EARTH AND SKY

Astronomy and Geography at the University between the 15th and the 18th centuries

The exhibition can be visited from the 22th of June
to the 20th of September, 2005

Opening hours: Monday-Friday: from 10 a.m. to 6 p.m.

University Library of Eötvös
Loránd University, Hall
1053 Budapest, Ferenciek tere 6. Tel.: 4116738
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1. SHOWCASE

Nicolaus Copernicus (1473–1543) was a Polish astronomer, who developed the heliocentric theory of the solar system in a form detailed enough to make it scientifically useful. In 1491 Copernicus entered the Jagiellonian University in Kraków, After four years and a brief stay in Toruń, he moved to Italy, where he studied law and medicine at the universities of Bologna and Padua. His collection of observations and ideas on the theory started in 1504. Having left Italy at the end of his studies, he came to live and work in Frombork. In 1514 he made his *Commentariolus*, a short, handwritten text describing his ideas about the heliocentric hypothesis, available to his friends. Copernicus was still completing his work (even if he was not convinced to publish it), when in 1539 Georg Joachim Rheticus, a great mathematician at Wittenberg, directly arrived in Frombork. Rheticus became a disciple of Copernicus' and stayed with him for two years, in which he wrote a book, *Narratio prima*, in which he included the essence of the theory. In 1542, in the name of Copernicus, Rheticus published a treatise on trigonometry (later included in the second book of *De revolutionibus*). Aristarchus of Samos (3rd century BC) developed some theories by Heraclides Ponticus (already talking about a revolution of our planet on its axis) to propose what is, to the best of our knowledge, the first serious model of a heliocentric solar system. It is notable that, according to Plutarch, a contemporary of Aristarchus accused him of impiety for putting the Earth in motion. Copernicus cited Aristarchus and Philolaus in an early manuscript of his book which has survived, stating: *„Philolaus believed in the mobility of the earth, and some even say that Aristarchus of Samos was of that opinion."* For reasons unknown he crossed out this passage before publication of his book. Copernicus' major theory was published in the book *De revolutionibus orbium coelestium* (On the Revolutions of the Heavenly Spheres) in the year of his death 1543, even though he had arrived at it several decades earlier. The work of Copernicus dedicated to the Pope Paul III, is divided into 6 books. The first book contains a general vision of the heliocentric theory, and a summarized exposition of his idea on the World. The second book is mainly theoretical and reports the principles of spherical astronomy and a list of stars (as a basis for the arguments developed in the following books). The third book is mainly dedicated to the apparent movements of the Sun and to related phenomena. The fourth book contains a similar description of the Moon and its orbital movements. The fifth and the sixth books contain the concrete exposition of the new system.

Tycho Brahe (1546–1601) was a Danish astronomer. On 1559 Tycho began his studies at the University of Copenhagen. Tycho realized that progress in the science of astronomy could be achieved not by occasional haphazard observations, but only by systematic and rigorous observation, night after night, and by using instruments of the highest accuracy obtainable. He was able to improve and enlarge the existing instruments, and construct entirely new ones. Tycho's naked eye measurements of planetary parallax were accurate to the arcminute. While a student, Tycho lost part of his nose in a duel with broadswords with Manderup Parsbjerg, a fellow Danish nobleman (when they were studying at the University of Rostock). On November 11, 1572, Tycho observed a very bright star which unexpectedly appeared in the constellation Cassiopeia. Since it had been maintained since antiquity that the world of the fixed stars was eternal and unchangeable (a fundamental axiom of the Aristotelian world view, celestial immutability), other observers held that the phenomenon was something in the Earth's atmosphere. Tycho, however, observed that the parallax of the object did not change from night to night, suggesting that the object was far away. Tycho argued that a nearby object should appear to shift its position with respect to the background. He published a small book, *De Stella Nova* (1573), thereby coining the term nova for a 'new' star. King Frederick II of Denmark and Norway, impressed with Tycho's 1572 observations, financed the construction of two observatories for Tycho on the island of Hven in Copenhagen Sound. These were Uraniborg and Stjerneborg. Uraniborg also had a laboratory for Brahe's alchemical experiments. Because Tycho disagreed with Christian IV, the new king of his country, he moved to Prague in 1599. Sponsored by Rudolf II, the Holy Roman Emperor, he built a new observatory (in a castle in Benátky nad Jizerou) and worked there until his death. In return for their support, Tycho's duties included preparing astrological charts and predictions for his patrons on events such as births; weather forecasting; and astrological interpretations of significant astronomical events such as the comet of 1577 and the supernova of 1572.

Johannes Kepler (1571–1630), a key figure in the scientific revolution, was a German astronomer, mathematician and astrologer. At age six, he observed the Comet of 1577, writing that he *„...was taken by* [his] *mother to a high place to look at it."* In 1587, Kepler began attending the University of Tübingen, where he proved himself to be a superb mathematician. Upon his graduation from that school in 1591, he went on to pursue study in theology, becoming a part of the Tübingen faculty. In December 1599, Tycho Brahe wrote to Kepler, inviting Kepler to assist him at Benatek outside Prague. After Tycho's death, Kepler was appointed Imperial Mathematician (from November 1601 to 1630) to the Habsburg Emperors. In October 1604, Kepler observed the supernova which was subsequently named Kepler's Star. In January 1612 the Emperor died, and Kepler took the post of provincial mathematician in Linz. In 1611, Kepler published a monograph on the origins of snowflakes, the first known work on the subject. On March 8, 1618 Kepler discovered the third law of planetary motion: distance cubed over time squared. He initially rejected this idea, but later confirmed it on May 15 of the same year. Like previous astronomers, Kepler initially believed that celestial objects moved in perfect circles. These models were consistent with observations and with the Platonic idea that the sphere was the perfect shape. However, after spending twenty years doing calculations with data collected by Tycho Brahe, Kepler concluded that the circular model of planetary motion was inconsistent with that data. Using Tycho's data, Kepler was able to formulate three laws of planetary motion, now known as Kepler's laws, in which planets move in ellipses, not circles. Kepler discovered the laws of planetary motion while trying to achieve the Pythagorean purpose of finding the harmony of the celestial spheres. He thereby identified the five Platonic solids with the five intervals between the six known planets - Mercury, Venus, Earth, Mars, Jupiter, Saturn; and the five classical elements. On October 17, 1604, Kepler observed that an exceptionally bright star had suddenly appeared in the constellation Ophiuchus. The appearance of the star, which Kepler described in his book *De Stella nova in pede Serpentarii* (On the New Star in Ophiuchus's Foot), provided further evidence that the cosmos was not changeless; this was to influence Galileo in his argument.

2. SHOWCASE

Georg Agricola (1490–1555) was a German scholar and man of science. Known as „the father of mineralogy", he was born at Glauchau in Saxony. His real name was Georg Bauer; Agricola is the Latinised version of his name, Bauer meaning peasant. Gifted with a precocious intellect, he early threw himself into the pursuit of the „new learning," with such effect that at the age of twenty he was appointed Rector extraordinarius of Greek at the so-called Great School of Zwickau, and made his appearance as a writer on philology. After two years he gave up his appointment in order to pursue his studies at Leipzig, where, as rector, he received the support of the professor of classics, Peter Mosellanus (1493–1524), a celebrated humanist of the time, with whom he had already been in correspondence. Here he also devoted himself to the study of medicine, physics and chemistry. After the death of Mosellanus he went to Italy from 1524 to 1526, where he took his doctor's degree. He returned to Zwickau in 1527, and was chosen as town physician at Joachimsthal, a centre of mining and smelting works, his object being partly „to fill in the gaps in the art of healing," partly to test what had been written about mineralogy by careful observation of ores and the methods of their treatment. His thorough grounding in philology and philosophy had accustomed him to systematic thinking, and this enabled him to construct out of his studies and observations of minerals a logical system which he began to publish in 1528. Agricola's dialogue *Bermannus, sive de re metallica dialogus*, (1530) the first attempt to reduce to scientific order the knowledge won by practical work, brought Agricola into notice; it contained an approving letter from Erasmus at the beginning of the book. In 1530 Prince Maurice of Saxony appointed him historiographer with an annual allowance, and he migrated to Chemnitz, the centre of the mining industry, in order to widen the range of his observations. The citizens showed their appreciation of his learning by appointing him town physician in 1533. In that year, he published a book about Greek and Roman weights and measures, *De Mensuis et Ponderibus*. He was also elected burgomaster of Chemnitz. He now lived apart from the contentious movements of the time, devoting himself wholly to learning. His chief interest was still in mineralogy; but he occupied himself also with medical, mathematical, theological and historical subjects, his chief historical work being the Dominatores Saxonici a prima origine ad hanc aetatem, published at Freiberg. In 1544 he published the De ortu et causis subterraneorum, in which he laid the first foundations of a physical geology, and criticized the theories of the ancients. In 1545 followed the *De natura eorum quae effluunt e terra*; in 1546 the *De veteribus et novis metallis*, a comprehensive account of the discovery and occurrence of minerals; in 1548 the De animantibus subterraneis; and in the two following years a number of smaller works on the metals. His most famous work, the *De re metallica libri XII*, was published in 1556, though apparently finished several years before, since the dedication to the elector and his brother is dated 1550. It is a complete and systematic treatise on mining and metallurgy, illustrated with many fine and interesting woodcuts and containing, in an appendix, the German equivalents for the technical terms used in the Latin text. It long remained a standard work, and marks its author as one of the most accomplished chemists of his time. Believing the black rock of the Schlossberg at Stolpen to be the same as Pliny's basalt, he applied this name to it, and thus originated a petrological term which has been permanently incorporated in the vocabulary of science. In spite of the early proof that Agricola had given of the tolerance of his own religious attitude, he was not suffered to end his days in peace. He remained to the end a staunch Catholic, though all Chemnitz had gone over to the Lutheran creed; and it is said that his life was ended by a fit of apoplexy brought on by a heated discussion with a Protestant divine. He died at Chemnitz on the 21st of November 1555, and so violent was the theological feeling against him, that he was not suffered to rest in the town to which he had added lustre.

