The golden ratio or the divine proportion

Phi, also known as the golden ratio, or the divine proportion, and by many other names, is approximately the number 1.618, which refers to a geometrical proportion. Some of the early mentions about Phi were made in 300 B.C by Euclid in "Elements", by Luca Pacioli (1509) in "De Divina Proportione" and by Johannes Kepler (1600). Like Pi(π), a ratio defined by the circumference of a circle to its diameter, Phi (φ) is the ratio of the line segments that results when a line is divided in to two parts in such a unique way, such that the ratio of the length of the full line segment (AC) to the larger segment (AB) equals the ratio of larger segment (AB)to the shorter segment (BC), and equals the constant 1.618 that denotes Phi(φ). Defined mathematically, two quantities are said to be in the golden ratio (Phi) if their ratio is the same as the ratio of their sum to the larger of the two quantities. By logical extension it is honoured by the Fibonacci series which was introduced by Fibonacci in the early 13thcentury. Fibonacci series happens to be an infinite sequence of integers, (0, 1, 1, 2, 3, 5, 8, 13,21,34….), wherein, each term is formed by the sum of the two terms preceding it and when divided (number starting with 3) by the immediate predecessor (5/3,..34/21 and so on…) leaves the quotient approximately a value of 1.6 (φ).

However, the mystery of divine proportion (φ) was popularized by revealing it to the genre of lesser mortals like me in 2003 by the novelist Dan Brown in his best selling sensational novel "*The Davinci code*". The literature on divine proportion is well researched with numerous and varied examples where nature in its entirety has evolved in all spheres with this celestial proportion that gets the eponymous name, *the divine proportion*. We sample here a few simple examples.

1. The number of *petals in a flower* follows the Fibonacci sequence such as in a lily,- it has three petals, in buttercups- five, the chicory's 21 and the daisy's 34. Each petal is placed at 0.618034 per turn (out of a 360° circle), the inverse of Phi, allowing for the best possible exposure to sunlight and other factors.

2. *Sea shells* progressively exhibit the width of the outer shell as 1.6 times the inner one.

3. In *human bodies,* the navel to the floor measures about 1.6 times that of the top of the head to the navel.

4. For *honeybees*, the number of females in a colony is 1.6 times the number of males.

Ancient Greek and Egyptian architectures, paintings of Leonardo da Vinci and Kepler's hypothesis all are proof of profound exploitation of the divine proportion for enhancing beauty of arts and science.

In this context, what strikes me as interesting is the chance relevance of, Phi, in geophysical applications for oil exploration. If one remembers the Peter's slope empirical method (1949) used widely to estimate depth from magnetic profiles, it states the slope to depth ratio as 1.6. Much later, for seismic multifold surveys, the granny's recipe for deciding the length of spread with respect to target depth used to be around 1.6 times, pleading a good tradeoff between cancelling multiples and facilitating NMO velocity analysis. And the last and latest

example that comes to my mind is the ratio V_P/V_S as 1.6, used globally as an indicator of hydrocarbon-saturated clean sands.

I am sure there would be many more examples which have missed our observation and investigation that could unravel further the mystery of the Phi, the divine proportion. Adding more examples to the list of Phi, would be a challenge and fun something likened to the Pokémon-Go game.