Ground Truth

Most of the asteroid detection systems can spot asteroids when they are within a certain distance from Earth. It is difficult to detect smaller asteroids that are approaching from the direction of the sun. Apart from this, illumination issues and poor weather conditions at times make the detection of an asteroid difficult for earth based telescopes. In the past, there have been instances where asteroids big enough in size were only detected after passing close to Earth. For example, an asteroid comparable to the size of Leaning Tower of Pisa, NT-1, was detected 2 days after it made its closest approach in July 2023 [1]. In the story, NASA had detected only one asteroid (MeSh-1.0) which was approximately 300m in diameter. The twist was, there was another asteroid (~50m in diameter) coming from the direction of the sun, which collided with MeSh-1.0 just before MeSh-1.0 reached the point of closest approach. This collision, instead of fragmentation, resulted in a direction change of MeSh-1.0 such that it started moving towards the earth. Although the dynamics is complex, this is possible. Double Asteroid Redirection Test (DART) conducted by NASA indicated that collision may lead to direction change rather than fragmentation.

Collision takes place just before the closest approach of MeSh-1.0 i.e. around 1 lakh kilometers away from the Earth. However, the speed of the asteroid played a critical role. After the collision, MeSh-1.0 traveling at the speed of ~55,000 km/ hr, gave only 2 hours for scientists to prepare, and definitely this time was not enough. By the time the news was confirmed with other space agencies, the impacting location was found and alerts were issued, the asteroid had entered the Earth's atmosphere. Hence, everyone was wondering how this could happen.

The asteroid enters the South Atlantic ocean. Asteroids around 500m in size can have a significant impact and pose tsunami threats [2]. In the story, because of the huge asteroid impact, a Tsunami hits Argentina. Here, a tsunami is one of the immediate consequences of the asteroid crashing into Earth along with generation of huge shock waves on landmass, and release of numerous particles or reactive chemicals in very large amounts which can seriously affect the environment on a global scale [3]. Large scales of ice melt in moments due to the high temperature of the burning asteroid and its speed with which it hits the surface. Humidity and Organic matter deposition due to tsunami creates a perfect environment for bacterial and fungal growth. Now, this is not an immediate consequence but can be possibly observed in a few months after the asteroid impact. This gives a chance to the newly evolved bacteria that can survive using a mix of energy sources, but can thrive in sulphur rich areas. The highly localized and unknown strain of bacteria named Acidithiobacillus spp. gets the chance to prosper. The bacteria starts growing at a significantly high rate. Groundwater is a highly suitable place for these bacterial growth . Thus, it reaches to the other countries in Argentina and thrives in areas with suitable conditions. The organisms on the earth are evolving constantly. So there are possibilities that such a strain might evolve into species that can adapt themselves well in

environmental variations. Also, organisms that survive using a mix of energies do exist and they are called mixotrophs [4].

The bacterial strain mentioned in the story can survive by oxidation of sulphur and specific carbon compounds. The known species of Acidithiobacillus spp. can survive by oxidizing sulphur. In the story, we have considered them to grow significantly in a few months because of the resultant acidic medium. Research indicates that the evolved strain can adapt and grow even in a neutral medium and whenever sulphur is available, they utilize it and thrive. This is the reason the new strain can grow at great speed. It is the one responsible for concrete deterioration because sulphuric acid is produced during sulphur oxidation, which reacts with the calcium hydroxide in concrete, leading to the corrosion of the concrete [5]. It has shown that exposure to biogenic sulphuric acid can lead to significant weight loss in concrete, even up to 31% weight loss in five months [5]. Since concrete is currently a very basic resource that human life mostly depends on for shelter, it can be destroyed before humans even guess the cause of the massive damage.

References:

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