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## A WATERY EARTH

Ken Tapping, 22<sup>nd</sup> April, 2014

Because we look down at the Earth and up at all the usual astronomical objects, it is easy to forget that the Earth is an astronomical object too. It is the third planet out from a fairly ordinary yellow dwarf star about two thirds of the way out from the centre in a spiral galaxy much like millions or billions of others.

An alien spacecraft would probably pass right by the Solar System except for one thing, the cacophony of strange radio emissions coming from it. Some careful measurements would show these emissions do not come from the central star in the Solar System, or the gas giant planets, which are the places we would expect them to come from; they are coming from the third planet. Humans have been squirting radio signals in all directions for more than 100 years, which means now there is a sphere of space currently having a radius of around 100 light years within which their signals can be detected. So we go to investigate.

As we approach the Earth, we will see the second planet, Venus, and the third, Earth, are very similar in size. Venus has a diameter of 12,104 km and the Earth 12,756 km. However, Venus is hot and covered with clouds; the Earth has cloud cover, but the surface of the planet is blue, and it's much cooler. About two thirds of the surface is covered with water. Unlike Venus, Earth has a large satellite – The Moon, which is an airless rock ball, like many other bodies in the Solar System.

Then there is another surprise; about 20% of the atmosphere consists of oxygen. This is odd because oxygen is a very reactive gas, and would have disappeared from the atmosphere long ago. The only way for it to be present is if there is something continuously topping up the supply. We know that we have plants to thank for this. Most oxygen is produced by plants in the sea and forests on land. If there is a significant amount of oxygen, or any other highly-reactive gas for that matter in a planet's atmosphere it is likely that some form of life is responsible for it

Mars is red because there is a lot of iron oxide in its soils and rocks. This suggests that long ago there was oxygen in the atmosphere or at least iron rusting in a lot of water. There are ancient rocks on Earth that are very red. These are a record of a time, about 360 million years ago, when the Earth had more than one and a half times the oxygen in its atmosphere than it does now. This allowed the development of dragonflies with a wingspan of more than 60 cm. Then gradually iron in the rocks absorbed some of that oxygen, forming iron oxide, which turned them red.

The Apollo astronauts brought back enough material from the Moon to show that the surface of that world has not undergone major change for billions of years. This is consistent with current knowledge that the Earth and Moon are about 4.5 billion years old. There are some rocks on Earth, mainly in Australia and Northern Canada that are of similar ages to those on the Moon, but most of the rocks on Earth are younger. That is because something is going on here that is unique in the Solar System, plate tectonics. The surface of the Earth is constantly being recycled. The oceans are probably one of the causes of this. This recycling has helped make our world a good place for life.

The Apollo astronauts all came back talking about seeing the Earth as a blue marble with snow-white clouds, an inhabitable oasis in the hostile blackness of space. At the moment there are no accessible places in the universe where we can live without a very high level of technological support. Our world is unique to us and we need to look after it.

At nightfall, Mars lies in the southeast and Jupiter high in the west. Saturn rises around 10pm and Venus about 5 am, in the predawn twilight. The Moon will reach Last Quarter on the 28<sup>th</sup>.

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