Pilgrimage through the History of German Natural Science, University City Bonn

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(Received 10 July 2001, Accepted 10 September 2001)

Introduction

In the Roman days, Bonn was a citadel of Castra Bonnensia, and later the city of Bonn was a Teritory of the Archbishop of Koln for many years. In the year 1786, the University was established, but it was closed after 10 years. In the year 1818 a new University was established again in Bonn. Since then, Bonn has been a University town. Therefore, University of Bonn is relatively new in Germany as is the University of Berlin (established 1810). But many famous scholars have emerged from the University. The university is officially called "Rheinisch Friedrich-Wilhelm-Universitat zu Bonn" by the name of the founder. However, the organization is usually called "University of Bonn (Universtat Bonn)" for convenience by the town's name where the university is there.

After world war Ⅱ, Bonn became a temporary capital of West Germany (Bundes Republik Deutschland, BRD), and many government buildings were constructed, bringing many people to this small town. But in 1989, BRD and East Germany (Deutsche Demokratische Republik, DDR) were unified, and Berlin became the official capital of the new Germany. Government organizations and their functions in Bonn are moving slowly to Berlin, and the city of Bonn is going back to the quiet university town as it was years ago.

This short article deals with a part of the academic side of the city of Bonn, especially on the work of scientists in Bonn. In this article, I would like to show readers many photographs including portraits and plaques where the scientists were born, lived, worked, and died, monuments made of bronze or stones and various remains of the famous scientists, in particular gravestones.

Some reader may feel strange that the author is searching and visiting graves, but visiting graveyards is an ordinary established custom in our society. Somereaders may not know that the shady graveyard is a nice place to take a walk.

I believe that it is worth while historically, scientifically and also philosophically to visit monument and remains of famous scientists. The gravestone is a personal monument recording official and personal history. Visiting remains and various memorials of famous scholars gives me a satisfactory feeling. The intellectual impression was quite different from that I got by reading a textbook dealing with the same subject, because grave visiting is a personal contact with historical person. I would like to call such a visit a "pilgrimage" through the history of natural sciences. We may learn sciences through the pilgrimage, and also learn history through the pilgrimage.

In this article, famous scientists are the main target of our "pilgrimage", however, some famous nonscientists are also included because they are also contributors to our human history.

University of Bonn

The most impressive public building in the town is the Electoral Residence and Hofgarten. This is a baroque Schloss, which now belongs to the University of Bonn(Fig. 1). The large building with the black roof and yellow wall is beautiful if we look at it from the Hofgarten. At the west end of Poppelsdorf Allee there is a similarly colored Poppelsdorf Schloss. This baroque building is also used for research building of the University. Other new University buildings are distributed in the north side of Meckenheimer Allee. Backside of the Poppelsdorf Schloss is a botanical garden, which is famous for its collection of various plants. It is said that Carl Linn'e (1707-1778) stayed in this botanical garden.

Fig. 1. The building of the old palaces are now used for research and administration of the University.

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Statue of A. Kekulé

Along the Meckenheimer Allee, there stands the old chemistry building. A bronze statue of August Kekulé (1829-1896) is standing with two white stone sphinx(Fig. 2a, 2b). In the statue A. Kekulé is lecturing while holding a book in his left hand. There is a plaque in front of the basement, in which a goddess gives a benzene ring to two engineers. The goddess would be Pallas Athena. She is the virgin goddess of knowledge, battle and art. Her helmet is behind her. This picture symbolizes the discovery of the benzene structure by Kekulé, and the development of the coal tar industry in Germany which started in about 1860 along the river Rhein(Fig. 3).

The old chemistry building is now used for various branches of biological sciences. The building was constructed with the help of Kaiser Wilhelm (Ⅱ). When he was a crown prince, he attended the chemistry lecture made by A. Kekulé. We now leave the research complex of University of Bonn along the Meckenheimer Allee, and cross the Kelule street on the way to Poppelsdorfer Cemetery(Fig. 4).

Fig. 2a

Fig. 2b

Fig. 2a, 2b Kekulé's statue is standing in front of the old chemistry building along the Meckenheimer Allee.