Athanasius Kircher (1601?–1680) was a 17th century German Jesuit scholar who published around 40 works, most notably in the fields of oriental studies, geology and medicine. Kircher was born on May 2, 1601 or 1602 in Geisa, Buchonia, near Fulda. From his birthplace he took the epithets Bucho, Buchonius and Fuldensis which he sometimes added to his name. He attended the Jesuit College in Fulda from 1614 to 1618, when he joined the order himself as a seminarian. The youngest of nine children, Kircher was a precocious youngster who was taught Hebrew by a rabbi in addition to his studies at school. He studied philosophy and theology at Paderborn, but fled to Cologne in 1622 to escape advancing Protestant forces. On the journey, he narrowly escaped death after falling through the ice crossing the frozen Rhine, one of several occasions on which his life was endangered. Later, travelling to Heiligenstadt, he was caught and nearly hanged by a party of Protestant soldiers. At Heiligenstadt he taught mathematics, Hebrew and Syrian, and produced a show of fireworks and moving scenery for the visiting Elector Archbishop of Mainz, showing early evidence of his interest in mechanical devices. He joined the priesthood in 1628 and became professor of ethics and mathematics at the University of Würzburg, where he also taught Hebrew and Syrian. From 1628 he also began to show an interest in Egyptian hieroglyphs. Kircher published his first book (the *Ars Magnesia*, reporting his research on magnetism) in 1631, but the same year he was driven by the continuing Thirty Years War to the papal University of Avignon in France. In 1633 he was called to Vienna by the emperor to succeed Kepler as Mathematician to the Habsburg court. On the intervention of Nicholas-Claude Fabri de Peiresc the order was rescinded and he was sent instead to Rome to continue with his scholarly work, but he had already set off for Vienna. On the way, his ship was blown off-course and he arrived in Rome before he knew of the changed decision. He based himself in the city for the rest of his life, and from 1638 taught mathematics, physics and oriental languages at the Collegio Romano for several years before being released to devote himself to research. He studied first malaria and then the plague, and amassed a collection of antiquities which he exhibited along with devices of his own creation in the Museum Kircherianum. In 1661 Kircher discovered the ruins of a church said to have been constructed by Constantine on the site of St Eustace's vision of Christ in a stag's horns. He raised money to pay for the church's reconstruction as the Santuario della Mentorella, and his heart was buried in the church on his death. On a visit to southern Italy in 1638 Kircher was lowered into the crater of Vesuvius, then on the brink of eruption, in order to examine its interior. He was also intrigued by the subterranean rumbling which he heard at the Strait of Messina. His geological and geographical investigations culminated in his *Mundus Subterraneus* of 1664, in which he suggested that the tides were caused by water moving to and from a subterranean ocean. Kircher was puzzled by fossils. He understood that some were the remains of animals which had turned to stone, but ascribed others to human invention or to the spontaneous generative force of the earth. Not all the objects which he was attempting to explain were in fact fossils, hence the diversity of explanations.

3. SHOWCASE

Michael Mästlin (1550–1631) German astronomer and mathematician who was one of the first scholars to accept and teach Polish astronomer Copernicus's observation that the Earth orbits the Sun. One of Mästlin's pupils was German mathematician Johannes Kepler. In 1580 he became professor of mathematics at Heidelberg and in 1584 at Tübingen, where he taught for 47 years. In 1573, Mästlin published an essay concerning the nova that had appeared the previous year. Its location in relation to known stars convinced him that the nova was a new star, which implied, contrary to traditional belief, that things could come into being in the spheres beyond the Moon. Observation of the comets of 1577 and 1580 convinced Mästlin that they also were located beyond the Moon. Together with other observations, this led him explicitly to argue against the traditional cosmology of Aristotle.

Georg Peurbach (1423–1461) was a German astronomer. He was appointed court astronomer by King Ladislaus of Hungary in 1454. Peurbach was served as professor of astronomy at the University of Vienna. Peurbach wrote on astronomy and gave tables of eclipse calculations in *Tabulae Ecclipsium*. He observed Halley's comet in June 1456 and wrote a report on his observations. He made further observations of comets and, together with Regiomontanus, recorded the lunar eclipse of 3 September 1457 from a site near Vienna. Peurbach published further tables, checked by his own eclipse observations, and devised astronomical instruments. In *Theoricae Novae Planetarum* Peurbach gave Ptolemy's epicycle theory of the planets. Peurbach believed that the planets were in solid crystalline spheres although he believed that their motions were controlled by the Sun.

Caspar Peucer (1525–1602) was a German reformer, physician, and scholar. In 1554, he became professor of mathematics at Wittenberg, and in 1560 professor of medicine, leading the Wittenberg faculty in that field. Until 1574, he also served several times as Dean and Rector. He observed the new star in Cassiopeia, he belived that this object was in the spheres beyond the Moon. In spite of his medical profession, in 1570, he became even personal physician to the Elector of Saxony, he was, after the death of Melanchthon, one of the leading Protestants in Saxony. However, in 1574 Peucer was officially charged with Crypto-Calvinism in an inter-Lutheran fight for power and put in jail in the famed Königstein Fortress for 12 years. Released in 1586, he went to the Duchy of Anhalt, where he became Councillor and personal physician of the Prince of Anhalt.

Tadeáš Hájek z Hájku (1525–1600) was the personal physician of the Holy Roman Emperor Rudolph II. In 1554 he studied medicine in Bologna and went to Milan the same year to listen to lectures by Girolamo Cardano, but he soon returned to Prague, where he became a professor of mathematics at the Charles University of Prague in 1555. He published the *Aphorismi Metoposcopici* in 1561, dealing with divination and diagnosis by interpreting moles on one's body. He triangulated the area around Prague and co-authored a map of it in 1563; the map is unfortunately now lost. In 1566–1570, he served as an army doctor in Austria and Hungary during the war with Turkey. He published his studies of a supernova in the constellation Cassiopeia in 1574. Hájek was in frequent scientific correspondence with the recognized astronomer Tycho and played an important role in persuading Rudolph II to invite Brahe (and later Kepler) to Prague. His voluminous writings in Latin were mostly concerned with astronomy and many regarded him as the greatest astronomer of his time. Besides his work, Hájek eagerly collected manuscripts, especially those by Copernicus, and may have been the one to convince Rudolph II to procure the infamous *Voynich manuscript*. The Voynich manuscript is a mysterious illustrated book of unknown contents, written some 500 years ago by an anonymous author in an unidentified alphabet and unintelligible language. Over its recorded existence, the Voynich manuscript has been the object of intense study by many professional and amateur cryptographers – including some top American and British codebreakers of World War II fame – who all failed to decipher a single word. This string of egregious failures has turned the Voynich manuscript into the Holy Grail of historical cryptology; but it has also given weight to the theory that the book is nothing but an elaborate hoax – a meaningless sequence of random symbols. The book is named after the Russian-American book dealer Wilfrid M. Voynich, who acquired it in 1912. It is presently item MS 408 in the Beinecke Rare Book Library of Yale University. Throughout his life he also published numerous astrological prognostics in Czech and that is why he was until recently viewed as an „occultist" rather than a great scientist.

Dudith András (1533–1589) was a Hungarian humanist. 1550–1553, he studied in Verona and Paris. He was raised a Catholic and occupied high positions in the Catholic church. However, he believed strongly that priests should be allowed to marry and was unpopularly in favor of reconcilliation with the Lutherans. 1553–1557, secretary to the papal legate to England, Cardinal Reginald Pole. His time was divided between London and Paris. 1557, he returned to Hungary and became provost of Overbaden and canon of Strigone. He travelled to Italy, where he spent 1558–1560. It is not clear to me whether he retained the income from these positions then or whether he relied on patrons, like Verancsics, bishop of Eger, who in 1558 offered him the income from two benefices in his bishopric. He does not appear to have accepted this offer, but there was probably some support from Verancsics Antal or other patrons. 1560–1562, he returned to court in Vienna, was granted the bishopric of Tinin, Dalmatia, and administered it for two years. 1562–1563, he was elected by the Hungarian clergy and served as representative to the council of Trent. 1564–1576, he served the imperial court. He attempted to resign from the court, but Maximillian II retained him as ambassador to Poland and secret councillor. In 1567 he married a Polish noblewoman and subsequently subscribed to the Lutheran faith. This brought condemnation and excommunication from Rome, but he retained the trust and favor of the emperor. Early in his intellectual life he interested himself in astrology, but eventually rejected it and argued strongly against it. 1576, he was finally forced to leave the court and retired as baron of a property he had obtained in Moravia. He also had the title of seigneur de Smigla, which came from another holding in Poland. 1579–1589, he retired to Breslau. He corresponded on astronomical matters with Thadaeus Hagecius.

4. SHOWCASE

Aratos (c. 315 BC–240 BC) was a Greek poet. His principal work, the *Phaenomena* (Appearances), versifies one or more works of Eudoxus of Cnidus. In 1154 hexameters he lays bare the names and movements of the heavenly bodies, and the significance of various weather signs. Technical description are primary but mythical digressions are frequent. Aratus wrote a number of other poems, many of an astronomical or technical nature. In the first half of the 9th century, at the time of Louis the Pious (814–840), the Aratea was commissioned from an unknown artist who copied a manuscript from late Antiquity.The work was later brought into the Roman culture by Claudius Caesar Germanicus who translated it into Latin. From there it spread through to medieval Christianity at the time of Charlemagne, and remained a fundamental source of knowledge for the western view of the heavens until the advent of Arabian astronomy.In the Early Middle Ages the preservation of antique sciences and of the classical cultural heritage was considered one of the most noble tasks of scholarship. It is thus assumed that the manuscript was made to the order of Empress Judith, second wife of Emperor Louis the Pious, a great patron of sciences and the arts. Posterity remembers her for her fight for the rights of her son, Charles the Bald. It seems that the manuscript was later kept in the abbey of Saint Bertin in the North of France. In the 16th century it changed hands and became the property of the humanist and patrician Jakob Susius of Gent before being rediscovered by Hugo Grotius. After that the fabulous manuscript belonged to Queen Christina of Sweden who donated the Aratea to her librarian Isaac Vossius before her departure to Rome. In 1690, the Leiden University acquired the book.

