



Interpreting the Geology of Europa & Ganymede

Comparing Jupiter's Moons

Answers:

3a	What are the circular features seen in the image?
	Impact craters (1)
3b	Compare circular features B and C. Which one looks more recent?
	C (1)
3c	Explain your choice.
	Any one of: <ul style="list-style-type: none"> • C is fresher/less eroded in appearance than B (1) • B has younger cracks running across it (and these are overlain by region E upon which crater C sits) (1) • C is smaller. There is trend towards smaller craters with time because early small craters tend to be destroyed by further cratering and larger impacts, such as B, become less frequent with time (1)
3d	A series of fine cracks (A) run across circular feature B. Which is older, the cracks (A) or the circular feature (B)?
	B (1) (the cracks are younger)
3e	Explain your choice.
	The cracks cut through the crater so it must have already been in existence when they were created (1)
3f	Examine the circular feature F and the wide linear feature E. What has happened to F?
	Half of crater F has been destroyed by linear feature E (1)
3g	Which is younger, E or F?
	E (1) (has to be younger to destroy part of F)
3h	Compare linear features D and E. Which is the older one?
	D (1)
3i	Explain your choice.
	Any one of: <ul style="list-style-type: none"> • Linear feature E cuts through linear feature D (1) • Linear feature E appears more distinct/fresher than D (1) • Linear feature E is straighter/less distorted than D (1)
3j	Finally, try to arrange features B, C, D and E in the correct time order, oldest first, youngest last.
	B (1), D (1), E (1), C (1)
4a	Compare the whole image of Europa to the whole image of Ganymede. Which surface looks older?
	Ganymede (1)
4b	Give two reasons for your choice.
	Any two of the following:



	<ul style="list-style-type: none"> • Ganymede has more impact craters and these include large ones. (In fact Europa has hardly any and they are tiny.) (1) • Ganymede's surface is darker due to a more lengthy surface contamination (1) • Ganymede's surface is more distorted and has greater relief, suggesting a more lengthy history of geological events. Europa is fairly smooth (1)
4c	Examine the linear features X and Y. Are they different features or parts of a single feature?
	Single feature (1)
4d	Explain your answer.
	The feature, which has the same visible structure at X and Y, has been split in two by feature D (1)
4e	Feature Q is a crater. Locate any other craters you see and draw circles around them. Comment on the number of craters in seen throughout this image (crater density).
	Students will find small craters scattered throughout the image but their density is low, i.e. very few in a given area. Note that some 'holes' may not be craters, such as those on area D, because they are not circular (1)
4f	Comment on their size and appearance.
	The craters are tiny but look quite fresh with sharp relief, revealed by deep shadows within them (2)
4g	What does this tell you about the age of the surface of Europa, compared to Ganymede.
	Fewer craters indicate a younger surface because cratering builds up with time. Europa's almost uncratered surface must be quite young (1)
4h	Linear features A, B, C, D, E, F and G crosscut each other and clearly have different ages. Try to reorder this list correctly with respect to time, oldest first to youngest last.
	G (1), E (1), D (1), F (1), A (1), C (1), B (1) Based on the way these features cut across each other, oldest to youngest, the sequence is likely to be G, E, D, F, A, C, B. However, the relationship between features A and F is ambiguous because they do not intersect anywhere in the image. Their time order is thus interchangeable and marks can be awarded for either interpretation. (7 marks)