Passage where there were hundreds of stones in glass fronted cupboards. Petrified this and fossilized that. Blue John and Lapis Lazuli were the most exciting. Large flints, which looked as if they had been picked up by the side of the road, the least valuable. The minerals in the North Passage are good enough for a museum.

(from The Pursuit of Love, written in 1945, by Nancy Mitford, the Dowager Duchess' late sister)



Figure 22. The malachite-faced clock from Russia on display in the Sculpture Gallery.

The Mineral Collections

The minerals at Chatsworth House comprise three main collections, those of Georgiana, Duchess of Devonshire (1757-1806), those of her son the 6th Duke, and those of the late (11th) Duke. The significant material is in the first two of these mineral collections, which have been recently restored by members of the Russell Society, and their highlights are described below. The main collection is now housed in a Chatsworth store in two old mahogany drawer units purchased from the Hunterian Museum in Glasgow. Some is exhibited in Georgiana's original display cases in the stable-block conference centre, but there is very little on public display. Access is by request via the curatorial staff.

Perhaps surprisingly there is no great wealth of mineral material from the family's own mines, either at Ecton or elsewhere in England, as the collections were made independently by family members who gained enjoyment from the collecting. The family is Derbyshire based, and there is no direct connection with mines in Devon; their Devonshire name originates only from the fact that this was an available dukedom at the time of their elevation to the peerage.

These notes do not refer to the large display minerals that are scattered around the house; these were purchased separately, from Sotheby auctions and other sources, largely by the 11th Duke, and were specifically for display; they are briefly described within the notes above where they are encountered along the tour route around the House.

Georgiana, Duchess of Devonshire

The Devonshire Mineral Collection was begun by Georgiana Spencer, daughter of John Spencer (the 1st Earl Spencer) and Georgiana Poyntz of Althorp. Georgiana began collecting minerals in the closing years of the 18th century. At the time she was exiled in Europe, banished from her husband's house as a result of her absurd gambling debts and the discovery of her affair with the politician Charles Grey. While she was living in France, Georgiana began to study natural science, partly as a means of supporting and contributing to her children's education, and almost certainly as an escape from her sad state. Quite apart from any innate interest in the subject (she already professed a fascination with geology, the hottest science of the day), she may have been influenced not only by the considerable vogue for natural history collecting at the time, but also by the eminent mineralogists among her many acquaintances abroad. By the time of her return to England in 1793 her collection was quite substantial and she continued to add to it with gifts and purchases.

White Watson (1760-1835) was employed for nine weeks, April to June 1799, to catalogue her then substantial collections at Chiswick. On the same visit to London he also arranged the mineral collection of

Lady Henrietta Bessborough (Georgiana's sister) in Cavendish Square. Five years later he performed the same task on Georgiana's specimens at Chatsworth.

From Watson's original handwritten *Catalogues* it is apparent that many of Georgiana's specimens, especially those from Derbyshire, were supplied by him, but it is obvious from certain *Catalogue* entries and omissions that several collections were already in existence when he began his work. Watson also instructed the Duchess in mineralogy, and an interesting hand-written *Catalogue of External Characters of Fossils* by White Watson F.L.S. Bakewell, Derbyshire 1798 survives at Chatsworth (the term "fossils" in those days included minerals and archaeological material as well as true fossils). The book may also have been used to teach Georgiana's children mineralogy.

Watson listed Georgiana's minerals as ten separate collections, and his catalogues survive in two hardbound notebooks in the Devonshire archive at Chatsworth. Georgiana's original display cases also survive: a pair of matching bow-fronted glazed cabinets. Their construction (by one James Frost) appears to have been organized by White Watson in 1797 and 1798 at a cost of about £24 each, and he completed the arrangement of their contents in 1799. These cabinets have closely spaced, steeply sloping shelves each fitted with narrow horizontal strips of wood to support the specimens. The collection must have been very crowded in this limited space.



Figure 23. A boulder of Blue John fluorite, 250 mm tall, with some cut and polished faces, from Castleton.