Fig. 3 Two engineers are receiving "Benzene Ring" from Goddes (Pallas Athena). The relief symbolizes the prosperity of coal tar industry along the River Rhein.

Fig.4 Road sign "Kekulé street".

Friedrich August Kekulé

Friedrich August Kekulé (1829-1896) was born in Darmstadt as a son of high ranking officer of Hessen Darmstadt. He was a clever boy and draw picture very well. He wanted to become an architect, but he studied chemistry by the influence of Justus Liebig (1803-1873). After he became a chemist, he traveled to France and England and made good academic friends. After he came back to Germany, he got position at Heidelberg and became a professor of chemistry in 1856.

Kekulé interested in valency of element probably because of the influence of his British friend Alexander William Williamson (1824-1904). Williamson was a pupil of Liebig as Kekulé was. At that time it was considered that a molecule is composed of atoms, and the studies on atomic compositions of molecule were going on. Kekulé's interest was the atomic arrangement in a molecule. In other words his interest was the structure of molecule.

He became a professor of chemistry at Ghent University in Belgium (1858). He presented his ideas on the valence theory. The contribution of his theory to the chemistry is that the valency

of carbon atom is 4, and the atomic composition of methane is CH_4. The Kekulé's valency theory contribute to the chemical structure of organic compounds.

There is an interesting historical fact concerning the valency of carbon atom. One Scottish young chemist Archibald Scott Cooper (1831-1892) proposed independently that the valency of carbon atom is 4. Unfortunately young man's claim was not accepted, and he became mentally ill and he disappeared from the academic society. Later very fortunately Cooper was found and his contribution to chemistry was evaluated by both German and British chemists. The German chemist who looked for the forgotten Cooper is Richard Anschutz (1852-1937)(Fig. 5). Anschutz is the successor of Kekulé in Bonn and he published large two volumes biography of "August Kekulé (1927)" and also wrote article on the Scottish young chemist..

Fig. 5 Large biography of August Kekulé written by Richart Anschutz in two volumes(1929).

One another structural problem in organic compound is the structure of benzene. Kekulé proposed cyclic benzene structure as shown below. The cyclic structure of benzene (1) is called Kekulé benzene.

Kekulé moved to University of Bonn (1867), and stayed in the new chemical laboratory until his death. Kekulé became a nobleman in his late years, and he called himself August Kekulé von Stradonitz.

After Kekulé's death, Richard Anschutz made the following works for Kekulé.

1) preparation of his biography "Augusut Kekulé".
2) search for A. S. Cooper.
3) establish "Kekulé Collection (Kekulé Sammlung)" in Darmstadt (Fig. 6, 7).

In the "Kekulé Collection", many interesting things and goods are collected. One interesting thing is pictures drawn by 14—15 years old Kekulé.

Fig. 6 Marble bust of aged August Kekulé (Kekulé Collection, Darmstadt).

Fig. 7 Certificate August Kekulé received when he became a nobleman (Kekulé Collection, Darmstadt).

Poppelsdorf Friedhofer (Poppelsdorfer Cemetery)

A. Kekulé

We find the gravestone of A. Kekulé made of red granite and with Kekulé's beautiful bronze relief. Kekulé's superior forehead is impressive. In the late years, Kekulé became a nobleman. He called himself August Kekulé von Stradonitz. The family crest made of bronze is on the gravestone(Fig. 8a, 8b).

Fig. 8a

Fig. 8b

Fig. 8a, 8b Kekulé's gravestone is made of red granite with bronze relief.

A. Strasburger

Near the entrance of the Poppersdolf Cemetery, we find the gravestone of Alexander Strasburger (1844-1912)(Fig. 9). He is a botanist, and he traveled with Ernst Haeckel (1834-1919) for the study of genealogical study and also studied fertilization mechanism and cell division.

Fig. 9 Granvestone of Alexander Strasburger (Botanist).

Old Cemetery of Bonn (Alter Friedhof, Bonn).