Galileo Galilei (1564–1642), was a Tuscan astronomer, philosopher, and physicist who is closely associated with the scientific revolution. Although the popular idea of Galileo inventing the telescope is inaccurate, he was one of the first people to use the telescope to observe the sky. He published his initial telescopic astronomical observations in March 1610 in a short treatise entitled *Sidereus Nuncius* (Sidereal Messenger). On January 7, 1610 Galileo discovered three of Jupiter's four largest satellites (moons): Io, Europa, and Callisto. Ganymede he discovered four nights later. He determined that these moons were orbiting the planet since they would occasionally disappear; something he attributed to their movement behind Jupiter. The demonstration that a planet had smaller planets orbiting it was problematic for the orderly, comprehensive picture of the geocentric model of the universe, in which everything circled around the Earth. Galileo noted that Venus exhibited a full set of phases like the Moon. The heliocentric model of the solar system developed by Copernicus predicted that all phases would be visible since the orbit of Venus around the Sun would cause its illuminated hemisphere to face the Earth when it was on the opposite side of the Sun and to face away from the Earth when it was on the Earth-side of the Sun. By contrast, the geocentric model of Ptolemy predicted that only crescent and new phases would be seen, since Venus was thought to remain between the Sun and Earth during its orbit around the Earth. Galileo's observation of the phases of Venus proved that Venus orbited the Sun and lent support to (but did not prove) the heliocentric model. Unfortunately, Galileo went too far in arguing for the heliocentric model by claiming that ocean tides are caused by Earth's rotation. His argument was incorrect and easily refuted, as it predicted one tide per day rather than two. Galileo was one of the first Europeans to observe sunspots, although there is evidence that Chinese astronomers had done so before. The very existence of sunspots showed another difficulty with the perfection of the heavens as assumed in the older philosophy. Galileo observed the Milky Way, previously believed to be nebulous, and found it to be a multitude of stars, packed so densely that they appeared to be clouds from Earth.

Giovanni Battista Riccioli (1598–1671) was an Italian astronomer. He was a Jesuit who entered the order in 1614. He devoted his career to the study of astronomy, often working with Francesco Maria Grimaldi. He wrote the important work *Almagestum novum* in 1651. By necessity, he opposed the Copernican heliocentric theory though praising its value as a simple hypothesis. He and Grimaldi extensively studied the Moon, of which Grimaldi drew a map. Much of the nomenclature of lunar features still in use today is due to him and Grimaldi. He also observed Saturn, and was the first to note that Mizar was a double star.

John Flamsteed, (1646–1719) was an English astronomer. On March 4, 1675, he was appointed by royal warrant „The King's Astronomical Observator" – the first British Astronomer Royal, with an allowance of £100 a year. In June 1675, another royal warrant provided for the founding of the Royal Greenwich Observatory, and Flamsteed laid the foundation stone in August. In February 1676, he was admitted a Fellow of the Royal Society, and in July, he moved into the Observatory where he lived until 1684, when he was finally appointed priest to the parish of Burstow, Surrey. He held that office, as well as that of Astronomer Royal, until his death. In 1720 he is buried at Burstow, Surrey. Flamsteed accurately calculated the solar eclipses of 1666 and 1668. He is responsible for one of the earliest recorded sightings of the planet Uranus, which he mistook for a star and catalogued as 34 Tauri. On August 16, 1680, Flamsteed catalogued a star, 3 Cassiopeiae, that later astronomers were unable to corroborate. Three hundred years later, the American astronomy historian William Ashworth suggested that what Flamsteed may have seen was the most recent supernova in this galaxy's history, an event which would leave as its remnant the strongest radio source in the sky, known in the third Cambridge catalog as 3C 461. Because the position of „3 Cassiopeiae" does not precisely match that of the visual object associated with 3C 461, and because the expansion wave associated with the explosion has been worked backward to the year 1667 and not 1680, some historians feel that all Flamsteed may have done was incorrectly note the position of a star already known. Flamsteed is also remembered for his conflicts with Isaac Newton, then President of the Royal Society, who attempted to steal some of Flamsteed's findings for his own work. Newton tricked Flamsteed into doing so through an edict from the King, and produced the findings without crediting Flamsteed. Some years later, Flamsteed managed to buy most copies of the books back, and publicly burnt them in front of the Royal Observatory. In 1725, *the Historia Coelestis Britannica* was published. This contained Flamsteed's observations, and included a catalogue of almost 3,000 stars to much greater accuracy than any prior work. This was considered the first significant contribution of the Greenwich Observatory.

5. SHOWCASE

Benyovszky Móric (1741/1746–1786) was a Hungarian adventurer, globetrotter, explorer, colonizer, writer, the King of Madagascar, a French colonel, Polish military commander and Austrian soldier. He was the first European sailor in the North Pacific region, well before James Cook and Jean-François de La Pérouse. His career began as an officer of Austrian army in the Seven Years War, because Hungary was part of the Austrian Monarchy at that time. However, his religious views and attitudes towards authority resulted in his leaving the country. From this time on he was called a sailor, an adventurer, a visionary, a colonizer, an entrepreneur, and a king. In 1768 he joined the Confederation of Bar, Polish national movement against Russian intervention. He was captured by the Russians and interned in Kazan and later exiled in Siberia (Kamchatka). Subsequently, he escaped from Siberia and started a discovery trip through the Northern Pacific. In 1772 Benyowsky arrived in Paris where impressed King Louis XV. He was offered to act in the name of France on Madagascar. In 1776 Benyowsky was elected by the local tribal chiefs an Ampansacabe, (king) of Madagaskar. In 1776 he returned to Paris and in appreciation for his services as Commander of Madagascar, he was awarded with promotion to the rank of General, and granted the military Order of Saint Louis and a life pension by Louis XVI. In 1779 Benyowsky came to America, where he tried to obtain support in proposal to use Madagascar as a base in the struggle against England. He died in 1786 fighting with the French on Madagascar.

James Cook (1728–1779) was a British explorer and navigator. He made three voyages to the Pacific Ocean, in which its main shorelines were discovered. In 1766, the Royal Society hired him to travel to the Pacific Ocean to observe and record a transit of Venus across the Sun. Leaving in 1768, he arrived on April 13, 1769 in Tahiti, where he built a small fort and observatory to observe the transit; however, due to the lack of precise scientific instruments, there was no way to accurately measure it. He then explored the South Pacific for the mythical continent of Terra Australis, which the Royal Society, and especially Alexander Dalrymple, insisted must exist, despite Cook’s personal doubts. With the help a Tahitian named Tupaia who had extensive knowledge of Pacific geography, Cook did reach New Zealand, becoming only the second European in history to do so (behind Abel Tasman over a century earlier, in 1642). Cook mapped the complete New Zealand coastline, making only minor mistakes. He also discovered Cook Strait, which separates the North Island from the South Island, and which Tasman had not guessed at. Next, he went on to Australia, where he discovered its east coast. The site of Cook’s first landing, at Kurnell on Botany Bay, was intended to be the site of the first British colony in Australia. Cook also discovered the Great Barrier Reef, when his ship ran aground June 11, 1770; Endeavour was seriously damaged while repairs were carried out on the beach near the dock in modern Cooktown, at the mouth of the Endeavour River. While there, Joseph Banks and Daniel Solander made their first major collections of Australian flora and there were mainly peaceful meetings with the local Aboriginal people from whom the name ‘kangaroo’ was recorded and came into the English language from the local Guugu-Yimidhirr name for a Grey Kangaroo, which was gangaroo. He then sailed through Torres Strait between Australia and New Guinea, again becoming only the second European to do so (the first being Luis Vaez de Torres, in 1604). Cook’s journals were published upon his return, and he became something of a hero among the scientific community. Among the general public, however, the aristocratic botanist Joseph Banks was a bigger hero. Banks even attempted to take command of Cook’s second voyage, but removed himself from the voyage before it began. Cook was once again commissioned by the Royal Society to search for the mythical Terra Australis. Despite Cook’s evidence to the contrary from the first voyage, Dalrymple refused to believe a massive southern continent did not exist. Cook commanded HMS Resolution on this voyage, while Tobias Furneaux commanded HMS Adventure. Cook circumnavigated the globe at a very high southern latitude, becoming the first European to cross the Antarctic Circle on January 17, 1773, reaching 71°10’ south. He also discovered South Georgia and the South Sandwich Islands. In the Antarctic fog, Cook and Furneaux were separated. Furneaux made his way to New Zealand, where he lost some of his men following a fight with the Maori, and eventually sailed back to Britain, while Cook continued to explore the Antarctic. Cook almost discovered the mainland of Antarctica, but turned back north towards Tahiti to resupply his ship. He then travelled south again, in a second fruitless attempt to find the supposed continent, bringing with him a young Tahitian named Omai, who proved to be somewhat less knowledgeable about the Pacific than Tupaia had been on the first voyage. On his return voyage, he landed at the Friendly Islands, Easter Island, and Vanuatu, in 1774. His return home put to rest the popular myth of Terra Australis. Another accomplishment of the second voyage was the successful testing of John Harrison’s timekeeping instruments, which at last facilitated accurate measurement of longitude. Upon his return, Cook was given an honorary retirement from the Royal Navy, but he could not be kept away from the sea. A third voyage was planned to find the Northwest Passage. Cook would travel to the Pacific and hopefully travel east to the Atlantic, while a simultaneous voyage would travel the opposite way. On his last voyage, Cook once again commanded HMS Resolution, while Captain Charles Clerke commanded HMS Discovery. Ostensibly the voyage was planned to return Omai to Tahiti; this is what the general public believed, as he had become a favourite curiosity in London. After returning Omai, Cook travelled north and in 1778 became the first European to visit the Hawaiian Islands, which he named the "Sandwich Islands" after the 4th Earl of Sandwich, the acting First Lord of the Admiralty. From there, he travelled east to explore the west coast of North America, eventually landing near the First Nations village at Yuquot in Nootka Sound on Vancouver Island, although he unknowingly sailed past the Strait of Juan de Fuca. He explored and mapped the coast from California all the way to the Bering Strait, on the way discovering what came to be known as Cook Inlet in Alaska. The Bering Strait proved to be impassable, although he made several attempts to sail through it. Cook became increasingly frustrated on this voyage, and probably began to suffer from a stomach ailment; it is speculated that this led to irrational behaviour towards his crew, such as forcing them to eat walrus meat, which they found inedible. Cook returned to Hawaii in 1779. On February 14 at Kealakekua Bay, some Hawaiians stole one of Cook’s small boats. Normally, as thefts were quite common in Tahiti and the other islands, he would have taken hostages until the stolen articles were returned. However, his stomach ailment and increasingly irrational behaviour lead to an altercation with a large crowd of Hawaiians gathered on the beach. In the ensuing skirmish, shots were fired at the Hawaiians and Cook was clubbed and stabbed to death.