Consequently, there would have been little space for display labels, and it was perhaps to facilitate reference to a separate *Catalogue* that many specimen number labels were attached to the display surface of the pieces. In 1998 Georgiana's cabinets were refurbished and placed in the Coffee Room of the new conference centre in the Chatsworth Stable Block. A selection of specimens from the Devonshire Collections is displayed within them, but does not reflect the original arrangement.

Many of Georgiana's specimens are rather dull and unattractive to the modern collector; typical of a systematic collection rather than a display of the exceptional, they were obviously acquired with more regard for their place within some mineralogical scheme than for their aesthetic qualities. This may seem unexpected in a society hostess whose early involvement with fashion and frivolity was so often satirized and censured, whose homes were filled with the marvels of art, whose husband was one of the richest men in the country, well able to afford the premium that rarity and beauty acquire. It supports the idea that she had a genuine interest in the systematics of the subject, though it may equally demonstrate a lack of sophistication.

'Hart', the 6th Duke

William, known as Hart from his courtesy title of the Marquess of Hartington, was born in Paris in 1790 — a quite remarkable place for his mother to be in such troubled times, and an episode that stimulated an enormous amount of speculative gossip. Little more than two months after Hart came of age his father died, and he inherited title, estates, great houses, possessions and wealth almost beyond belief.

In London in 1816 Hart struck up a deep and lasting friendship with the Grand Duke Nicholas of Russia, destined to become the Czar of all Russia. When Nicholas left England to return home to his bride-to-be, he invited Hart along. Hart stayed for several weeks in St Petersburg and was much struck by the beauty of the city. He dined with the Emperor Alexander I and was feted by the Russian nobility. This fondness for Russia is later reflected in the Russian minerals he collected. The Duke was appointed as Britain's Ambassador Extraordinary to Russia on Nicholas's succession to the throne in 1826.

Hart employed the architect Jeffry Wyatt (later Sir Jeffry Wyatville), to build a formidable extension to Chatsworth to house his collections and accommodate his intentions for grand entertainments. Wyatt was wholly unimpressed with the window that the Duke had made from slabs of Blue John fluorite, as the Duke relates in his Handbook: *The Derbyshire spar in the window is made of beautiful specimens: it shows how fine a thing might be made of the material. The stones were intended for a cabinet of minerals, and from their shape could only be arranged in a formal and not graceful pattern; and much did Sir Jeffry condemn the whole thing, which he pronounced to be the exact*



Figure 24. Polished slabs of four different Derbyshire fluorites from the Faustino Corsi suite.

resemblance of his grandmother's counterpane. This window was moved by the 11th Duke from the Theatre to the West Sub-Corridor.

Hart toured Italy in search of Italian art, especially marble sculpture to which he devoted a fortune and much effort. His fascination with Italian decorative stone led him to Faustino Corsi (1771-1845), an Italian lawyer with judicial responsibility for the Vatican police and an expert on the decorative stones of antiquity. In his *Catalogo ragionato...* of 1825, he notes that the Duke of Devonshire had "honoured his collection with a visit, and also enriched it with precious gifts". Corsi's collection of 1000 slabs was presented to the University of Oxford in 1827, and is now in the Oxford University Museum of Natural History. It contains 16 polished slabs of Derbyshire stones (Fig 24), including Duke's Red Marble, Ashford Black Marble, Rosewood Marble, various fossil limestones, and fluorites including Blue John. The Duke's Red is a beautiful hematitic limestone that was found in a limited deposit near Newhaven in Derbyshire in the 1820s. The Duke used it extensively in table tops and other lapidary work for Chatsworth, where the remaining world's supply of this unique stone lies piled in a basement corridor. One block of stone recently taken from this pile was carved by Angela Conner to make a pen tray (Fig. 25). This has bands of vein calcite between slices of very dark red, hematitic limestone; there is some mystery over its exact source, but it may be vein material that lay within a wider mass of the Duke's Red and was therefore extracted at the same time.