Old cemetery in Bornheimer Strasse is about 400m north of Bonn station(Fig. 10). It was established in the 18th century and was used for soldiers and foreigners. But many famous people were later buried here. They are summarized in Table (I) and the grave sites are shown in Map (I)(Fig. 11). The actual photographs of the gravestones 1)～18) which were taken by the author are shown on the following pages.

Fig. 10 West entrance of Alter Friedhof, Bonn.

Table 1 Famous People in Alter Friedhof Bonn

1. Rudolf J. E. Clausius, 1822-1888, Physicist.
2. Heinrich Geissler, 1814-1879, Engineer.
3. Julius Plücker, 1801-1868, Mathematician, Physicist.
4. Friedrich W. A. Argelander, 1799-1875, Astronomer.
5. K. Friedrich Mohr, 1806-1879, Chemist.
6. Johann Jakob Noeggerath, 1788-1877, Geologist.
7. Franz Hermann Troschel, 1810-1882, Zoologist.
8. Gerhard Rath, 1830-1888, Geologist, Mineralogist.
9. Ferdinand Zirkel, 1838-1912, Geologist.
10. Gustav Bischof, 1792-1870, Chemist, Geologist.
11. Hermann Schaafhausen, 1816-1893, Anatomist.
12. Robert, Schumann, 1810-1856, Musician, Composer.
    Clara Schumann, 1819-1896, Musician, Pianist.
13. Friedrich C. Dahlmann, 1785-1860, Historian, Politician .
14. August Wilhelm Schlegel, 1767-1845, Literature Critic.
15. Barthold Georg Niebuhr, 1776-1831, Historian, Politician.
16. Ernst Moritz Arndt, 1769-1860, Historian, Politician.
17. Maria Magdalena van Beethoven, 1746-1787, Mother of Beethoven.
18. Charlotte Schiller, 1766-1826, Wife of F. Schiller.
    Ernst Schiller, 1796-1841, Son of F. Schiller

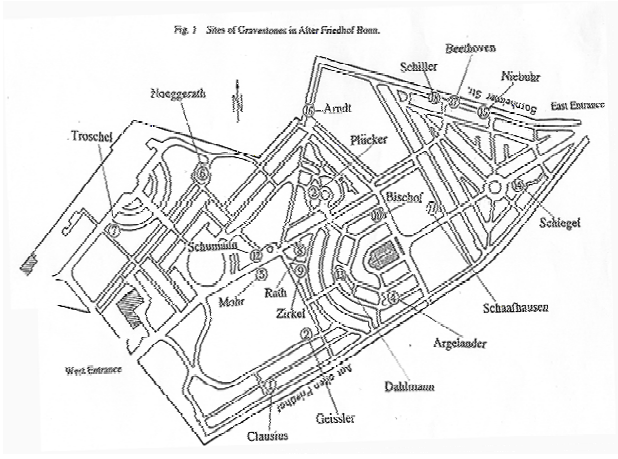

Fig. 11 Map (I)

R. Clausius

Rudolf Clausius (1822-1888), is a theoretical physicist. He formulated the 2nd law of thermodynamics, and introduced the concept of entropy, and mean free path in the kinetic theory of gas. He also proposed a new theory of electrolysis. A stone cross is

on the top of the gravestone, letters on the stone are painted in gold, and the gravestone is enclosed by a low iron fence(Fig. 12).

Fig. 12 Grave of Rudolf Clausius (Physicist) is surrounded by low iron fence.

H. Geisler

Heinrich Geisler (1814-1879) was originally a glassblower or glass engineer. He made various glass apparatus for scientific research and he became an expert of vacuum techniques. In 1854, he established a shop to make various apparatus for chemistry and physics in the University of Bonn. He made a mercury vacuum pump which was designed by J. Plücker and also made a vacuum tube for electric discharge (Geisler tube). He was awarded an honorary doctors degree for his contribution to physics. On the upper part of the gravestone, the letters "Dr". are engraved separately. Letters on the gravestone are painted in red(Fig. 13).

Fig. 13 Glass technician H. Geisler was awarded honorary doctor's degree for his contributions making various glass apparatus.

