Barry Lawrence Ruderman
Antique Maps Inc.

7407 La Jolla Boulevard
La Jolla, CA 92037

www.raremaps.com

(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Stock#: 84145
Map Maker: Arrowsmith / Conybeare

Date: 1812 (annotations from 1814)
Place: London
Color: Hand Colored
Condition: See Description
Size: 75 x 82 inches

Price: $ 85,000.00

Description:

The First Modern Geological Map of Germany.

A Geologic "Incunable." An Immense Nation-Scale Manuscript Mapping of Geologic Strata Pre-Dating the William Smith Map.

By William Conybeare, with input from William Buckland and George Greenough - The Founding Fathers of British Geology and The Villains of "The Map that Changed the World."

A cartographic milestone for Germany and Central Europe, being the first comprehensive modern geological mapping of that region, produced by William Smith's competitors.

While William Smith was finalizing his publication of his geological map of England and Wales, members of the scientific elite in London were already focused on a different project: the mapping of the geology

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

underlying the European continent. Led by Oxford professor William Buckland during the early part of 1814, this project consolidated manuscript large-scale geological maps of individual European countries produced primarily by William Conybeare. This is the remarkable, mammoth map of Germany from that series, being the earliest-known Smithian geological map of that great European power.

Composed on the 1812 edition of Aaron Arrowsmith's *Map of Germany*, considered the most accurate map of Napoleonic Germany available in Britain, the map is colored in bright hues representing strata of different ages and lithologies. To create this map, Conybeare compiled information gathered by Continental scientists during the late 18th and early 19th centuries. These Europeans had made detailed primary observations that allowed the identification of fossils and rock types, but they were handicapped from making a modern geological map by their "Wernerian" approach, which assumed that all rocks were deposited from a secularly receding ocean. As such, it required a British scientist to translate these observations into an accurate geological map.

The map shows nine types of strata that can be indexed by comparison with Conybeare's contemporary writings, annotations on the map, and modern-day geological maps of the region. Much of the coloring is in the southern part of the map, with the alluvial north being primarily infilled with quaternary deposits (e.g., modern alluvial sediments) that are not of interest to geologists focused on the distant past. Present-day maps similarly leave much of northern Germany blank or filled in with quaternary coloring. Many mineral and ore deposits are marked, as are coal seams. The presence of mines is often indicated. Additional annotations line the borders of the map, these are done in several hands and in several generations, with erased pencil annotations being replaced by ink manuscript.

This map includes indications that it may have been supplemented by on-the-ground observations. Conybeare, Greenough, and Buckland traveled to Germany in 1816 for five months, following the conclusion of the Napoleonic War, and thus were in a prime position to check some of Conybeare's hypotheses made on the map, as mentioned in his obituary notice from the *Quarterly Journal of the Geological Society of London*. Some minute changes on the map appear to make sense only if the map was either annotated during this journey, or by someone with intense local knowledge. To the immediate northeast of Gottingen, the town of "Huren" is corrected in manuscript to the true name of Hörden, now Hörden am Harz. Near this, a river is extended, again in manuscript, above the hamlet of Schweigerhausen, into the foothills of the Harz. Other annotations show that the map was likely used in planning the journey. Near Regensburg, on the Danube, an annotation says "4 Days by water to Wien," a possible planned stop on the tour.

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Attribution of the Map

The map is unsigned and undated. However, several features identify Conybeare and his associates as the necessary authors of this piece. Firstly, Arrowsmith's map was only in circulation between 1812 and 1816, when it was superseded by a second edition. The number of geologists able to make such a map before 1816 was extremely limited. They included William Smith, some of his associates, and members of the Royal Geological Society, the latter of which took a keen interest (some may say ill-intentioned) in Smith's mapping techniques.

Among the geologists of the RGS, the only reference to a map of Germany from this time comes from correspondences between Conybeare, Greenough, and Buckland. Conybeare, in one letter, states that he "coloured a map including the East of France, Germany, Switzerland & Italy," which perfectly describes the extent of this map, which reached into France and Switzerland and south to the Adriatic. In another letter, dated 1814, Buckland writes to Conybeare telling him to "[s]end me also your map of Germany that I may transfer its contents to my map of Europe for the lectures." Conybeare describes some aspects of the map, including that he "recognized the existence (from the data afforded by Langius) of the Tertiary formations round the Lake of Constance," shown as a green outline to the south and east of the Bodensee.