Hart died in his sleep in 1858. No catalogue of the collection from the Duke's time exists, though there are a few short lists of items acquired c.1817-1827. None of his specimens is systematically catalogued,

Figure 25. The pen tray carved by Angela Conner out of banded red calcite that appears to be associated with the Duke's Red Marble.



though many bear handwritten or printed labels of one sort or another. The earliest record of his collecting is that of Hart buying specimens from White Watson in 1809: Watson's cashbooks record a "Tablet of Ironstones and coals" purchased by the Marquis of Hartington for £6.0.0. Unfortunately this cannot be found today – perhaps it was a gift for another. We know too that he bought from Henry Heuland (1778-1856), the leading mineral dealer of the day, in 1820 and 1833, and attended a Heuland auction in May 1834. Lecturer and mineral dealer Prof. James Tennant (1808-1881) is known to have stayed at Chatsworth while working on the collection, though we do not know what he did and only one specimen can be attributed to him (it bears his label and must date from after 1840). The Duke had sufficient confidence in Tennant to entrust him with the "Duke's Emerald," to exhibit at his stand in the Great Exhibition at Crystal Palace in 1851, along with the Simplon Pass quartz crystal on display in the Chatsworth Sculpture Gallery.

Other than the Heuland specimens described below, Hart's most inspired purchases were from the sale of the collection of Sir Alexander Crichton (1763-1856).

The polymathic Crichton was physician to Emperor Alexander of Russia from 1803 to 1814, and was well respected for his work on insanity. In 1818, Crichton's mineral collection was described by Joseph F. Wagner as the finest in Russia. Wagner tells us that the Duke of Devonshire gave Crichton specimens for his collection including an "extraordinarily beautiful" tourmaline with apatite, from the then-new occurrence at Bovey Tracey in Devon. A pocket book of the Duke's dating from shortly before 1817 lists "Minerals given me by Doctor Creighton [sic] in exchange for Cornish and Derbyshire ones." There are 18 specimens listed, many of which seem to be of good quality, but it has so far not been possible to reconcile them with extant specimens. Whether the two men first met in England or Russia we can't tell, but in his *Handbook to Chatsworth and Hardwick*, the Duke mentions the existence in the Devonshire Collection of "specimens I added, and some that Dr. Creighton assisted me in procuring at St. Petersburg, where I gave some Derbyshire and Cornwall ores in exchange."

Crichton retired from his post in Russia in 1819 and returned to London. His marvellous mineral

Figure 26. A sample of the minerals in the 6th Duke's collection.

From left to right, and top to bottom -

- amethyst,
- smoky quartz,
- heulandite,
- grossular garnet,
- fluorite,
- aquamarine,
- sphalerite,
- gold on quartz,
- siberite,
- prehnite



collection was auctioned in London by George Brettingham Sowerby 1 (1788-1854) in 2721 lots over a period of 16 days from 20 April 1827. The Duke attended the Crichton sale, choosing the lots himself on the 4th and 7th of May. To identify them, the entries in the sale Catalogue were carefully cut out and pasted onto the specimens.

The Mineral Collection Today

By the mid-19th century the Devonshire mineral collections seem to have been long neglected. As early as 1844 the Duke comments in his Handbook: "All these minerals [i.e. his mother's and his own] are in a disgraceful state of neglect and want of classification. Those collected by my Mother ought to be replaced in their former order, as they were in the days of White Watson of Bakewell, who in vain endeavoured to hammer mineralogy into our youthful heads."

The collection continued in a more or less neglected state until the 1990s when the Russell Society took on the challenge of restoration, including systematic cataloguing and historical research. According to Watson's *Commonplace Book*, the Chiswick Collection contained 1076 specimens in 1799, and the Chatsworth Collection about 1000 in 1804. The Russell Society's analysis shows that the Chiswick Collection accounts for 1076 entries in the catalogue of which 1036 were extant when Watson did his work. The Catalogues of the Chatsworth Collection have 1032 potential entries but only 858 specimens were described. Watson, therefore, found 1894 specimens from a potential total of 2137, and noted that the specimens at Chiswick also included "a large collection of lavas, etc. collected by Her Grace in Italy that were not catalogued or described." Of the Duke's collection, the Crichton list numbers 75 pieces, there are 10 pieces in the 1820 Heuland purchase, and some 50 pieces in other *Catalogues* that we assume to have been his. This gives a grand total of about 2250 known to have been in the collections at one time or another since 1799. There are many un-labelled, and so far un-reconciled, specimens remaining at Chatsworth.



