365–376; O. Silvestri, "Ambrogio Soldani e le sue opere," in *Atti della Società italiana di scienze naturali*, **15** (1872), 273–289; and F. Rodolico, "Ambrogio Soldani e Ottaviano Targioni Tozzetti: carteggio sulla 'pioggetta di sassi' del 1794," in *Physis*, **12** (1970), 197–210.

FRANCESCO RODOLICO

SOLDNER, JOHANN GEORG VON (*b.* Georgenhof, near Feuchtwangen, Germany, 16 July 1776; *d.* Bogenhausen, Munich, Germany, 18 May 1833), *geodesy, astronomy.*

Soldner's father, Johann Andreas Soldner, was a farmer in Georgenhof. The boy's schooling began in Banzenweiler and continued in Feuchtwangen and at the Gymnasium in Ansbach, where he was taught by the physicist Julius Yelin. His education was interrupted by periods of work on his father's farm. Soldner's diary indicates that his earliest interest in land surveying was aroused by neighboring farmers and by some geometric notes in an early Ansbach calendar. He was largely self-taught and he devised his own instruments for measuring the altitude of the sun.

Soldner was a pupil of the astronomer Bode and first became known through his contributions to Bode's *Astronomisches Jahrbuch*. In 1805 Frederick William of Prussia made him director of the survey of Ansbach, but the battles of Jena and Auerstedt made this work impossible.

Soldner was patronized by the astronomer Ulrich Schiegg, who in 1808 was appointed technical member of the Tax Rectification Commission. Correct land-tax assessments required an accurate survey of the province, and in 1811 Soldner was appointed to the Bavarian Land Survey. In May 1810 he had published his famous memorandum on the calculation of a triangle network, in recognition of which he was made an ordinary member of the Munich Academy of Sciences. This work was lost until 1873, when Karl Orff published an account of the Bavarian survey.

Soldner's method for calculating the spherical triangles of the main network was an improvement on Delambre's method, which was adequate for degree measurement but was not suitable for land surveying, that is, when the lengths of arcs of spherical triangles must be known. Soldner used a system of coordinates that introduced three points into every mesh of the network plan, accurately aligning it with the land to be surveyed. Thus he was able to measure arcs to an accuracy of one centimeter. Also, his solution of spherical triangles was more convenient than that of Legendre; Soldner kept two angles of the spherical triangle the same and altered the length of the sides when comparing it to a plane triangle.

In 1813 Soldner prepared a paper on a new method of reducing astronomical azimuths. His method depended on the observation of the maximum east and west displacements from the North Star. This discovery aroused the jealousy of the astronomer and councillor Karl Felix Seyffer, who, in 1815, was removed from office and was succeeded by Soldner as director of the Bogenhausen observatory. Soldner was responsible for supervising the construction and equipping of the new observatory. He also retained his post as consultant to the land-tax commission. In 1820 Delambre defended the originality of Soldner's work in the *Connaissance des temps*.

The observatory was completed in 1818, and instruments from the workshops in Utschneider, Reichenbach, and Fraunhofer were installed. Soldner had previously tested many of these instruments for their accuracy and suitability. By 1820 he had begun to observe the positions of the stars and planets on the meridian circle. With Nicolai, he worked on the measurement of a degree; and, independently, he studied lunar methods for determining longitude.

From 1823 on Soldner confined himself to the administration of the observatory; his assistant, Lamont, who succeeded him as director, undertook the observational work. During these years, Soldner's health deteriorated because of a liver ailment.

Soldner was simple and reserved in manner, and he valued real scholarship for its own sake. His painstaking observational work on the detection of motion among the fixed stars could be of value only to future generations of astronomers and illustrates the unselfish spirit of his work. His writings are clear and concise, and he avoided repetition of what was already common knowledge.

BIBLIOGRAPHY

I. ORIGINAL WORKS. Soldner's papers appeared in many leading astronomical journals. His books include *Théorie et tables d'une nouvelle fonction transcendente* (Munich, 1809); *Bestimmung des Azimuths von Altomunster* (Munich, 1813); *Neue Methode, Beobachtete Azimuthe zu Reduzieren* (Munich, 1813); and probably *Astronomische Beobachtungen von 1819 bis 1827 auf*

der Sternwarte zu Bogenhausen, 3 vols. (Munich, 1833–1835). Hostile colleagues prevented the publication of later volumes of this last work.

II. SECONDARY LITERATURE. Biographical information is given by C. M. Bauernfeind, in *Allgemeine Deutsche Biographie*, XXXIV, 557–563; F. J. Müller, *Lebenslaufe aus Franken*, II (Wurzburg, 1922), 417–427; and *Poggendorff*, II, 955–956.