J. Plücker

Julius Plücker (1801-1868) is a mathematician and physicist. He was a professor of mathematics at the University of Bonn (1836). Plücker was known in the field of analytical geometry, especially as a mathematician on the geometry of space. He was also an experimental physicist. He was interested in the luminous effects of electric discharge through gases at low pressure (1858). He found that the glow was deflected in a strong magnetic field. Plücker's grave is constructed with white marble, and the whole construction is like a Greek shrine, with his marble bust sitting in the middle of the shrine(Fig. 14a, 14b).

Fig. 14a

Fig. 14b

Fig. 14a, 14b Julius Pllucker is a mathematician and experimental physicist. His grave is like a Greek shrine made of white marble.

F. W. A. Argelander

Friedrich W. A. Argelander (1799-1875) was a professor of astronomy at the University of Bonn. When he was young, he studied law first, but he changed to the field of astronomy. In 1823 he became director of a new observatory at Abo in Finland.

He then obtained a chair of astronomy at the University of Bonn, where he stayed for the rest of his life. He established a new observatory in Bonn with the help of his friend King Friedrich William Ⅳ(1840-1861, King) of Prussia. The observatory was considered a model at the time. Argelander's contribution is the remarkable survey of the position of stars brighter than 9th magnitude in the northern sky. The catalogue he made includes 324,198 stars. The pioneering survey of the stars of the north sky advanced to further survey of southern hemisphere by the Argelander's colleagues Eduard Schonfeld and Adalbert Kruger(Fig. 15a, 15b).

Fig. 15a

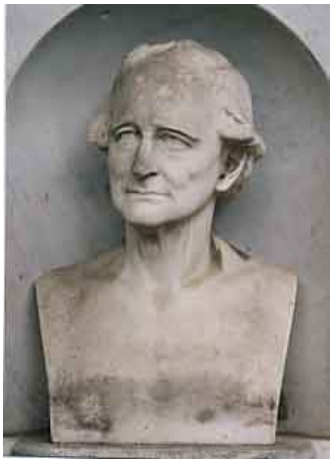

Fig. 15b

Fig. 15a, 15b Astronomer Friedrich Argelander's grave is made of white marble with his bust.

C.F.Mohr

C. Friedrich Mohr (1806-1879), is a chemist and pharmacist. He became lecturer (1854) and then professor of pharmacology (1867) at the University of Bonn when he was more than 60 years old. He is a pioneer of volumetric analysis. He invented various small goods convenient for chemical experiment especially for chemical analysis. The small goods invented by F. Mohr are as follows:

biuret, pinch cock, cork bowler, rubber tube, round filter paper etc.

Mohr published numerous papers and books in the field chemistry and pharmacology. Mohr's salt is well known in analytical chemistry. He improved the method of volumetric analysis more reliable. He also left an interesting article on the general view of energy. He thought that light, electricity, magnetism, and mechanical movement are equivalent (1837). The philosophical thought might be connected with the fundamental natural law of "Conservation of Energy". Thus his thought is philosophical and scientific(Fig. 16a, 16b).

Fig. 16a

Fig. 16b

Fig. 16a, 16b I found Karl Friedrich Mohr's gravestone accidentally, because the word "nature" is on the front side of the stone, a marble portrait relief is on the stone.

J.J.Noeggerath

The sitting figure of Geologist Johann Jakob Noeggerath (1788-1877) is unique and interesting(Fig. 17).

Fig. 17 Geologist J. J. Noeggerath's grave is a sitting figure made of white marble.

F.F.Troschel

The gravestone of the paleontologist F. F. Troschel (1810-1882) is made of reddish granite and the letters on the stone are gold filled(Fig. 18).

Fig. 18 Franz Hermann Troschel is a paleontologist.

G.Rath

Gerhard Rath is a geologist and mineralogist. He was a professor of mineralogy at Bonn. There is a round white relief portrait on his gravestone(Fig. 19a, 19b).

Fig. 19a

Fig. 19b

Fig. 19a, 19b Gerhard Rath is a geologist and mineralogist.

F.Zirkel

Ferdinand Zirkel (1839-1912) is a mineralogist. He invented a new method for Rock study. He made thin sections of rocks and examined them microscopically(Fig. 20a, 20b).