Figure 27. Mick Cooper working on the Chatsworth mineral collections in their new housing.



Figure 28. Calcite on fluorite from the Gregory Mine at Ashover.

Minerals from Georgiana's collection featured in an exhibit at Chatsworth concerning her life and times, following the publication of Amanda Foreman's fine biography, but this has now been closed. Suites of specimens from her and her son's collection toured several American museums in 2003 as part of the travelling exhibition *The Devonshire Inheritance*.

Highlights of the Mineral Collections

The restoration of the collection by the Russell Society has retained the arrangement established in Watson's original catalogues (here lettered A-K) and has added several other "artificial" catalogues based upon groups of specimens brought together by shared label styles or other common associations.

Catalogue A

Catalogue of a Collection of Fossils, the Productions of Derbyshire, in Her Grace the Duchess of Devonshire's Cabinet at Chatsworth: Arranged According to the Order of the Respective Strata in which they are found; Accompanied with a Tablet Representing a Section of the strata in Derbyshire, with a Printed Explanation. By White Watson F.L.S. &c 1804.

This contains a superb series of about 30 excellent galena, fluorite and sphalerite specimens from the Gregory mine, Ashover, in Derbyshire, many of which seem to have come from the same find (Fig. 28). The best show cuboctahedral galena crystals to 5 cm or so on colourless fluorite cubes with later, smaller, purple fluorite crystals and a sprinkling of minute chalcopyrite and marcasite crystals. They are surprisingly free from damage, given the fragile nature of the minerals present, and represent some of the finest Derbyshire galena specimens known. The fluorite specimens comprise groups of colourless cubes to almost 5 cm, spangled with minute sulphide crystals or scatterings of larger, well-defined sphalerite crystals. Some of the specimens exhibit minute crystals of enargite. Another Derbyshire speciality in the

collection is “Elastic Bitumen” from Castleton, including one huge lump of this intriguing mineraloid some 30 cm across. There are 30 specimens of chalcopyrite and other minerals from Ecton Hill in Staffordshire, including some malachite which is of rare occurrence there (Fig. 29).

Catalogue B

Catalogue of a Collection of Fossils Chiefly Volcanic and Pseudo volcanic from Dr. Townson. [White Watson, Chatsworth 1804].

Dr Robert Townson (1763-1827) was an important English traveller, naturalist and geologist, who was an expert on the petrology of volcanic rocks. He was the author of, among other works, of *The Philosophy of Mineralogy* (1789), which he dedicated to Georgiana (suggesting, incidentally, that her interest in the subject predated her lessons on her European exile). We still have 21 of Townson’s 24 “pseudo-volcanic rocks,” a third of which were baked clays and marls from a burning coalfield between Birmingham and Dudley in the English Midlands. Many of the remainder are basalts from various British and Welsh localities. The realization of the volcanic origin of basalt was a relatively new idea (by the Plutonists) at the time, and had been the subject of much contention with those (the Neptunists) that considered basalt of aqueous origin.