6. SHOWCASE

Jean François Galaup, count (comte) de La Pérouse (1741–1788) was a French naval officer and explorer whose expedition vanished in Oceania. He studied in a Jesuit college, and entered the naval college in Brest when he was fifteen, and fought the British off North America in the Seven Years' War. In the beginning of the war he was wounded in a naval engagement off the French coast and was briefly imprisoned. He was promoted to rank of commodore when he defeated English frigate Ariel in the West Indies. In August 1782 he made fame by capturing two English forts on the coast of the Hudson Bay, but left the survivors with food and ammunition when he departed. The next year his family finally consented in his marriage to Louise-Eléonore Broudou, a young creole from modest origins he had met on Île de France (present-day Mauritius). He was appointed in 1785 to lead an expedition to the Pacific. His ships were the Astrolabe and the Boussole, both 500 tons. They were storeships, reclassified as frigates for the occasion. La Pérouse was a great admirer of James Cook, tried to get on well with the Pacific islanders, and was well-liked by his men. Among his 114 man crew there were ten scientists: An astronomer, a physicist, three naturalists, a mathematician, three draftsmen, and even both chaplains were scientifically schooled. He left Brest on August 1785, rounded Cape Horn, investigated the Spanish colonial government in Chile, and, by way of Easter Island and Hawaii, sailed on to Alaska, where he landed near Mount St. Elias in late June 1786 and explored the environs. A barge and two longboats, carrying 21 men, were lost in the heavy currents of the bay called Port des Français by La Pérouse, but now known as Lituya Bay. Next he visited Monterey, where he examined the Spanish settlements and made critical notes on the treatment of the Indians in the Franciscan missions. He again crossed the Pacific Ocean to Macao, where he sold the furs acquired in Alaska, dividing the profits among his men. The next year, after a visit to Manila, he set out for the northeast Asian coasts. He saw the island of Quelpart (Cheju), which had been visited by Europeans only once before when a group of Dutchmen shipwrecked there in 1635. He visited the mainland coast of Korea, then crossed over to Oku-Yeso (Sakhalin). The inhabitants had drawn him a map, showing their country, Yeso (also Yezo, now called Hokkaido) and the coasts of Tartary (mainland Asia). La Pérouse wanted to sail through the channel between Sakhalin and Asia, but failed, so he turned south, and sailed through La Pérouse Strait (between Sakhalin and Hokkaido), where he met the Ainu, explored the Kuriles, and reached Petropavlovsk (on Kamchatka peninsula) in September 1787. Here they rested from their trip, and enjoyed the hospitality of the Russians and Kamchatkans. In letters received from Paris he was ordered to investigate the settlement the British were to erect in New South Wales. Barthélemy de Lesseps, the French vice consul at Kronstadt, who had joined the expedition as an interpreter, disembarked to bring the expedition's letters and documents to France, which he reached after a year-long, epic journey across Siberia and Russia. His next stops were in the Navigator Islands (Samoa). Just before he left, the Samoans attacked a group of his men, killing twelve of them, among which de Langle, commander of the Astrolabe. The expedition continued to Tonga and then to Australia, arriving at Botany Bay on 26 January 1788, just as Captain Arthur Phillip moved the colony from Botany Bay to Port Jackson. The British received him courteously, but were unable to help him with food as they had none to spare. La Pérouse sent his journals and letters to Europe with a British ship, obtained wood and fresh water, and left for New Caledonia, Santa Cruz, the Solomons, the Louisiades, and the western and southern coasts of Australia. Although he wrote that he expected to be back in France by December 1788, he nor any of his men was seen again. Fortunately, before he set sail, de Galaup had sent the valuable written details of his expedition to Paris where it was published posthumously. In 1791–1793 Antoine de Bruni, chevalier d'Entrecasteaux looked for La Pérouse. His expedition followed La Pérouse's proposed path through the islands northwest of Australia. D'Entrecasteaux died during the voyage, and the expedition found no trace of La Pérouse's expedition. It was not until 1826 that an English captain, Peter Dillon, found evidence of the tragedy. In Tikopia (one of the islands of Santa Cruz), he bought some swords he had reason to believe had belonged to La Pérouse. He made enquiries, and found that they came from nearby Vanikoro, where two big ships had broken up. Dillon managed to obtain a ship in Bengal, and sailed for Vanikoro where he found cannon balls, anchors and other evidence of the remains of ships in water between coral reefs. He brought several of these artifacts back to Europe, as did D'Urville in 1828. De Lesseps, the only member of the expedition still alive at the time, identified them, as all belonging to the Astrolabe. From the information Dillon received from the people on Vanikoro, a rough reconstruction could be made of the disaster that struck La Pérouse, which was confirmed by the find and search of the shipwreck of the Boussole in 1964. Both ships had been wrecked on the reefs, the Boussole first. The Astrolabe was unloaded and taken apart. A group of men, probably the survivors of the Boussole, were massacred by the local inhabitants. According to natives, surviving sailors built a two-masted craft from the wreckage of the Astrolabe, and left westward about 9 months later, but what happened to them is unknown. The La Perouse Strait between Hokkaido and Sakhalin is named in his honour, as is La Perouse, the northern headland of Botany Bay.

Jules Gabriel Verne (1828–1905) was a French author and a pioneer of the science fiction genre. Verne was noted for writing about space, air, and underwater travel long before they were possible. After completing his studies at the lycée, Verne went to Paris to study for the bar. About 1848, in conjunction with Michel Carre, he began writing librettos for operettas. During this period, he met the authors Alexandre Dumas and Victor Hugo, who offered him some advice on his writing. With her encouragement, he continued to write and actively try to find a publisher. Verne's situation improved when he met Pierre-Jules Hetzel, one of the most important French publishers of the 19th century, who also published Victor Hugo, George Sand, and Erckmann-Chatrian, among others. Hetzel's advice improved Verne's writings, which until then had been rejected and rejected again by other publishers. Hetzel read a draft of Verne's story about the balloon exploration of Africa, which had been rejected by other publishers on the ground that it was „too scientific". With Hetzel's help, Verne rewrote the story and in 1863 it was published in book form as *Cinq semaines en ballon* (Five Weeks in a Balloon). Verne became wealthy and famous. From that point on, and for nearly a quarter of a century, scarcely a year passed in which Hetzel did not publish one or more of his stories. The most successful of these include: *Voyage au centre de la terre* (Journey to the Center of the Earth, 1864); *De la terre à la lune* (From the Earth to the Moon, 1865); *Vingt Mille Lieues sous les mers* (20,000 Leagues Under the Seas, 1869).

7. SHOWCASE

Claudius Ptolemaeus (c. 85 – c. 165) was a Greek geographer, astronomer, and astrologer. Ptolemy was the author of two important scientific treatises. One is the astronomical treatise that is now known as the *Almagest* (The Great Treatise). It was preserved, like most of Classical Greek science, in Arabic manuscripts and only made available in Latin translation (by Gerard of Cremona) in the 12th century. In this work, one of the most influential books of Antiquity, Ptolemy compiled the astronomical knowledge of the ancient Greek and Babylonian world; he relied mainly on the work of Hipparchus of three centuries earlier. Ptolemy formulated a geocentric model of the solar system which remained the generally accepted model in the Western and Arab worlds until it was superseded by the heliocentric solar system of Copernicus. The Almagest also contains a star catalogue, which is probably an updated version of a catalogue created by Hipparchus. Its list of 48 constellations is ancestral to the modern system of constellations, but unlike the modern system they did not cover the whole sky. Ptolemy's other main work is his *Geography*. This too is a compilation, of what was known about the world's geography in the Roman empire at his time. The first part of the Geography is a discussion of the data and of the methods he used. Like with the model of the solar system in the *Almagest*, Ptolemy put all this information into a grand scheme. The maps in surviving manuscripts of Ptolemy's *Geography* however, date only from about 1300, after the text was rediscovered by Maximus Planudes. Maps based on scientific principles had been made since the time of Eratosthenes (3rd century BC), but Ptolemy invented improved projections. It is known that a world map based on the *Geography* was on display in Autun (France) in late Roman times. In the 15th century Ptolemy's *Geographia* began to be printed with engraved maps; an edition printed at Ulm in 1482 was the first one printed north of the Alps. For longitude this was even worse, because there was no reliable method to determine geographic longitude; Ptolemy was well aware of this. It remained a problem in geography until the invention of chronometers at the end of the 18th century AD. It must be added that his original topographic list cannot be reconstructed: the long tables with numbers were transmitted to posterity through copies containing many scribal errors, and people have always been adding or improving the topographic data: this is a testimony of the persistent popularity of this influential work. Ptolemy's treatise on astrology, the *Tetrabiblos*, was the most popular astrological work of antiquity and also enjoyed great influence in the Islamic world and the medieval Latin West. The *Tetrabiblos* is an extensive and continually reprinted treatise on the ancient priciples of astrology in four books. That it did not quite attain the unrivalled status of the *Syntaxis* was perhaps because it did not cover some popular areas of the subject, particularly horary astrology (interpreting astrological charts for a particular moment to determine the outcome of a course of action to be initiated at that time), electional astrology, and medical astrology. The great popularity that the *Tetrabiblos* did possess might be attributed to its nature as an exposition of the art of astrology and as a compendium of astrological lore, rather than as a manual. It speaks in general terms, avoiding illustrations and details of practice.

