CARL ZEISS, A BIOGRAPHY 1816-1888

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Carl Zeiss, A Biography 1816-1888.
by Stephan Paetrow and Wolfgang Wimmer. Jena: Zeiss Archives, 2016. 143 pages.

This book was published in 2016, the two hundredth anniversary of the birth of Carl Zeiss, founder of the German company which bears his name. Zeiss was born in Weimar, the fifth of twelve children of a wood turner. He attended grammar school in Weimar before starting an apprenticeship in Jena in 1834. He was apprenticed with University of Jena mechanic Friedrich Körner (1778-1847) until 1838. During this time, he also took classes in math and science at the university.

From 1838 to 1845, Zeiss was a journeyman mechanic in workshops making mostly scientific instruments in Stuttgart, Darmstadt, Vienna, and Berlin. In 1845 to 1846, Zeiss attended lectures in mathematics at the university in Jena. It is difficult to relate training then to comparable status today; the book suggested that Zeiss' mathematical and linguistic skills would resemble those of a present-day engineer.

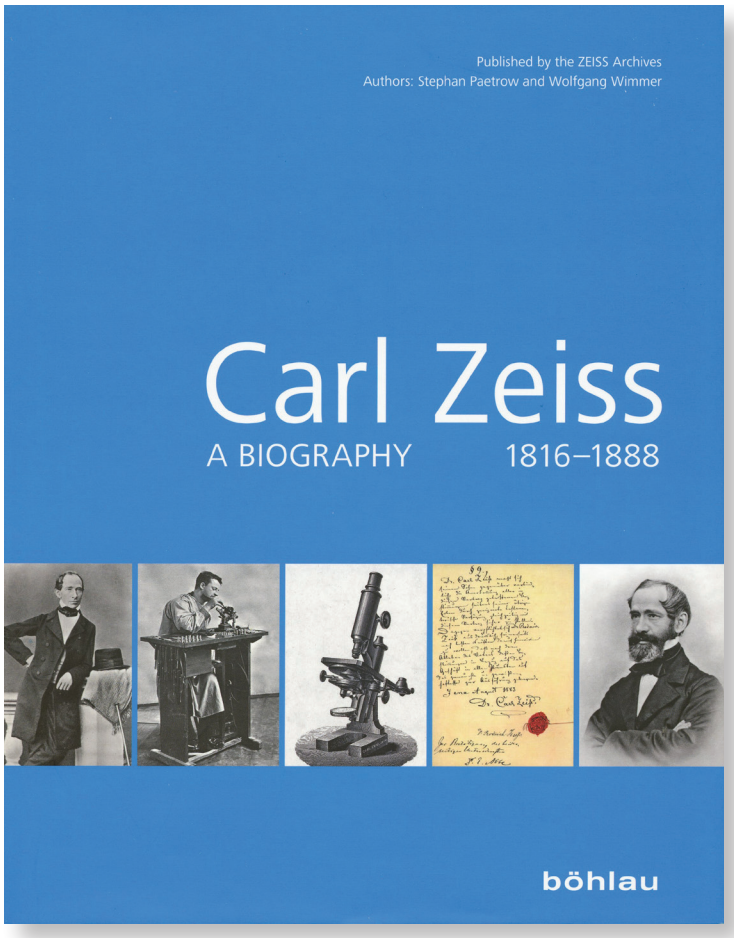
In 1846, Zeiss opened his own workshop in Jena. He sold spectacles, loupes, and thermometers, among other items. In 1847, he sold his first simple microscope. Zeiss was acquainted with the microscopy pioneer Matthias Jakob Schleiden (1804-1881), a botanist who was co-founder of the cell theory. Zeiss incorporated suggestions made by Schleiden for the improvement of microscopes. From 1847 to 1852, Zeiss sold 20 to 40 simple microscopes annually, but he was struggling to keep his business financially viable.

One problem was that the optical construction of microscopes was largely trial and error. Zeiss recognized that their construction would benefit from collaboration with a qualified scientist. His first collaboration was with mathematician Wilhelm Barfuss in 1852. Modest improvements were made before the death of Barfuss in 1854.

Zeiss started making compound microscopes in 1857, but sales remained low. He made only 17 compound microscopes between 1857 and 1859. In June of 1859, he had to reduce the number of his employees from three to two.

Things started looking up for Zeiss in 1860 when he was appointed University Mechanic at the University of Jena. In 1861, he was one of 28 winners out of 1,300 exhibitors at the General Thuringian Trade Exhibition, receiving a gold medal "for one of the most sublime microscopes ever produced in Germany." (p. 72) In 1863, he was named Grand Ducal Mechanic of the Court.

In 1866, Zeiss had an eleven man work force, and he brought Ernst Abbe (1840-1905) into the company to work toward a more scientific and repeatable method of producing lenses. Abbe had completed a doctorate degree in physics and was a lecturer in mathematics and



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physics at the University of Jena. Abbe's efforts resulted in the development of instruments to measure focal lengths, lens radii, lens thickness, and refractive index. Through collaboration with Abbe, Zeiss was able to modernize production methods and reduce the price of microscope lenses. That work by Abbe, along with his studies on aperture size and diffraction in the early 1870s, resulted in substantial improvements in microscope quality by 1872. The collaboration was proving to be a successful combination of the theoretical and the practical.

By the mid 1870s, Zeiss had more than twenty employees. Innovations in microscope design continued in the late 1870s with the introduction of new stands, a lens turret for ease in changing between lenses, and an oil immersion objective lens. Sales of microscopes increased significantly so that in 1880, Zeiss announced that he was transferring his business in eyeglasses, telescopes, thermometers, barometers, and other equipment to another company.

For many years, Zeiss was dependent on external suppliers of glass. Zeiss and Abbe enticed chemist Otto Schott (1851-1935) to come to Jena in 1882 to continue his experimentation on glass. In 1883, Zeiss made his first microscope lens using Schott glass, yielding further improvement in optics.

In the 1880s, Carl Zeiss gradually withdrew from involvement in the company. Before his death in 1888, Carl Zeiss saw his company expand its distribution of microscopes into international markets and, in 1886, produce its 10,000th microscope. He received many recognitions, including an honorary degree from the University of Jena (1880) and presentation of the Knight's Cross First Class by the Grand Duke of Saxe-Weimar-Eisenach (1886). In the 1890s, the Zeiss company started expanding its product line to include binoculars, camera lenses, astronomical equipment, and other instruments.

In addition to the interesting narrative on the life of Carl Zeiss, the book contains the transcripts of interviews of four present-day individuals with ties to Carl Zeiss through family, the Zeiss company, or the physics of microscopy. All of them expressed admiration for Carl Zeiss's skills as an entrepreneur and as a visionary for how science and craftsmanship can be synthesized. The book is nicely illustrated with numerous photographs and images. As an aside, one of the photographs that I found interesting was a picture of nine individuals identified as the 1891 Zeiss scientific staff and lens designers, including Carl Pulfrich, well known to vision scientists for the Pulfrich effect, and Siegfried Czapski, who worked closely with Ernst Abbe. The book is highly recommended for anyone who wants to learn about the life of Carl Zeiss or the people behind nineteenth century developments in microscope optics.