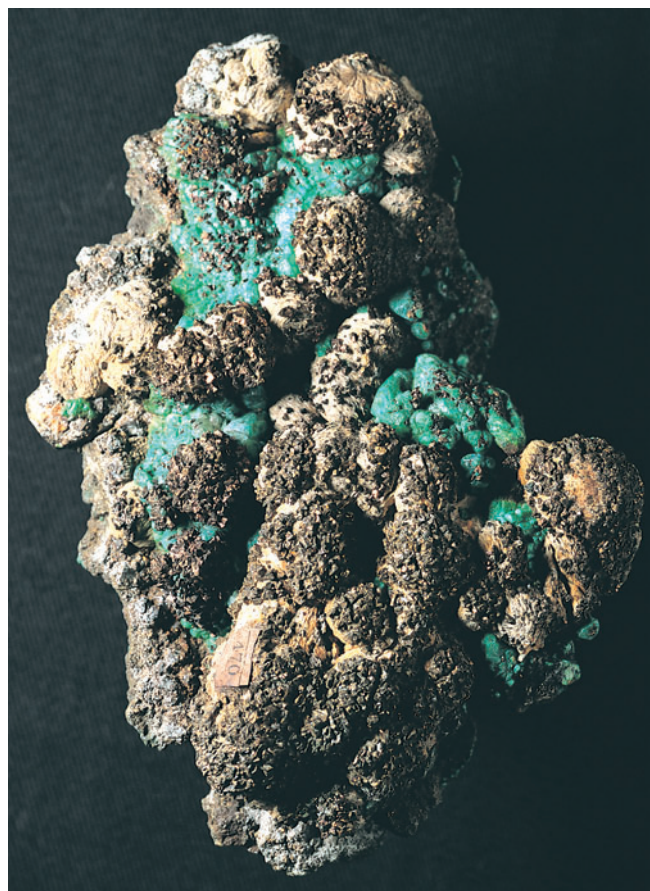


Figure 29. Chalcopyrite and malachite overlying baryte in a specimen 130 mm long and from the mines in Ecton Hill.



Figure 30. Dendritic native copper displayed on a marble slab, in a framed display 152 mm tall.

Catalogue C

Catalogue of a Systematic Collection of British Fossils [White Watson, Chatsworth 1804].

Notable inclusions here are specimens of galena, sphalerite, calcite and baryte from the Earl Ferrer’s mine, now totally under water, at Staunton Harold in Leicestershire.

Catalogue D

Catalogue of a Collection of Fossils, The Productions of Cornwall [White Watson, Chatsworth 1804].

The majority of extant specimens from Georgiana’s Cornish suite are cassiterite, copper and cuprite. Some of the latter were once good pieces, but have tarnished and darkened with the passage of time. The most interesting item in the Catalogue is No. D-254: *Arborescent Native Copper, Inlayed on an oval of White Statuary Marble, surrounded with black marble and a white frame by White Watson.* It is a rectangular slab of white marble upon which several flat pieces of arborescent copper have been glued, not inlayed (Fig. 30). This arrangement is surrounded by an oval mount of black marble and the whole is framed by a thin moulding of white marble; its front is glazed. There is no maker’s mark or other inscription, and the item is unique among Watson’s known work.

Catalogue E

Catalogue of a Collection of Fossils from Scotland, chiefly polished. [White Watson, Chatsworth 1804].

This small collection of Scottish minerals is mostly composed of cut and polished samples of the small but

exquisite agate pebbles and nodules for which Scotland is world-famous. The best here are from Montrose. There are also a few small examples of the smoky quartz crystals known, from the locality, as cairngormite. Of an original 64 pieces, 58 survive.

Catalogues F and G

F: Catalogue of the Fossils in the Cabinet in the Closet adjoining Her Grace's Dressing Room; & G: Catalogue [sic].

There were 231 specimens in Catalogue F, of which 164 survive. Catalogue G had 371 specimens, of which 303 have been identified. It is probable that these are mostly specimens acquired by Georgiana during her European exile and may in part be those arranged for her by Henri Struve. These Catalogues contain similar mixes of species, the majority of which are European, including many Alpine rock crystal and smoky quartz crystals (most rather damaged), kyanite with staurolite ("Sappare with red Shorl in micaceous Shistus") typical of material from Pizzo Forno, Switzerland, and adularia. There is a lump of massive pyromorphite from Anglesey (a rarity for the locality), a drawerful of Elba hematites of middling quality (obviously a favourite species at the time), and a plethora of "Vesuvian Hyacinths in the Matrix," most of which is well-crystallized vesuvianite (also known as idocrase) from Vesuvius. There are two specimens of well crystallized gold, and an *Eaglestone*, which no self-respecting 18th century mineral collection should lack: these hollow rattling ironstone nodules were once supposed to be found in eagles' nests and were imbued with all manner of occult powers, from combating miscarriage to curing gout.



Figure 31. Siberite, a variety of tourmaline, from the Urals.

