



# A legacy of ancient times: So near, and yet so far...

In the 4th and 5th centuries BC the Greek philosophers are known for their efforts to understand the world and matter. Could the ancient geometers have been inspired by the geometric shapes of the stone around them?

## The world by numbers

For Pythagoras the world could be explained in numbers. Numbers were associated with geometric forms. Squares or cubes could be formed by arrangements of small pebbles or « calculi ».

## The world as geometry

Plato went a step further. The world was all geometry to him, a world of shapes and ideas. Legend has it that it was the minerals in the Laurion mines that inspired Plato's theory of the five « Platonic solids ».

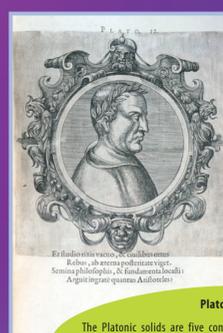
## Atoms come onto the stage...

Democritus suggested that all natural forms are the result of the agglomeration of small particles or « atoms ». The idea didn't take on and disappeared until the Renaissance.

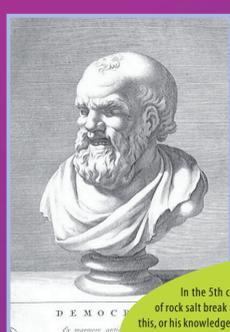
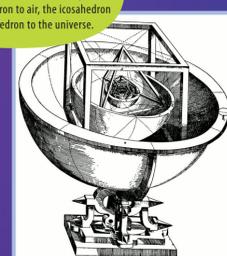
## The four elements

Aristotle took a different view - he preferred to think in terms of the « four elements » (earth, water, air and fire). Inert matter cannot create form; it has to be shaped from the outside.

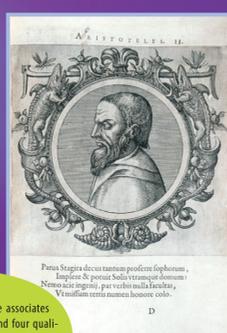
Aristotle's view prevailed for almost 20 centuries, slowing down research into the nature of crystals.



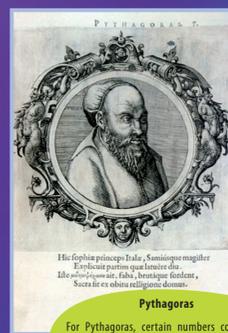
**Plato's solids**  
The Platonic solids are five convex volumes enclosed by identical faces with equal edges. The tetrahedron corresponds to fire, the cube to earth, the octahedron to air, the icosahedron to water, and the dodecahedron to the universe.



**Democritus**  
In the 5th century BC Democritus noticed that crystals of rock salt break up into smaller but identical crystals. Can it be this, or his knowledge of Pythagoras' piles of pebbles, which led him to suggest that all of nature's forms are the result of the agglomeration of tiny particles? The particles are more or less rough, smooth or prickly; they vary in form, are tiny in size, and are indestructible. They cannot be broken down further - which this explains the Greek word « atoms »: indivisible.



**Aristotle**  
In Aristotle's view - in his physics therefore - he associates four causes (material, formal, efficient and final) and four qualities (heat, cold, moistness, dryness) with the four basic elements (fire, water, air and earth). He considered that inert matter - the mineral world - could not possess inherent form; only outside causes could give it form.



**Pythagoras**  
For Pythagoras, certain numbers correspond to geometric forms. The piles of pebbles in a square or cube have given us our modern-day terminology for the for the root or power of a number.

