
The current exploration strategy for Europa, for which the Europa orbiter is the next step, was predicated on a prevailing belief that Europa's ocean, if any, lies isolated from the surface beneath ~10 km or more of ice [1]. First, the orbiter would determine whether there indeed is a liquid water ocean. Then a lander would assess surface conditions, laying the groundwork for a subsequent mission to send a probe down through the ice to the ocean below. The ocean is the ultimate destination because of its appealing possibility as a site of life. In this scenario, the multiple missions and the central technological challenge of devising a way to penetrate the ice imply a timetable stretching over several decades.

During the past few years since that strategy was developed, our knowledge and understanding of Europa has increased dramatically. Evidence has mounted that there is in fact an ocean. Moreover, we have developed several lines of evidence that indicate the ice may be thin enough at various times and places for openings to link the ocean to the surface. That evidence suggests that most of the rapid and recent resurfacing of Europa involves interaction of the ocean with the surface. Understanding of tidally driven tectonics may identify sites of most recent activity. The picture emerging from that work is that the habitable zone of Europa may extend to within centimeters of the surface [2].

If we knew with certainty that conditions on Europa were like that, the strategy for exploration would be quite different from the current plan. A campaign laying the foundation for a deep penetration would be irrelevant. Instead, an orbiter (or several) might do detailed reconnaissance, so that a lander could be placed at a site where fresh oceanic material lies on (or perhaps is delivered in real-time to) the surface, readily accessible for investigations of composition or signs of life.

Because, at this time, we cannot be certain whether there is an ocean, or how thick the ice may be, we need to devise a strategy that is not predicated on one extreme model, but instead we should be designing a strategy that early-on resolves the issue of whether or not the interesting oceanic material is physically isolated from the surface. Then subsequent missions could follow a plan appropriate to that result. The currently conceived Europa Orbiter will partially address this problem by measuring ice thickness (assuming its radar remains adequate, or even better optimized, for this purpose). However, the Europa Orbiter imaging is unlikely to determine conclusively whether the ocean is responsible for resurfacing and where a lander might find oceanic material. High-resolution imaging over a substantial portion of the surface, under consistent conditions that eliminate observational selection biases, might help, but technological constraints are limiting. If oceanic material is naturally delivered to the surface and an early Europa orbiter cannot recognize it, we may waste decades following an exploration strategy optimized to solve an irrelevant problem.

Another related issue is the possibility that Europa's surface may be vulnerable to forward contamination by terrestrial organisms. This problem has not been given the analytical consideration that it deserves [3], especially given the possibility of a near-surface biosphere. Planning and policy for Europa exploration should include such considerations.