Johannes Müller von Königsberg (1436–1476), known by his Latin pseudonym Regiomontanus, was an important German mathematician, astronomer and astrologer. Three years later he continued his studies at Alma Mater Rudolfina, the university in Vienna, Austria. There he became a pupil and friend of Georg von Peurbach. In 1457 he graduated with a degree of „magister artium" (Master of Arts) and held lectures in optics and ancient literature. That same year he built an astrolabe for Maximilian I, the Holy Roman Emperor, and in 1465 a portable sundial for Pope Paul II. His work with Peurbach brought him to the writings of Nicholas of Cusa (Cusanus), who held a heliocentric view. Regiomontanus, however, remained a geocentrist after Ptolemy. Following Peurbach's death, he continued the translation of Ptolemy's Almagest which Peurbach had begun at the initiative of Johannes Bessarion. From 1461 to 1465 Regiomontanus lived and worked at Cardinal Bessarion's house in Rome. He wrote *De Triangulis omnimodus* (1464) and *Epytoma in almagesti Ptolemei*. *De Triangulis* (On Triangles) was one of the first textbooks presenting the current state of trigonometry and included lists of questions for review of individual chapters. In the Epytoma he critiqued the translation, pointing out inaccuracies. Later Nicolaus Copernicus would refer to this book as an influence on his own work. In 1467 Regiomontanus left Rome to work at the court of Matthias Corvinus of Hungary. There he calculated extensive astronomical tables and built astronomical instruments. In 1471 he moved to the Free City of Nuremberg, in Franconia, then one of the Empire's important seats of learning, publication, commerce and art. Regiomontanus remains famous for having built at Nuremberg the first astronomical observatory in Germany, perhaps in Europe. There he published many astronomical charts. In 1475 he went to Rome to work with Pope Sixtus IV on calendar reform. While there, Regiomontanus died mysteriously: some say of plague, others by (more likely) assassination. That was on July 6, 1476, when he had just turned forty a month earlier. His *Tabulae* directionum, completed in Hungary, were designed for astrological use and contained a discussion of different ways of determining astrological houses.

Hartmann Schedel (1440–1514) Settled Nuremberg 1484, published Nuremberg Chronicle 1493. First modern map of Germany after Cusanas by Hieron. Muntzer. World map and town plans. Schedel's library sold in 1552 to Hans Jacob Fugger. Schedel's *Nuremberg Chronicle* must have been one of the most popular of incunables, judging by the number of surviving copies. Some 800 copies of the Latin edition have been traced and 400 of the German. This is not surprising considering that this compilation of sacred and profaned history was the most elaborate printed book of its time, illustrated with more than 1800 woodcuts. Among these were a number of double-page city views, a folding map of the world and another of northern and central Europe. The text is an amalgam of legend, fancy and tradition interspersed with the occasional scientific fact or authentic piece of modern learning. Hartmann Schedel, a physician of Nuremberg, was the editor-in-chief; the printer was Anton Koberger, and among the designers the most famous were Michael Wolgemut and Hanns Pleydenwurff, masters of the Nuremberg workshop where Albrecht Durer served his apprenticeship. The first edition of the *Nuremberg Chronicle* in July 1493 was in Latin and there was a reprint with German text in December of the same year.

8. SHOWCASE

Abraham Ortelius (1527–1598) was a cartographer and geographer, credited as the creator of the modern atlas. He is specifically known to have traveled throughout the Seventeen Provinces. Beginning as a map-engraver, in 1547 he entered the Antwerp gild of St Luke as afsetter van Karten. His early career is that of a businessman, and most of his journeys before 1560 are for commercial purposes. In 1560, however, when travelling with Gerardus Mercator to Trier, Lorraine and Poitiers, he seems to have been attracted, largely by Mercator's influence, towards the career of a scientific geographer; in particular he now devoted himself, at his friend's suggestion, to the compilation of that atlas or *Theatrum Orbis Terrarum* (Theatre of the World) by which he became famous. In 1564 he completed a mappemonde, eight-leaved map of the world, which afterwards appeared in the Theatrum. The only extant copy of this great map is in the library of the University of Basle. He also published a map of Egypt in 1565, a plan of Brittenburg Castle on the coast of the Netherlands, and a map of Asia, before the appearance of his great work. In 1570 was issued, by Gilles Coppens de Diest at Antwerp, Ortelius' *Theatrum Orbis Terrarum*, the 'first modern atlas' of 53 maps. Three Latin editions of this (besides a Flemish, a French and a German edition) appeared before the end of 1572; twenty-five editions came out before Ortelius' death in 1598; and several others were published subsequently, for the vogue continued till about 1612. Most of the maps were admittedly reproductions, and many discrepancies of delineation or nomenclature occur. Its immediate precursor and prototype was a collection of thirty-eight maps of European lands, and of Asia, Africa, Tartary and Egypt, gathered together by the wealth and enterprise, and through the agents, of Ortelius' friend and patron, Gilles Hooftman, lord of Cleydael and Aertselaer: most of these were printed in Rome, eight or nine only in Belgium. In 1573 Ortelius published seventeen supplementary maps under the title of *Additamentum Theatri Orbis Terrarum*. By this time he had formed a fine collection of coins, medals and antiques, and this produced (also in 1573, published by Philippe Galle of Antwerp) his *Deorum dearumque capita ... ex Museo Ortelii* (reprinted in Gronovius, Thes. Gr. Ant. vol. vii.). In 1575 he was appointed geographer to the king of Spain, Philip II, on the recommendation of Arias Montanus, who vouched for his orthodoxy (his family, as early as 1535, had fallen under suspicion of Protestantism). In 1578 he laid the basis of a critical treatment of ancient geography by his *Synonymia geographica* (issued by the Plantin press at Antwerp and republished as *Thesaurus geographicus* in 1596). In 1584 he brought out his *Nomenclator Ptolemaicus*, his Parer gon (a series of maps illustrating ancient history, sacred and secular), and his *Itinerarium per nonnuilas Galliae Belgicae partes* (published at the Plantin press, and reprinted in Hegenitius, Itin. Frisio-Hoil.), a record of a journey in Belgium and the Rhineland made in 1575.

Willem Janszoon Blaeu (1571–1638), also rendered Willem Jansz Blaeu, was a Dutch cartographer and atlas maker, born in Alkmaar. As the son of a well-to-do herring salesman, he was predestined to succeed his father in the trade, but his interests lay more in mathematics and astronomy. Between 1594 and 1596 as a student of the Danish astronomer Tycho Brahe he qualified as an instrument and globe maker. Once he returned to the Netherlands he made country maps and world globes, and as he possessed his own printing works was able to regularly produce country maps in an atlas format, some of which appeared in the *Atlas Novus* published in 1635. In 1633 he was appointed map-maker of the Dutch East India Company. He was also an editor and published the works of Willebrord Snell, Metius, Vossius and the historian and poet Pieter Corneliszoon Hooft. He had two sons, Johannes and Cornelis, who continued their father's mapmaking business after his death in 1638. Prints of the family's works are still sold today. Original maps are rare collector items.

Johann Baptist Homann (1664–1724) of Nuremberg, Germany was a geographer and cartographer, who was instrumental in making maps of the Americas to show to Europeans, and in turn bringing Europeans to see America. In 1715 Homann was appointed Imperial Geographer of the Holy Roman Empire. Giving privileges to individuals was an added right that the emperor of the Holy Roman Empire enjoyed. Of particular significance to cartography were the imperial printing privileges (Latin privilegia impressoria). These protected for a time the authors in all scientific fields such as printers, copper engravers, map makers and publishers. They were also very important as recommendation for a potential customer. In 1716 Homann published his masterpiece *Grosser Atlas ueber die ganze Welt* (Grand Atlas of all the World).