This map contains numerous stylistic hallmarks of pre-1815 geological mapping. Coloring is darkened in areas of increased rock outcrop (i.e., mountains and some river valleys), which follows the 1815 Smith map. This practice was abandoned by 1819 when Greenough published his {{MAP}}, which shows lithologies mostly monochromatically. It lacks a stratigraphic table on the map, which many early geologists, Conybeare included, are known to have oftentimes omitted. Further, the map omits on-the-ground information gathered during the 1816 Greenough-Conybeare-Buckland trip to the region, which any geologist from the period would have known about following the publication of results and included on such a map.

The manuscript annotations on the map appear in several different hands. Much of the ink manuscript appears in a single hand and resembles Conybeare's writing from this period. There is manuscript in additional hands, some of which is in French and some of which is in German. This further manuscript is as-yet unattributed.

Geological Legend

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Conybeare omitted geological legends on some of his early maps. In one letter, he admits that he had to add to a lithological table on the verso of another of his maps only when this was pointed out. However, comparison with Conybeare's written works and our present understanding of the geology of the region allows us to propose possible links between the colors and corresponding lithology:

- Light green: Tertiary sediments. Conybeare identified these in the western part of the map using Langius's early-18th-century studies. They cover a significant portion of the map and form a wedge between Munich and Vienna.
- Blue: Part of the Jurassic and Cretaceous sequences. From their appearance on the map, these sediments conformably underlay the light green Tertiary rocks. Conybeare discusses this transition group in an 1823 memoir.
- Yellow: Lias (Jurassic). This is annotated in red pen in the northwest of the map, near Minden. This agrees with the conformable succession of the two above strata in the northern alpine region.
- Dark blue/green: this may be an igneous unit, as it shows dike-like intrusions in certain parts of the map, most notably in the Tyrol just northeast of the Lago di Garda.
- Pink: highly metamorphosed rocks including gneisses and schists. These occupy the center of the alpine region, as described by Conybeare in his aforementioned 1823 memoir and widely recognized at the time.
- Purple: Possibly Upper Devonian. This only appears in a handful of places on the map, and its attribution is based on correlations with other detailed German geological maps.
- Red: Likely granite. This is the color most often reserved for granite on early geological maps, and its outcrop pattern (sparse, limited to regions in the high Alps), corresponds with some of Conybeare's work.
- Orange: Uncertain, possibly Triassic sediments from comparing with later maps.
- Sky blue: Uncertain, likely an igneous unit from the symbols used to describe it and its outcrop pattern.

William Smith, "The Map That Changed the World," and the Revolution in Geology at the Start of the 19th Century

The 1815 William Smith geological map of England and Wales, formally entitled *A Delineation of the Strata of England and Wales, with Part of Scotland*, has been termed "The Map that Changed the World" because of its revolutionary understanding of the nature of geological strata, which opened up the doors to mineral and fossil fuel exploration on a vast, unprecedented scale. This theory was based on

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Smith's theory, first developed in 1796 during his tenure as a surveyor of canals and quarries, “that each stratum is also possessed of properties peculiar to itself, has the same exterior characters and chemical properties, and the same extraneous or organized fossils throughout its course.”

This magnificent realization meant that Smith could correlate beds across large areas, that is, he could predict the precise locations and depths of certain strata given some preliminary information. This changed geology into an empirical science that produced testable theories. More importantly, this allowed for improved resource exploitation which continues to fuel us today - when a petroleum geologist digs a new well in Texas, or a major mining company decides where to emplace a new iron mine in Western Australia, they rely on William Smith's theories.

Between 1796 and 1815, William Smith dedicated himself to mapping the geology of the United Kingdom on a large scale. His first nation-scale geological map, sketched in 1801, was produced on a small John Cary map of England and included only rough outlines of the geological structure. He spent the next 14 years attempting to publish his large-scale map, which he finally achieved in 1815.