Fig. 20a

Fig. 20b

Fig. 20a, 20b Ferdinand Zirkel is also a mineralogist and he developed a new microscopic method for study rocks.

G. Bischoff

Gustav Bischoff (1792-1870) was a professor of geology at the University of Bonn. He planned to establish a new geology which was grounded by physics and chemistry(Fig . 21).

Fig. 21 Gustav Bischoff have planned to create a new geology with solid backgrounds of chemistry and physics.

H. Schaafhausen

Hermann Schaafhausen (1816-1893) was a physician and anatomist. He examined the excavated bone from Neanderthal, and he concluded that the bone was an ancestral man(Fig. 22).

Fig. 22 Hermann Schaafhausen is an anatomist, and he examined the bones found in the "Neanderthal Cave".

A. Beer

Beer (1825-1863) was a mathematician and his gravestone is made of sandstone which is now covered with green moss. His gravestone holds his white marble relief(Fig. 23).

Fig. 23 A.Beer is a mathematician at University Bonn.

F. C. Dahlmann

Friedrich Christoph Dahlmann (1785-1860), is a German historian and politician. He was a professor at the University of Göttingen. He lost his chair because of his liberalistic behavior (1837). He is one of the "Göttinger Sieben". He got a position of professor of history (1843) at the University of Bonn. He was always at the far front of the liberal movement. On the front side of his gravestone, there is a sturdy bronze portrait of Dahlmans(Fig. 24).

Fig. 24 Friedrich Christoph Dallman is a historian and politician. He is one of the "Göttinger Sieben".

R. & C. Schumann

Beautiful marble gravestones of Robert Schumann (1810-1856) and Clara Schumann (1819-1896) are in the middle of the Alter Friedhof(Fig. 25a, 25b). Robert is a well known

composer and Clara is also a famous pianist. They married in 1840. Robert was mentally ill in his late years and threw himself into the river Rhein. He was rescued and hospitalized, but died without regaining consciousness. Clara's portrait is on the 100 DM note today. Every time I visit the Schumann's grave, I find flowers in front of the gravestone dedicated to Schumanns. A female figure sitting in the front and looking up to Robert is said to be Clara.

Fig. 25a

Fig. 25b

Fig. 25a, 25b Beautiful marble gravestone of Robert and Clara Schumann is in the middle of the Cemetery. Every time I visited, I saw flowers dedicating for the musician Schumanns.

A. W. Schlegel

August Wilhelm Schlegel (1767-1845) was a German poet and literary critic. Both he and his brother Friedrich Schlegel (1772-1829) were pioneer of the romanticism movement. He later moved to academia to study literature. He obtained the positions at the University of Jena, Berlin and Bonn. He made beautiful translations of the W. Shakespeare (1564-1616) and Dante (1265-1321) into German. He is also a founder of oriental studies(Fig. 26a, 26b).

Fig. 26a

Fig. 26b

Fig. 26a, 26b August Wilhelm Schlegel was a poet, literary critique and also a founder of oriental studies.

B. G. Niebuhr

Barthold Georg Niebuhr (1776-1831) was a historian of ancient German history and he was also a politician. He was originally a finance commissioner of the Prussian government, but he resigned his position. He lectured in Roman history at the University of Berlin and Bonn. He was the most critical historians in the modern days. His life work 「Roman History, 3 vol.」 was written on the basis of vast political, legal and economical backgrounds of ancient Rome(Fig. 27a, 27b).

Fig. 27a

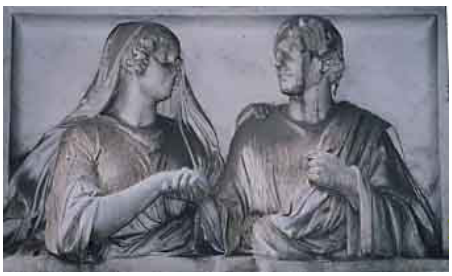

Fig. 27b

Fig. 27a, 27b Barthold Geolg Niebuhr was critical historian of ancient German and Romans.