Christiaan Huygens (1629–1695), was a Dutch mathematician and physicist. Born in The Hague as the son of Constantijn Huygens. Historians commonly associate Huygens with the scientific revolution. Christiaan generally receives minor credit for his role in the development of modern calculus. He also achieved note for his arguments that light consisted of waves; see: wave-particle duality. In 1655, he discovered Saturn's moon Titan. He also examined Saturn's planetary rings, and in 1656 he discovered that those rings consisted of rocks. In the same year he observed the Orion Nebula. Using his modern telescope he succeeded in subdividing the nebula into different stars. (The brighter interior of the Orion Nebula bears the name of the Huygens Region in his honour.) He also discovered several interstellar nebulae and some double stars. After Blaise Pascal encouraged him to do so, Huygens wrote the first book on probability theory, which he had published in 1657. He also worked on the construction of accurate clocks, suitable for naval navigation. In 1658 he published a book on this topic called *Horologium*. In fact his invention, the *Pendulum clock* (patented 1656), was a breakthrough in timekeeping. The Royal Society elected Huygens a member in 1663. In the year 1666 Huygens moved to Paris where he held a chair at the French Royal Society. Using the Parisan observatory (completed in 1672) he made further astronomical observations. Huygens early speculated in detail about life on other planets (although we do not know to what extent ancient writers exercised such speculation, since most of their work has not survived). In his book *Cosmotheoros*, further entitled „*The celestial worlds discover'd or, conjectures concerning the inhabitants, plants and productions of the worlds in the planets"* he imagined a universe brimming with life, much of it very similar to life on 17th century Earth. The liberal climate in the Netherlands of that time not only allowed but encouraged such speculation. In sharp contrast, the Italian authorities had burned philosopher Giordano Bruno, who also believed in many inhabited worlds, at the stake for his beliefs in 1600. In 1675, Christian Huygens patented a pocket watch. Huygens moved back to The Hague in 1681 after suffering serious illness and died there 14 years later on July 8, 1695.

9–10. SHOWCASE

Thomas Harriot (ca. 1560–1621) was an English astronomer and mathematician. Some sources give his surname as Harriott or Hariot. He attended Oxford University. He founded the „English school" of algebra. He used his knowledge of astronomy to provide navigational expertise for Sir Walter Raleigh, and was also involved in designing Raleigh's ships and served as his accountant as well. He went on at least one expedition and spent time in the New World visiting Roanoke Island off the coast of North Carolina. His account of the voyage, Brief and True Report of the New Found Land of Virginia, was published in 1588. The Report contains an early account of the Native American population encountered by the expedition: its prejudicial attitudes were to influence later English explorers and colonists. He wrote: *„Whereby it may be hoped, if means of good government be used, that they may in short time be brought to civility and the embracing of true religion."* At the same time, his relatively sympathetic views of Native Americans' industry and capacity to learn were also later largely ignored in favor of the parts of the *„Report"* about extractable minerals and resources. As scientific adviser during the voyage, Harriot was asked by Raleigh to find the most efficient way to stack cannon balls on the deck of the ship. His ensuing theory about the close-packing of spheres seems to be an early predecessor of later atomic theory. At times he was accused of believing in atomism; some people see a link. His correspondence about optics with Johannes Kepler, in which he described some of his ideas, later influenced Kepler's conjecture. He also studied optics and refraction and apparently discovered Snell's law 20 years before Snell did, although, like so much of his work, this remained unpublished. Raleigh later fell from favour, and Harriot's other patron Henry Percy, the Ninth Earl of Northumberland, was imprisoned in 1605 in connection with the Gunpowder Plot as he was the grandfather of one of the conspirators, Thomas Percy. Harriot himself was interrogated and briefly imprisoned but soon released. The 1607 apparition of what later came to be known as Comet Halley caused him to turn his attention to astronomy. He was an early user of telescopes and was one of the first to observe sunspots. Harriot's accomplishments remain relatively obscure because he did not publish any of his results and because many of his manuscripts have been lost; those that remain are in the British Museum and in the Percy family archives at Petworth House (Sussex) and Alnwick Castle (Northumberland). After his death in 1621, his executors published his *Artes Analytcae Praxis* on algebra in 1631.

Amerigo Vespucci (1454–1512) was an Italian merchant and cartographer who voyaged to and wrote about the Americas. His exploratory journeys along the eastern coastline of South America convinced him that a new continent had been discovered, a bold contention in his day when everyone, including Christopher Columbus, thought the seafaring trailblazers setting out from European docks were travelling to East Asia. The role of Vespucci has been much debated, particularly due to two of his letters whose authenticity has been brought into doubt: the *Mundus Novus* (New World) and the *Lettera* (or The Four Voyages). It may have been the publication and widespread circulation of his letters that led Martin Waldseemüller to name the new continent America on his world map of 1507. Vespucci styled himself Americus Vespucius in his Latin writings, so Waldseemüller based the new name on the Latin form of Vespucci's first name, taking the feminine form America. It is now generally accepted by historians that no voyage was made in 1497 (which allegedly began from Cádiz on May 10th of that year). Little is known about the final voyage. In 1499–1500, Vespucci joined an expedition led by Alonso de Ojeda. After hitting land at the coast of what is now Guyana, the two seem to have separated. Vespucci sailed southward, discovering the mouth of the Amazon River and reaching 6°S, before turning around and seeing Trinidad and the Orinoco River and returning to Spain by way of Hispaniola. Vespucci claimed, in a letter to Lorenzo di Medici, that he determined his longitude celestially on August 23, 1499, while on this voyage. But his claim is clearly fraudulent, which casts more doubt on Vespucci's credibility. His next voyage in 1501–1502 was in service of Portugal, when he reached the bay of what is now Rio de Janeiro. The leader of this expedition was Gonsalvo Coelho. On this voyage he sailed southward along the coast of South America.

This extremely curious and interesting plaquette purports to be a translation into German of a letter describing the arrival of a vessel from **Brazil** (Ant. 0024) to a port not mentioned ... The letter describes an exploration coastwise of nearly two thousand miles undertaken with two vessels belonging to one 'NoNo' (?) and to the well-known Christopher de Haro, with the authorization of the King of Portugal. There seems to be no uniformity of opinion amoung scholars regarding the date of this letter and the exploration it describes. Mentions a.o. the natural resources of Brazil and the manners and customs of its population.

Benzoni, Girolamo (c.1519–c.1572), traveller, born in Italy about 1520. He spent many years in America, and in 1565 published an account of his travels and adventures, from 1541 until 1556, entitled *History of the New World*. He was to spend fifteen years in the territories conquered and being exploited by the Spaniards, travelling widely through the South American continent, the Caribbean, Venezuela, Guatemala, Mexico, Peru, Panama and Nicaragua. He had a good ear for gossip and a good eye for local colour. Exactly what he was doing in the New World is not clear: he attached himself to various military expeditions though he was not by nature a fighting man; he reveals a good knowledge of political intrigue but does not apparently become involved in politics; he is informed about economics but does not discuss the commodities he traded in. The tale of his experiences was not to be made public for ten years. By this time the nations of Europe, jealous of Spam's material advantages in the New World, were leaguing against tier influence. Benzoni had strong views about Spanish imperialism, and in 1565 *La Historia del Mondo Nuovo* came out at an appropriate moment. Published in Venice and dedicated to Pop Pius IV, it was translated into Latin, German and Flemish and m abbreviated form by Purchas into English. The de Bry version, which was spread over three volumes of America, was issued between 1594 and 1596. It cannot be claimed that the work is more than a hearsay source for the stories of Columbus and of the Conquistadors which are tangled up with his text. But the descriptions of the cruelties of the Spaniards towards the Indians, though often echoing stories from Las Casas, cannot be dismissed as mere anti-Spanish propaganda.

These letters of missionaries **János Zakarjás** and Dávid Fáy were dated between the years of 1749–1756 and their copies were previously preserved in the University Library as part of the Kaprinai collection. The Jesuit missionary János Zakariás wrote a letter from his mission in Peru on April 16, 1756 to the rev. József Bartakovics. His letter was written in the Hungarian and Latin languages, where he used rovás characters in the Latin text only. Apparently he wanted to use the Hungarian rovás texts as a secret message. He also made a remark*: „If you don't know the Siculo-Hunnic characters, go for advise to Vargyasi, Bél, and Otrokócsi."* He had ample reason for secrecy based upon the translation of the text, which was completed by prof. Csallány: „*These (persons) usually place everyone whom they meet in workplaces like the mines or even seize them to do some other lowly work, and the old people are killed in order not to spread the news of these actions, and they cut off the four fingers of some others, the fingers which are necessary to span the bow; to make the mothers more suitable for travel they tear their babies from their bosoms and smash the babies to the first stake they can find. And in order to cast an even stronger snare for gullible people they send ahead a person from among themselves who according to his clothes and appearance can be mistaken as a missionary."* From the 1730s, Ferenc B. Kéry built reflectors (telescopes made of concave metal mirrors) at the University of Nagyszombat. Some of them were unusually large for that time. Several of his astronomic instruments were in use far from Hungary: the Jesuit János Zakariás wrote in 1749 that Kéry telescopes were used at the University of Peru.