By the period starting in 1806, Smith had succeeded in convincing a small group of academics to accept his theories. Foremost among these were his archrivals at the nascent Geological Society of London, who denied him membership, possibly due to his lower class background. Despite these differences, George Greenough, President of the Society, and other members realized that Smith's ideas were superior to those that came from the Continent. These ideas entered the mainstream in part due to William Buckland's readership at Oxford, where he built a collection at the Ashmolean and held regular lectures on the subject.

Smithian geological maps were not widely produced until the Smith map was finally in press in 1815, and even then, the number of adequately trained geologists who could produce such a map was very limited. That makes the present map, executed in 1814, a remarkable "incunable," effectively a geological map from the earliest stages of the development of the science. It is a Smith-style manuscript geological map of an entire nation published before the 1815 Smith map, and apparently, the first instance of Smith's theories applied to the German region.

Science During War Time: A Look Past the Napoleonic Blockade

Sources differ in the extent to which scientific information could travel between England and the

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Continent. Most famously, Sir Joseph Banks, a chief naturalist on the *Endeavour*, president of the Royal Society and the dedicatee of the Smith map, used prisoner of war ships to ferry letters to and from the Continent, with some government support. However, other sources argue that Banks, with his nationwide fame and political connections, was fortunate and exceptional in the extent to which he could gather information from Europe.

That said, other scientists of the time were able to receive some material published in Europe, including British geologists, who were intensely keen to see if the organization of strata developed in the British Isles could be replicated on the Continent. Conybeare clearly had access to some of these in order to create his suite of European geological maps in 1814. Conybeare's later writing reveals that he must have known at least of the work of the Dane Heinrich Steffens in northern Germany during the early 1800s, as revealed by Greenough's notes on a conversation between himself, Conybeare, and Werner in 1816. Further, works published by Conybeare in 1822 and 1823 heavily reference two small, primitive geological maps of the Alps and Europe by Ebel, published in 1808 that would have been key in developing this map. There are also indications that Conybeare used the primary observations in earlier works. In a letter to Greenough in 1823, he refers that, in making his 1814 map, he had used the early 18th-century naturalist Langius's treatise to identify Tertiary formations around the Bodensee.

Buckland's, Greenough's, and Conneybeare's Grand Tour of German Geology

Following the conclusion of the Battle of Waterloo in 1815, Conybeare, Greenough, and Buckland ventured to the Continent to explore the places detailed on the map in northern Italy and Germany. They ventured out not only to talk to the most learned minds of the day, including Goethe (who had a significant interest in the coloring of geological maps) and Werner (who bestowed his name to Wernerian theory), but also to visit the areas that they had researched in the previous years.

While they visited a large area in central Europe, much of their visit was focused on their Alpine region, where they could see many different types of rocks in a large area. They visited the Eocene fish fossils from Monte Bolca, an important "lagerstätte" with exceptional fossil preservation (on the map, a French hand has annotated "voyage a Monte Bolca" with a mention of a nearby inn, likely in preparation for this voyage). Their interactions with the German luminaries were disappointing, and Greenough, in his notes from the voyage, laments how far behind English geologists their Continental counterparts have fallen.

The Arrowsmith Map of Germany: The Most Accurate Early 18th-Century Map of Napoleonic

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

Territory

Aaron Arrowsmith, the mapmaker who produced the base map used by Conybeare, was the leading London cartographer who produced accurate, modern-style maps of far-flung parts of the world. For example, his *Map of the Interior Parts of North America* was both used by Lewis and Clark during their famous expedition and one of the first maps to show the results of their discoveries.

Arrowsmith's map of Germany is remarkable as it was composed during wartime and first published in 1812. It emphasizes topographical features and roads, belying one of its purposes as a military map for the ongoing Napoleonic War. The dedication to the Duke of Cambridge further supports this purpose, as this 7th son of George III was a student at Göttingen who had studied military tactics in Prussia and served with the Hanoverian army.

