The Moon: A 100% isolation barrier for Earth during exobiological examination of solar system sample return missions. *Barry E. DiGregorio, Buckingham Centre for Astrobiology, University of Buckingham, Buckingham MK18 1EG, United Kingdom*

Introduction: In the coming decades NASA and all other capable space faring nations will want to return samples of Mars, samples of ice from Jupiter's moon Europa and samples of the plumes of water emanating into space from Saturn's Moon Enceladus to look for any evidence of extraterrestrial biology. As exciting as these sample return missions are to astrobiologists, lingering questions on how best to safely examine these samples without accidental contamination of the Earth's biosphere remain problematic. For example, robotic sample return missions that are sent to the surface of the Earth or Earth orbit for laboratory analysis do not offer a 100% guarantee that some technological or other errors would not lead to an eventual exposure of these materials to Earth's biosphere. Even if examined in an Earth orbiting space station, a contamination event might render it uninhabitable, ultimately to reenter the Earth's atmosphere where sections of the spacecraft could survive intact and spread out over vast distances of our planet.

The only 100% guarantee of protecting Earth's biosphere from a hazardous back contamination event is to use the Moon as a sample return examination facility to qualify samples for eventual return to Earth. A well planned lunar quarantine laboratory as part of a larger lunar base would be perceived by the public and scientific community as another legitimate reason to reinvest in a return to the Moon.

Pros: The size of sample return payloads could be much larger because of the Moons 1/3 gravity. Aside from the Moon offering a 100% back contamination barrier to Earth, it also has enough gravity that would make working with extraterrestrial materials less difficult than working in a microgravity environment of an orbital space station or other orbiting module designed for such a purpose. The Moon's lack of an atmosphere with near vacuum conditions greatly reduces the possibility of the spread of a back contamination event to other areas of a lunar scientific outpost.

If putative extraterrestrial microorganisms are found in samples, a lunar planetary quarantine facility could be used to test a wide variety of terrestrial ecosystems in enclosed modules simulating various Earth environments.

Finally, other advantages would be experiments on the mutation rates of terrestrial microorganisms in the lunar radiation environment that might help how humans could best survive radiation exposure on Mars.

Cons: Cost. Obviously the establishment of a lunar quarantine facility as part of large scientific outpost would require the commitment and resources from a number of space faring partners.

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