The **Black Legend** (in Spanish, leyenda negra) is the depiction of Spain and the Spaniards as bloodthirsty and cruel, greedy and fanatical, in excess of reality. This term was coined by Julián Juderías in his 1914 book *La leyenda negra y la verdad histórica* (The black legend and the historical truth). This is contrasted with the White Legend (in Spanish, leyenda rosa, which means rosy legend) which promoted an idealized view of Spaniards. Needless to say, both expressions are themselves highly colored and not propitious for a neutral historical analysis except of folkloric perceptions. From the 13th century, the Crown of Aragon (then a kingdom including Catalonia, with Barcelona as the kingdom's leading city) dominated Naples and Sicily, creating a great hate towards Catalans. The Valencian pope Alexander VI became almost a mythical villain, and countless legends and traditions attached to his name. Cardinal Giuliano della Rovere called Pope Alexander VI „Catalan, marrano and circumcised." According to Sverker Arnoldsson, the Italians' criticisms of the Spaniards were cultural and racial, not only economical and political: „age-long mixture of Spanish with Oriental and African elements, plus the Jewish and Islamic influence upon Spanish culture; this motivated the view of the Spaniards as a people of inferior race and doubtful orthodoxy." The Spanish Inquisition was the most important topic of the Black Legend in the 16th century. Although the Inquisition had existed in many European countries before it existed in Spain, Ferdinand II of Aragon instituted the inquisition in Spain primarily to investigate and punish conversos, former Jews and Muslims who had converted to Roman Catholicism, but whose conversions were not entirely trusted. Some of the most famous support for the legend comes from two Protestants: the Englishman John Foxe, author of *the Book of Martyrs* (1554) and the Spaniard Reginaldo González de Montes, author of *the Exposición de algunas mañas de la Santa Inquisición Española* (Exposition of some vices of the Spanish Inquisition, 1567). No small part of the Black Legend comes from self-criticism in Spain itself. As early as 1511, some Spaniards criticized the legitimacy of the Spanish colonization of the Americas. In 1552, the Dominican friar Bartolomé de las Casas published his *Brevísima relación de la destrucción de las Indias* (Short Account of the Destruction of the Indies), a polemical and arguably exaggerated account of the excesses which accompanied colonization, in which he compares the natives with tame ewes and blames Spaniards for the murder of 30,000,000 to 50,000,000 Arawaks on the island of Hispaniola (now home to the Dominican Republic and Haiti). Recent genetic research contradicts the theory of the total Spanish genocide in the Caribbean. Mitocondrial and Y-chromosome analysis have shown that 62% of Puerto Ricans come from an Amerindian ancestry and well over 70% have a white ancestry; see Demographics of Puerto Rico for further information. Another early source is Girolamo Benzoni's *Historia nuovo* (New History), first published in Venice in 1565. The Duke of Alva's actions in the Netherlands, sent to stamp out heresy and political unrest in August 1567 contributed to the Black Legend, in a part of Europe where printing presses were a constant source of heterodox opinion. One of Alva's first acts was to gain control of the book industry; in one year several printers were banished and at least one was executed. Book sellers and printers were raided in the search for banned books, many more of which were added to the *Index librorum prohibitorum*. In 1576 Spanish troops attacked and pillaged Antwerp, over three terrible days that came to be known as „The Spanish Fury." The soldiers rampaged through the city, killing and looting; they demanded money from citizens and burned the homes of those who refused to (or could not) pay. Plantin's printing establishment was threatented with destruction three times but was saved each time when a ransom was paid. Antwerp was economically devastated by the attack, and Plantin's business suffered. Such facts similar to German rampages Sacco di Roma (in the sack of Rome 1527) were enlarged upon to enhance the Black Legend. Other critics of Spain included Antonio Pérez, the fallen secretary of king Philip II of Spain. Pérez fled to England, where he published libels against the Spanish monarchy under the title Relaciones (1594). These books were extensively used by the Dutch during their fight for independence from Spain, and taken up by the English to justify their piracy and wars against the Spanish. Foxe's book was among Sir Francis Drake's favourites; Drake himself was and is regarded by the Spaniards as a cruel and bloodthirsty pirate. The two northern nations were not only emerging as Spain's rivals for worldwide colonialism, but were also strongholds of Protestantism while Spain was the most powerful Roman Catholic country of the period. The imprisonment of Don Carlos by his father, King Philip II of Spain, which was followed by the Prince's mysterious death, added to the legend, according to which the young heir had been murdered. In the 17th century, Barcelona, the capital of Catalonia that had by then been unwillingly absorbed into the Spanish monarchy dominated by Castille, was the great producer of these libels.

11. SHOWCASE

Peter Apian (1495–1552) was a German mathematician and astronomer. After his studies at Leipzig he moved to Vienna where he continued to study the same broad collection of applied mathematical topics. His first work was a world map *Typus orbis universalis* which he based on earlier 1520 work by Martin Waldsemüller. Apian's second work followed the year after and this was the *Isagoge*, a geographical commentary on the Typus orbis universalis. In 1524 Apain published his first work of major importance. This was *Cosmographia seu descriptio totius orbis* and was a work based largely on Ptolemy. Cosmographia provided an introduction to astronomy, geography, cartography, surveying, navigation, weather and climate, the shape of the earth, map projections, and mathematical instruments. The lavishly illustrated book was far more than an atlas but it did provide sketches of the continents and some of the earliest maps of America. From this point his career really took off although the arithmetic book which he published in that year was not a major factor. One aspect of this little work on arithmetic which, like all of Apian's contributions, is highly practical in its aims, was that the title page contained Pascal's triangle. This was the first time that this famous piece of mathematics appeared in print in Europe. At this time Charles V, the Holy Roman emperor, ruled over large parts of Europe as King of Spain and Archduke of Austria with a Spanish and Habsburg empire covering Europe from Spain and the Netherlands to Austria and Italy. It seems likely that Charles himself had studied cosmography, a useful subject for a ruler of so large an empire, under Apian around 1530. The evidence for this, however, is not conclusive. We know for certain that by the early 1530s Apian had special privileges granted by Charles and in 1540 Apian dedicated his next major work *Astronomicon Caesareum* to Charles. *Astronomicon Caesareum* was an even more lavish work than *Cosmographia*. It presented much of the same material but in a considerably more elegant and polished way. It contains some important new scientific ideas; for example Apian advocates the use of solar eclipses to determine longitude. The book also contains descriptions of five comets, in particular Halley's comet, and in *Astronomicon Caesareum* Apian is the first to make the important observation that a comet's tail always points away from the Sun. *Astronomicon Caesareum* delighted Charles V who on the strength of the work appointed Apian court mathematician and he knighted Apian and his three brothers. Between the publication of *Cosmographia* in 1524 and *Astronomicon Caesareum* in 1540, there had been further important publishing events. One was in 1533 when Gemma Frisius published a new edition of *Cosmographia*. Frisius had spent considerable effort on editing and enlarging Apian's book and it really paid off since this second edition became very much more popular than the first and was a best seller throughout Europe, being translated into all major European languages. Of course Frisius had ample reason to promote and improve the potential of the *Cosmographia* for he was a maker of instruments and *Cosmographia* was a work in which Apian had described and illustrated a wide range of mathematical instruments which were available from Frisius' workshop. The book illustrated and described wooden, brass and ivory instruments but there were even working paper instruments included in the text, called volvelles, which let readers experiment with the ideas described. With the volvelles that were supplied readers could solve calendar problems and find the positions of the sun, moon and the planets. Another publication between 1524 and 1540 was Apian's most important contribution to mathematics itself, rather than its applications. This was his book *Instrumentum sinuum sive primi* published in 1534 which contained the first sine tables calculated for every minute of arc. Like all other works by Apian this book contained a host of applications of mathematics, and the sine tables are applied to problems of astronomy, navigation and architecture. In 1534 Apian published the first large scale map of Europe but sadly this work is no longer extant. Following 1540 Apian became famous and wealthy.

Brahe and Uraniborg – Observatory, Laboratory and Castle. The island of Hven measures about 4.5 by 2.4 kilometres. It is a plateau with steeply rising shores, 20–40 meters high. On the highest point, in the middle of the island, 45 meters above the sea, Tycho in 1576 chose to construct his observatory Uraniborg. Uraniborg was surrounded by 5.5-meter high walls, 75 meters in square. The corners were very accurately orientated in the north-south and east-west directions. The building was in the centre of a circular place, and the space between this and the outer walls was occupied by a garden of Tycho's own design. The inner garden had a strict geometric layout, and there were cultivated flowers and in particular herbs for medical and household purposes. The outer garden consisted of fruit trees. One quarter of the garden has now been reconstructed with a good approximation of the original vegetation. Seeds have been found during excavations, and some clues have come from Tycho's own records. Improvement of the vegetation is carried on continuously in co-operation with the Swedish University of Agricultural Sciences. The material in the main building was red brick, with rich decorations of sandstone and limestone. The design was inspired by Dutch architecture. The building had two main floors, one basement floor and a loft floor. On the ground floor, there was a library in southern tower, a kitchen in the northern tower, and in the square centre there were four rooms of equal size. Three of these were intended for guest researchers, the fourth was for Tycho and his family. The second floor had two smaller rooms and one large room. The large room was exclusively intended for royal guests. The basement floor had a storage room for food, salt and fuel. The rest of it was occupied by Tycho's laboratory rooms. The loft floor had 8 small rooms for students. The size of Uraniborg was rather modest: the square central body of the building was 15 by 15 meters. However, Uraniborg was the first building ever designed with astronomical observations as its primary design criteria. The purpose of all the towers and balconies was that they should serve as instrument platforms. The orientation of the building was chosen for maximum coverage of the sky with the instruments, and to simplify the precise alignment of the great mural quadrant. The great mural quadrant was a masterpiece of simplicity and precision. It served to measure the arc height above the horizon (altitude) when the celestial objects passed the meridian plane, i.e. culminated due south. Since Uraniborg itself was aligned exactly north-south, the fine alignment of the quadrant and the stability of the alignment were greatly simplified. With an almost 2 meter radius of the brass arc, combined with Tycho's innovative aiming device and the transversally graded scales, the instrument had a resolution of a sixth of an arc minute, i.e. 10 arc seconds. This is the absolute limit for visual readings, and only using optics is it possible to surpass this. The laboratory in the basement was very well equipped. There were 16 furnaces for chemical, medical and alchemical experiments. Some of the furnaces were connected to distillers whose cooling pipes went out of the windows and back into the laboratory. Tycho largely held the results secret, but we know that he spent most of the time developing medicines.