Other than the Watson tablet, the most elaborately described item in the whole collection is the first in Catalogue F: *A stone which fell from the Clouds*. The entry contains a detailed account of the occurrence by "Mr Santi, [Giorgio Santi (1746-1822)] the Professor of Natural History at Pisa," who may, or may not, have supplied the specimen: *On the 16th of June 1794, at Pienza near Radifocini [sic], a dark and dense Cloud was discovered at a great height above the horizon, coming from the South east, that is, in the direction of Mount Vesuvius, which may be about 200 horizontal miles distant – from their height the Cloud was heard to issue noises like the discharge of several batteries of Cannon: it then burst into flames, at which moment fell a Shower of Stones, for seven or eight miles round, while the Cloud gradually vanished – These stones are various, being composed of grayish Lava, exactly resembling what is found on Vesuvius, and Mr. Santi, who took infinite pains to investigate this Phenomenon, is perfectly convinced, that the Cloud rose from Vesuvius, which was at that moment disgorging fires.* However, it is undoubtedly part of the meteorite shower of San Giovanni d'Asso (or Lucignano d'Asso) near Siena, an extremely important event in the history of meteorite science. In 2002, a piece of "Pallas's Iron" was discovered in a Chatsworth attic. It had been purchased from the collection of Alexander Crichton in 1827. This is another of the world's most famous meteorites. The original 700 kg mass was discovered some 230 km from Krasnojarsk, Siberia, in 1749, and was excavated by Peter Simon Pallas (1741-1811) of the St. Petersburg Academy of Sciences in 1772.

Several other specimens are also associated with well known scientists: Specimen F-219 is a piece of "Porphyry" obtained "from the very top of the highest point of the Mount St. Gothard" by Lieutenant General Benjamin Thompson, Count Rumford (1753-1814). Specimens of "*Sydneia of Terra Australis*" and amazonite were donated by the chemist and mineral collector Charles Hatchett (1765-1847) who analyzed Sydneia in 1798. Liversidge (1882) describes the material as "of no importance" but says of Hatchett's paper that "it contains probably the first analyses of any mineral from this Colony [Australia]." Sydneia had first been brought to England by Sir Joseph Banks, and was examined by Josiah Wedgwood (1790) for its potential for porcelain manufacture. It is an impure clay (probably kaolin) derived from altered granite.

By contrast to the majority of Georgiana's specimens, which have little aesthetic interest, many of Hart's specimens are of considerable beauty. Of particular note is a superb example of the rare raspberry-red siberite, a variety of tourmaline from Shaitansk, near Mursinsk, in the eastern Urals (Fig. 31), and an associated group of very dark green prisms. These were lots 2087 and 2082 from the Sowerby sale of the Crichton Collection, and Joseph Wagner illustrated both pieces life-size in his 1818 catalogue of Crichton's collection. A sprinkling of pale ivory-white sparkling crystals on one side of the

siberite spray appears to be the extremely rare rhodizite, a characteristic associate of siberite from Shaitansk, which is the co-type locality. Wagner considered Crichton's suite of siberite good reason alone to visit the collection, irrespective of its other merits.

Also identifiable from its label and its reproduction by Wagner is a large amazonite feldspar crystal described in the Sowerby Catalogue (lot number 2571) as "The Magnificent sousquadruple Crystal of Amazon Feldspar" and featured life-size by Wagner, who considered it one of the two finest crystals known.

Catalogue W: Heuland Specimens

The Silver Vault at Chatsworth is home to two of the most remarkable pieces in the collection - fine native silvers from Kongsberg, Norway. One is over 25 cm long and curls like a plume of metallic smoke, still lustrous, from a mass of crystallized white calcite (Fig. 32). The other is a thin, sail-like, triangular sheet of tarnished metal, 19 cm high, clasped at the base by a block of grey rock. They were sold by Henry Heuland, then the most famous and well-respected mineral dealer in Europe, with other pieces (including a Greenland tourmaline, a Saxony fluorite, a slab of rose



Figure 32. A twisted blade of native silver from the mines at Kongsberg in Norway.



Figure 33. The large crystal of vesuvianite from Italy.

quartz, and a German pyrargyrite) on the 6th April 1820, but how they came to Chatsworth remains a mystery. Hart also bought items from Henry Heuland's famous mineral auctions. On Wednesday 7th May 1834, lot number 512, "The most beautiful group known in this Country of the Amethyst from Rodna, in Transylvania; to be put up at £10", is probably the striking nest of milky, purple, bulbous amethyst crystals sprouting from pyrite-coated rock, which is still at Chatsworth.