E. M. Arndt

Ernst Moritz Arndt (1769-1860) was a historian, politician and poet. He was nationalistic and also an international politician in Napoleon's time. Above all he was a patriotist and acting historian. A large tree is growing between the gravestone of Ernst and his wife Ann Maria Arndt (1786-1869) and the gravestones are inclined both outside of the graves. Stone crosses are on the top of each gravestones(Fgi. 28).

Fig. 28 Ernst Moritz Arndt is a patriotic historian and also politician in the Napoleons time.

C. Schiller and E. Schiller

Charlotte Schiller (1766-1826) is the wife, and Ernst Schiller (1796-1841) is a son of Friedrich Schiller (1759-1805). The grave was made of large black iron plate with golden letters. Friedrich Schiller's grave is in the Goethe-Schiller mausoleum in Weimar(Fig. 29).

Fig. 29 Combined grave of F. Schiller's wife "Scharlotte" and his son "Ernst" is in this cemetery.

Euskirchen

The house where Emil Fischer (1852-1919) was born is still in Kollner Strasse 19, Euskirchen(Fig .30). Apparently, the house is not the original one, but remodeled or rebuilt one. On the right side of the entrance, there is an old bronze plaque for Emil Fischer. The plaque says as follows(Fgi. 31).

「In diesem Hause wurde an 9 Oktober 1852
Emil Fischer einer der grossen Meister auf dem
Gebiete der organischen Chemie geboren」

Emil Fischer Gymnasium is on the crossing point of Kornerstrasse and E. Fischerstrasse(Fig. 32, 33). In front on the main entrance of the high school building, there is a large plaque with Emil Fischer's bronze portrait(Fig. 34a, 34b). The relief is similar to the Emil Fischer medal of the German Chemical Society. One gymnasium student came to me and proudly explained Emil Fisher's plaque 「Emil Fischer is the great chemist Euskirchn born ___」.

Fig. 30 The house where Emil Fischer (Chemist) was born in Kollner Strasse 19 Euskirchen.

Fig. 31 The plaque said 「Emil Fischer was born in this house __」, however, it seems that the house is rebuild or remodeled

Fig. 32 Sign of Emil Fischer Gymnasium.

Fig. 33 Road sign of "Emil Fischer Street".

Fig. 34a

Fig. 34b

Fig. 34a, 34b In front on the main entrance of the "Emil Fischer Gymnasium", there stands a plaque of Emil Fischer with his portrait.

I found a memorial stone in the garden of the Gymnasium for students who died during world war Ⅱ(Fig. 35). I have seen such memorial stones several times in Germany, and these are usually found in the shade of trees. When we came back to the railway station of Euskirchen, a steam locomotive was coming in with many sightseeing passengers. Steam locomotives are always a center of attraction(Fig. 36). It was a nice opportunity to see the antique vehicle.

Fig. 35 Memorial stone (Gedenk Stein) for students died during the past world war.

Fig. 36 I have a chance to see old steam locomotive in the Euskirchen Station.

Neanderthal Man

Neanderthal Man is an ancestral human being that lived 50 ～100 thousand years ago. The first bones of this kind were discovered in a calcite cave in Neanderthal near Dusseldorf in 1856. H. Schaafhausen (his grave is in the Alter Friedhof) found several primitive characteristics in these bones. In the beginning of the 20th century, similar bones were found in various places of the world, and the antholopological studies advanced. This type of primitive man was called Neanderthal Man. The volume of the skull is 1300-1600 ml and the height of the skull is low. By the finding of this kind of bone, these bones were classified and the route of evolution was studied. There is a 「Neanderthal Man-Museum」 in Neanderthal with many educational displays. In the Rheinisches Landesmuseum

(Rhein State Museum) in Bonn, many archeological specimens are displayed. The most interesting and valuable specimen is the Neanderthal Man's skull. This is a perfect upper skull of the old man. I took a picture with the reconstructed Neanderthal man who is a distant ancestor of mine(Fig. 37).

Fig. 37 There is a perfect upper skull of the Neanderthal Man in the Rhein State Museum.