12. SHOWCASE

Eugene Savoy (1663–1736) born in Paris, and a prince of the House of Savoy, Eugene was the son of the Comte de Soissons, a French nobleman. It was rumoured that he was the illegitimate son of Louis XIV, however, and Louis strove mightily to keep down his supposed by-blow. Eugene was rebuffed from a commission in the French army and, frustrated, joined the Austrian army as an officer in 1683. He would spend the rest of his life opposing Louis XIV and French ambition in Europe. For the first part of his career he faced the Ottoman Turks on the battlefield, first coming to prominence during the last major Turkish offensive against the Austrian capital of Vienna in 1688. By the closing years of the 17^{th} century, he was already famous for securing Hungary from the Turks, and soon rose to the role of principal Austrian commander during the War of the Spanish Succession. In the opening shots of that war, he defeated French armies in northern Italy. As the area of French offensive action moved north (and as the war spread to include other nations such as England), he joined forces for the first time with his English counterpart, the Duke of Marlborough. Together they defeated the French in Bavaria at the Battle of Blenheim. For the next three years he was engaged in inconclusive fighting in northern Italy and Provence. He then moved north to Flanders, where he joined up with Marlborough again to win the battles of Oudenarde and Malplaquet. Unfortunately, the follow-up invasion of France that would have ended the war was blunted by the marginal victory of Malplaquet, and the retirement of Britain from the war. After one more year of fighting, Austria signed a favourable peace with France in 1714. In the same year he began construction of the Belvedere, a baroque palace in the 3^{rd} district of Vienna. Construction of various parts of the palace complex continued until 1723. One of the new Austrian possessions after this war were the former Spanish, now Austrian Netherlands. Eugene was made governor of this area, then later became vicar of the Austrian lands in Italy. Just two years after the end of the war against France, he led the Austrian armies during the Austro-Turkish War of 1716–1718. He achieved a series of decisive victories, including the Battle of Belgrade that led to the Treaty of Passarowitz. This temporarily added northern Serbia and Bosnia to the Austrian crown, and ended the Turkish threats to Vienna once and for all. Late in his life he engaged in one last war, the War of the Polish Succession. He died in Vienna in 1736, and is buried in a chapel of honor in the Cathedral of Saint Stephan there.

Luigi Ferdinando Marsigli, Count (1658–1730 Italian geographer and naturalist. He was a member of an old patrician family and was educated in accordance with his rank. He supplemented his training by studying mathematics, anatomy, and natural history with the best teachers, and by personal observations. As a soldier he was sent by the Republic of Venice to Constantinople in 1679. There he investigated the condition of the Turkish forces, while at the same time he observed the surroundings of the Thracian Bosporus. Both of these matters were fully reported by him. In 1680, when the Turks threatened to invade Hungary, he offered his services to the Emperor Leopold. On 2 July, 1683 (the feast of the Visitation), he fell wounded and was taken prisoner. He suffered as a slave until he was ransomed on 25 March, 1684 (the feast of the Annunciation). His reflections on these two feast days show his great piety: on these days, he says, on which the august protectress of the faithful is particularly honoured, she obtained for him two graces: salutary punishment for his past faults and an end to his punishment. After the long war he was employed to arrange the boundaries between the Venetian Republic, Turkey, and the Empire. During the war of the Spanish Succession he was second in command under Count d'Arco at the fortress of Breisach, which surrendered in 1703. Count d'Arco was beheaded because he was found guilty of capitulating before it was necessary, while Marsigli was stripped of all honours and commissions, and his sword was broken over him. His appeals to the emperor were in vain. Public opinion, however, acquitted him later of the charge of neglect or ignorance. In the midst of his work as a soldier he had always found enough leisure to devote to his favourite scientific pursuits. He drew plans, made astronomical observations, measured the speed and size of rivers, studied the products, the mines, the birds, fishes, and fossils of every land he visited, and also collected specimens of every kind, instruments, models, antiquities, etc. Finally he returned to Bologna and presented his entire collection to the Senate of Bologna in 1712. There he founded his „Institute of Sciences and Arts", which was formally opened in 1715. Six professors were put in charge of the different divisions of the institute. Later he established a printing-house furnished with the best types for Latin, Greek, Hebrew, and Arabic. This was put in charge of the Dominicans, and placed under the patronage of St. Thomas Aquinas. In 1727 he added to his other collections East India material which he collected in England and Holland. A solemn procession of the institute he founded was ordered for every twenty-five years on the feast of the Annunciation. In 1715 he was named foreign associate of the Paris Academy of Sciences; he was also a member of the Royal Society of London, and of Montpellier. His principal works are the following: *Osservazioni interne al Bosforo Tracio* (Rome, 1681); *Histoire physique de la mer, translated by Leclerc* (Amsterdam, 1725); *Danubius Pannonico-mysicus, observationibus* (7 vols., Hague, 1726); *L'Etat militaire de l'empire ottoman* (Amsterdam, 1732).

13. SHOWCASE

Vág Valley is described by map. The map's manufacturer and the date of manufacture is unknown.

The famous jesuit historian, **Hevenesi Gábor** owned this collection of sources, which consists of a map of counties, in addition the chairs of Székelys and Saxons.

The other **small pocket-map,** manufactured by Hevenesi Gábor, consists of 50 counties, episcopates and cities.

Short history of Jesuit Order. On August 15, 1534, Ignatius (born Iñigo López de Loyola) and six other students met in Montmartre outside Paris, probably near the modern Chapel of St Denys, Rue Antoinette, and binding themselves by a vow of poverty and chastity, founded the Society of Jesus – to „enter upon hospital and missionary work in Jerusalem, or to go without questioning wherever the pope might direct." In 1537 they travelled to Italy to seek papal approval for their order. Pope Paul III gave them a commendation, and permitted them to be ordained priests. A congregation of cardinals reported favorably upon the constitution presented, and Paul III confirmed the order through the bull Regimini militantis (September 27, 1540), but limited the number of its members to sixty. He sent his companions as missionaries around Europe to create schools, colleges, and seminaries. Ignatius wrote the Jesuit Constitutions, adopted in 1554, which created a monarchical organization and stressed absolute self-abnegation and obedience to Pope and superiors (perinde ac cadaver, „[well-disciplined] like a corpse" as Ignatius put it). His main principle became the unofficial Jesuit motto: Ad Majorem Dei Gloriam (for the greater glory of God). This phrase is designed to reflect the idea that any work that is not evil can be meritorious for heaven if it is performed with this intention, even things considered normally indifferent. The Society ranks among religious institutes as a mendicant order of clerks regular, that is, a body of priests organized for apostolic work, following a religious rule, and relying on alms for their support. The Jesuits were founded just before the Counter-Reformation, a movement whose purpose was to reform the Roman Church from within and to counter the Protestant Reformers, whose teachings were spreading throughout Catholic Europe. As part of their service to the Roman Church, the Jesuits encouraged people to continue their obedience both to scripture and also Roman doctrine, Ignatius himself taking an extreme position when he wrote: „I will believe that the white that I see is black if the hierarchical Church so defines it." Ignatius and the early Jesuits did recognize, though, that the hierarchical Church was in dire need of reform, and some of their greatest struggles were against the corruption, venality, and spiritual lassitude within the Roman Church. As a result, though the Jesuits were loyal sons of the pope, Ignatius and his successors often tangled with him and the Roman Curia. Throughout their history, the Jesuits have had the reputation for serving as papal „elite troops". One should regard such statements with caution, however. History demonstrates that the Jesuits have been at loggerheads with the pope as often as they have been in his good graces. Indeed, the pope even once ordered their total suppression, as will be described below. St. Ignatius and the Jesuits who followed him believed that the reform of the Church had to begin with the conversion of an individual's heart. One of the main tools the Jesuits have used to bring about this conversion has been the Ignatian retreat, called the Spiritual Exercises. During a four-week period of silence, individuals undergo a series of directed meditations on the life of Christ. During this period, they meet regularly with a spiritual director, who helps them understand whatever call or message God has offered in their meditations. The retreat follows a Purgative-Illuminative-Unitive pattern in the tradition of the mysticism of John Cassian and the Desert Fathers. Ignatius' innovation was to make this style of contemplative mysticism available to people in active life, and to use it as a means of rebuilding the spiritual life of the Church. The Jesuits also founded many schools, which, because of their advanced teaching methods and high moral tone, attracted the sons of the élite. The Jesuits were among the first to incorporate the Classical teachings of Renaissance humanism into the Scholastic structure of Catholic thought. In addition to teaching the faith, Jesuit schools were distinguished in their teaching of Latin, Greek, Classical Literature, Poetry, and Philosophy. Furthermore, Jesuit schools encouraged the study of vernacular literature and rhetoric, and thereby became important centers for the training of lawyers and other public officials. The Jesuit schools thus played an important part in winning back to Catholicism a number of European countries which had for a time been predominately Protestant, notably Poland. Even today, Jesuit schools in over one hundred nations continue to provide a high-quality education. Following the Roman Catholic tradition that God can be encountered through created things and especially art, they encouraged the use of ceremony and decoration in Catholic ritual and devotion (which the Lutherans so despised). Perhaps as a result of this appreciation for art, coupled with their spiritual practice of „finding God in all things", many early Jesuits distinguished themselves in the visual and performing arts as well as in music. The Jesuits were able to obtain significant influence in the Early Modern Period because Jesuit priests often acted as confessors to the Kings of the time. They were an important force in the Counter-Reformation and in the Catholic missions, in part because their relatively loose structure (without the requirements of living in community, saying the divine office together, etc.) allowed them to be flexible to meet the needs of the people at the time. Early missions in Japan resulted in the government granting the Jesuits the feudal fiefdom of Nagasaki in 1580. This was removed in 1587 however, due to fears over their growing influence. Francis Xavier arrived in Goa, in Western India in 1541 to consider evangelical service in the Indies. He passed away after a decade of evangelism in Southern India. Under Portugese royal patronage, the order thrived in Goa and until 1759 successfully expanded its activities to education and healthcare. On 17 December 1760, Marquis of Pombal, Secretary of State in Portugal expelled the Jesuits from India. Two Jesuit missionaries, Gruber and D'Orville, reached Lhasa in Tibet in 1661. Jesuit missions in Latin America were very controversial in Europe, especially in Spain and Portugal, where they were seen as interfering with the proper colonial enterprises of the royal governments. The Jesuits were often the only force standing between the Indians and slavery. Together throughout South America but especially in present-day Brazil and Paraguay they formed Christian-Indian city-states, called reductions (Spanish Reducciones). These were societies set up according to an idealized theocratic model.