Studies of Soldner's geodetical work include F. J. Müller, *Johann Georg von Soldner der Geodät* (Munich, 1914); and Gunther Rutz, *Die Alte Bayerische Triangulation von Johann Georg Soldner* (Munich, 1971). Müller and Rutz draw extensively on Bauernfeind. See also R. Sigl, "Johann Georg von Soldner zum Gedächtnis," in *Mitteilungsblatt des Deutsches Landesvermessungswerk, Landesverein Bayern*, no. 2 (1966). Archives relating to Soldner exist at the Bayerisches Landesvermessungsarnt, Munich. Letters between Soldner and Gauss exist at Niedersächsische Staats- und Universitätsbibliothek, Göttingen.

SISTER MAUREEN FARRELL, F.C.J.

SOLEIL, JEAN-BAPTISTE-FRANÇOIS (*b.* Paris, France, 1798; *d.* Paris, 17 November 1878), *optical instruments.*

Soleil learned his craft while working under the engineers Hareing and Palmer. From 1823 to 1827 he was intimately associated with the work of Fresnel. Soleil directed the construction of the annular lenses and the mechanism to rotate them that Fresnel had designed for use in lighthouses. Soleil's first lens was made under the direction of Fresnel and was based on his theory. In 1841 it was presented to the Académie des Sciences by his son, Henri. Soleil constructed most of the apparatus used by Fresnel in his optical research based on the experimental demonstration of the wave theory by Thomas Young. This work brought Soleil into contact with those scientists who, following Fresnel, developed the new optics: François Arago, Jacques Babinet, Charles Delezenne, Fredrik Rudberg, and Johann Nörrenberg. A notable piece of apparatus constructed by Soleil—the diffraction bench—was intended for use in public demonstrations of interference and diffraction phenomena with either sunlight or lamplight.

Soleil produced and sold a wide variety of optical instruments at 35 rue de l'Odéon. His inventions included an apparatus for measuring the interaxial angle in biaxial crystals and an improved model of Biot's saccharimeter. In 1849 he retired from business and was succeeded by his son-in-law and former apprentice Jules Duboscq. In November 1850 Soleil was named chevalier of the Légion d'Honneur.

Soleil received a number of exhibition awards, including a gold medal in 1849; and the physical optics section of the Great Exhibition of 1851 in London was devoted solely to the products and inventions of Duboscq and Soleil. This exhibition won the highest award—a council medal.

BIBLIOGRAPHY

I. ORIGINAL WORKS. Soleil's works include "Appareils pour la production des anneaux colorés à centre noir ou blanc," in *Comptes rendus hebdomadaires des séances de l'Académie des sciences*, **18** (1844), 417–419; "Note sur la structure et la propriété rotatoire du quartz cristallisé," *ibid.*, **20** (1845), 435–438; "Note sur moyen de faciliter les expériences de polarisation rotatoire," *ibid.*, 1805–1807; "Note sur perfectionnement apporté au pointage du saccharimètre," *ibid.*, **24** (1847), 973–975; "Notice sur l'horloge polaire de M. Wheatstone, construite et perfectionnée par M. Soleil," *ibid.*, **28** (1849), 511–513; and "Note sur un nouveau caractère distinctif entre les cristaux à un axe, positifs et négatifs," *ibid.*, **30** (1850), 361–362. Brief notices of apparatus shown to the Academy are also printed in *Comptes rendus hebdomadaires des séances de l'Académie des sciences.*

II. SECONDARY LITERATURE. See *Exhibition of the Works of Industry of All Nations 1851. Reports by the Juries on the Subjects in the Thirty Classes Into Which the Exhibition Was Divided* (London, 1852), 272; and G. Vapereau, *Dictionnaire universel des contemporains* (Paris, 1880).

G. L'E. TURNER

SOLLAS, WILLIAM JOHNSON (*b.* Birmingham, England, 30 May 1849; *d.* Oxford, England, 20 October 1936), *geology, paleontology, anthropology.*

Sollas was educated at the Royal School of Mines, London, where he studied under A. C. Ramsay and T. H. Huxley, and then at St. John's College, Cambridge, where T. G. Bonney, deputy to Adam Sedgwick, was his tutor. For six years he gave university extension courses in geology and biology to adult students in various parts of the country. He was afterward successively professor of geology at Bristol (1880–1883), Trinity College, Dublin (1883–1897), and Oxford (1897–1936). Sollas was a versatile investigator and experimentalist, and in the course of a long and active life he made significant contributions to many