Another highlight of the sale was "The most valuable Crystal known of the Idocrase, from Ala, Piemont; cost 600 francs; to be put up at £24", for which the Duke parted with £30. It is probable that this is the remarkable, deep olive-green, striated, single crystal that was mounted in an oak block and labelled as diopside. When removed from this support it was discovered that the perfect lustrous flat termination of this fine crystal (useful in distinguishing idocrase, now known as vesuvianite, from diopside) had been used as its base. The few small orange grossular crystals on one side are characteristic of material from Ala in Piedmont, though the crystal itself, at 13.5 x 5 x 4 cm, is anything but typical (Fig. 33). Even if this is not the Heuland specimen, it is still one of the largest vesuvianites known from Ala. Also within this collection are two beautiful specimens of heulandite, an orange-red zeolite, in basalts from the Clyde Valley of Scotland, purchased in 1827 (Fig. 34).

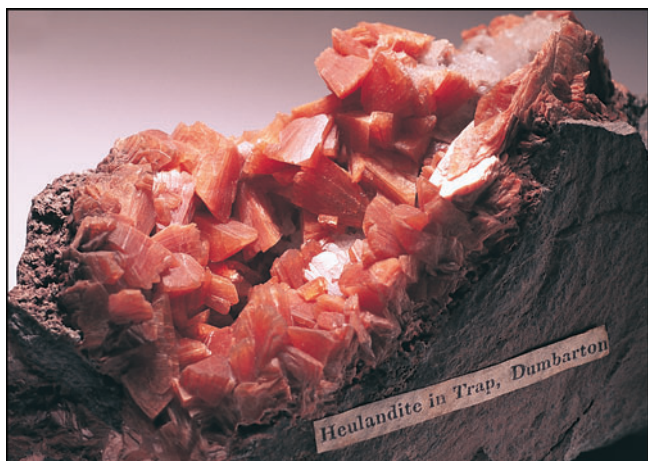


Figure 34. Beautiful heulandite in Scottish basalt.

“The Duke’s Emerald”

This emerald is an incredible terminated crystal from the mines of Muzo, Santa Fé de Bogota, in Colombia, home of the world’s finest emeralds. It is a superb, deep green crystal, perfectly transparent in places, though heavily flawed in others, 5 cm across the pinacoid, and weighing 1383.95 carats. It was for long renowned as the largest and finest uncut emerald in existence. It is said to have been given to the 6th Duke by Emperor Dom Pedro I of Brazil in 1831, though there is no original documentary evidence for this at Chatsworth. It is currently on display in the Natural History Museum, London, in their superb new exhibit “The Vault” at the far end of the main mineral gallery.

Acknowledgements

This paper originates from a visit to Chatsworth House by members of the Society on 17th September 2006. The Society group divided into two, and each toured both the decorative and buildings stones of the House (led by Ian Thomas, who wrote the first half of this text) and also the extensive mineral collections (led by Mick Cooper, who wrote the second half of the text).

The main rooms of the House are open for public access, and the above notes follow the normal visitor tour route (though parts of this may change in future years). The mineral collections are only accessible by special arrangement. The hospitality, assistance and advice of Stuart Band, Archivist in the Collections Department at Chatsworth House is gratefully acknowledged, as are the helpful observations made by Society members during the tour, and by Tapani Rämö and Trevor Ford.

Thanks are due to Tony Waltham for providing most of the photographs of the stones and minerals along the House tour route, to Wendell Wilson for supplying files of Mick Cooper’s mineral photographs from the archives of The Mineralogical Record, and to Diane Naylor for supplying photographs from the Devonshire Collection (reproduced by permission of Chatsworth Settlement Trustees).

While this issue was in press with the Society, Mick Cooper died, suddenly and unexpectedly. He had been an extremely knowledgeable mineralogist who worked as curator at the Nottingham City Museum, and was a very active and highly respected member of the Russell Society. His abilities and his kindness will be missed by many.

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Ian Thomas, National Stone Centre,
ian@nationalstonecentre.org.uk

Mick Cooper †, Russell Society