

## 8.6 Shen Gua - China's Renaissance Man

**Source:** Needham, J. *Science and Civilisation in China* (Cambridge, UK: Cambridge University Press).

**Background:** As government official during the Song dynasty (960 – 1279 AD), Shen Gua was a Chinese “Renaissance Man.” He conducted studies and made observations in a number of different fields. Shen developed three-dimensional relief maps, oversaw the construction of waterworks and fortifications, lobbied for the adoption of a solar calendar, argued that medical practice should be based on clinical observation, and wrote about the use of petroleum. In a study of petrified bamboo he hypothesized climate change over long periods of time and he demonstrated that changes in ocean tides correlated with lunar cycles rather than the rising and setting of the sun.

**Instructions:** Examine the edited excerpts A – D from his book *Dream Pool Essays* (c. 1088) and answer questions 1 – 6. **Extra-credit:** Illustrate each of the excerpts.

### Questions

1. Why has Shen Gua been compared to European Enlightenment figures?
2. How did Shen Gua explain finding “stone” bamboo in an area where bamboo did not grow?
3. What scientific technique does Shen Gua use to explain the shape of the sun and moon?
4. Why was the use of movable type for printing an important discovery?
5. Why is Shen Gua puzzled by the impact of the lodestone on the needle?
6. Which of the observations described in the background section or the excerpts from *Dream Pool Essays* do you consider the most scientifically significant? Explain.

**A. Petrified Bamboo:** There was a landslide on the bank of a large river. The bank collapsed, opening a space of several dozens of feet, and under the ground a forest of bamboo shoots was thus revealed. It contained several hundred bamboo with their roots and trunks all complete, and all turned to stone . . . Now bamboos do not grow in Yanzhou. These were several dozens of feet below the present surface of the ground, and we do not know in what dynasty they could possibly have grown. Perhaps in very ancient times the climate was different so that the place was low, damp, gloomy, and suitable for bamboos (Vol. 3, 1959, 614).

**B. Sun and Moon:** These celestial bodies were certainly like balls. How do we know this? By the waxing and waning of the moon. The moon itself gives forth no light, but is like a ball of silver; the light is the light of the sun. When the brightness is first seen, the sun alongside, so the side only is illuminated and looks like a crescent. When the sun gradually gets further away, the light shines slanting, and the moon is full, round like a bullet (Vol. 3, 1959, 415-416).

**C. Movable Type Printing:** The printer took sticky clay and cut in it characters as thin as the edge of a coin. He baked them in the fire to make them hard. He had previously prepared an iron plate and he had covered his plate with a mixture of pine resin, wax, and paper ashes. When he wished to print, he took an iron frame and set it on the iron plate. In this he placed the types, set close together. When the frame was full, the whole made one solid block of type. He then placed it near the fire to warm it. When the paste [at the back] was slightly melted, he took a smooth board and pressed it over the surface, so that the block of type became as even as a whetstone. If one were to print only two or three copies, this method would be neither simple nor easy. But for printing hundreds or thousands of copies, it was marvelously quick (Vol. 5, Part 1, 1985, 201).

**D. Compass:** When the point of a needle is rubbed with the lodestone, then the sharp end always points south, but some needles point to the north. I supposed that the natures of the stones are not all alike. Just so, at the summer solstice the deer shed their horns, and at the winter solstice the elks do so. Since the south and the north are two opposites, there must be a fundamental difference between them. This has not yet been investigated deeply enough (Volume 4, Part 1, 1962, 250).