This map is a remarkable compendium of information, representing a noticeable refinement from all previous English-made maps of Germany and a beautiful example of the mapmaker's art.

William Conybeare

Conybeare, the author of this map, is best known for the works that he would produce later in his life on fossil morphology and anatomy, including the first published scientific description of a plesiosaur. However, he was deeply involved in the pre-Smith map period of geological development as well.

He was born in London and educated at Westminster, before studying at Christ Church, Oxford. His passion for geology developed during his grand tour of Europe following his 1808 graduation, and he soon after joined the Royal Geological Society, where he helped educate William Buckland and Adam Sedgwick on technical geological matters.

During the spring of 1814, Conybeare's letters reveal that he was involved in a project with William Buckland to create geological maps of various European countries, in addition to a general map of Europe. Along with his map of Germany, he is known to have produced a map of France and a map of the Netherlands, although it is uncertain if those survive today. In 1823, his work was published in a significantly reduced version in the *Annals of Philosophy*, which includes a lengthy description of the geology of the European continent.

Conybeare's 1821 prediction of what a plesiosaur would look like from a fragmentary skeleton was proved

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

correct when a complete example was discovered in 1823. He also identified that there were three different types of ichthyosaurus. He would continue work on younger strata, mainly Carboniferous, until his death in 1857.

William Buckland

Perhaps the most famous, at the time, of the three geologists who undertook the 1816 tour to Germany, William Buckland was known for his ability to study the past, and by comparing it to the present, understand what clues were hidden in rocks and landscapes. His work in Germany, where he visited a cave filled with bones, would inform his discovery of the hyena den in Kirkdale Cave, Yorkshire, for which he won a Copley medal. This was, and is, the most prestigious medal offered by the Copley society.

It appears that Conybeare's maps of Europe were, perhaps, suggested by Buckland. In any case, he is known to have offered significant feedback on them. He and Conybeare discussed and traded these maps in the spring of 1814, in preparation for a series of lectures that Buckland would give in Oxford starting in June of that year. Those lectures covered Continental geology, for example, Buckland gave an entire lecture dedicated to the Paris Basin. He used, as reference, a geological map of Europe in those lectures that letters reveal was based on Conybeare's work.

George Greenough: Geologic Villain

The third member of the trio that went to Germany in 1816 was George Greenough, the first president of the Geological Society of London (later the Royal Geological Society). Most famous as the villain in William Smith's tale, whose publication of an 1819 map is purported to have landed Smith in debtor's jail, he was responsible for obtaining copies of Smith's map for members of the Society, who used it to contribute to Greenough's updated maps. Despite the purported enmity between Smith and Greenough, it appears that Greenough was responsible for introducing Smithian ideas to the rest of the members of the Society.

Most of the information that has survived about the 1816 trip to Germany is from Greenough's archives.

Conclusion

The map presented here is an example of Smithian geology before the publication of the 1815 Smith map. That later Smith map regularly retails for over $100,000, and the last example we locate was priced at £100,000, for a map of which 400 copies were made. This Conybeare map is the earliest, nation-scale

7407 La Jolla Boulevard
La Jolla, CA 92037
www.raremaps.com
(858) 551-8500
blr@raremaps.com

(The Earliest Modern Geological Map of Germany) To His Royal Highness the Duke of Cambridge , K.G. &c. This Map of the Physical Divisions of Germany, Exhibiting the Post Roads, Canals &c, Constructed from Original Materials Is with Permission Most humbly Inscribed by His Royal Highness' Faithful & Most Devoted Servant

example of such a work that we are aware of having appeared on the market, and, as a manuscript enterprise, it is truly unique.

As the earliest-known modern geological map of Germany, this map offers a glimpse into the pre-1815 world at a time when the wonders and wealth of geology - a field that would soon turbocharge the Industrial Revolution and give rise to such luminaries as Lyell and Darwin - were on the cusp of being announced to the world.

Detailed Condition:
Segmented in 51 pieces in four parts and laid on original publisher's linen, with original slip case. Extensive manuscript overlay to geology. Two sheets from upper left portion separated, small losses to linen in parts. Slipcase holding at one edge, rubbed.