Teaching material 2 (students):

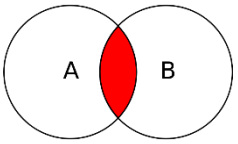
Do the given location factors on the Moon allow for human settlement in comparison to those on Earth?

The map content is also implemented into the augmented reality app "Columbus Eye" to be viewed and to interact with it.

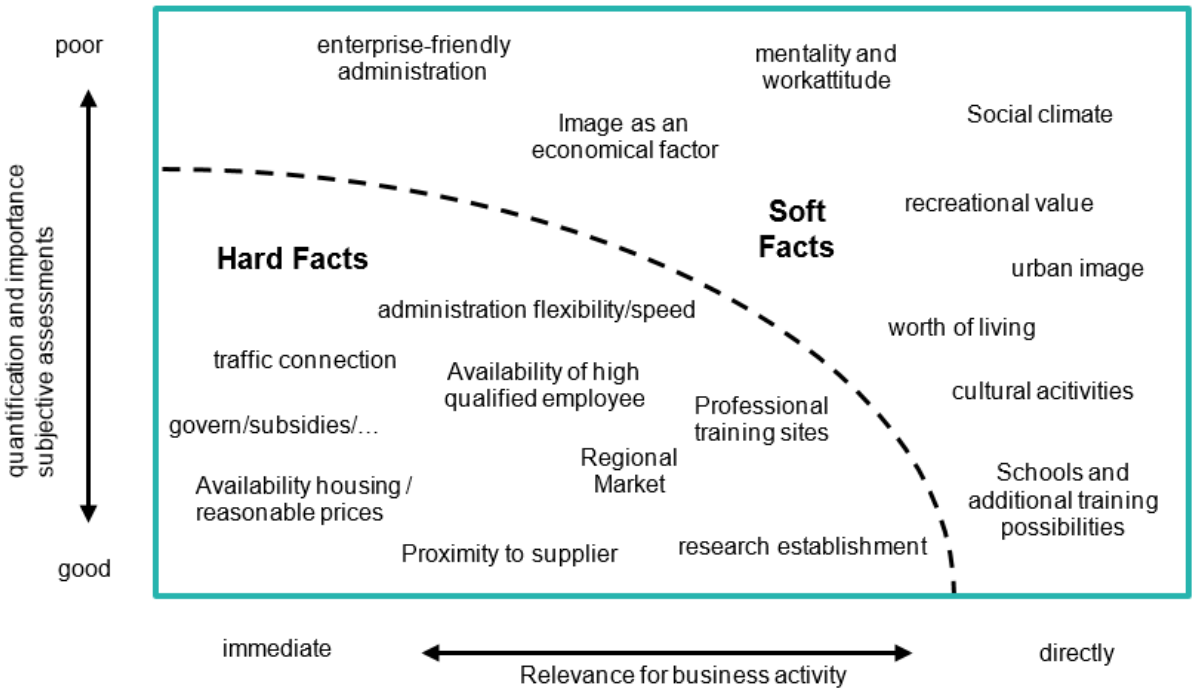
Apple Store Google Play

Is life on the Moon possible, and if so, where on the Moon should humans settle?

1. Consider whether life on the Moon would be possible. Compare the living conditions on Earth with those on the Moon and record your findings in a Venn diagram (see right). Complete the diagram at the end of the lesson.
2. Work individually on the following tasks:



2.1. Explain what a location factor is – hard and soft location factors. Use the following illustration to help you.



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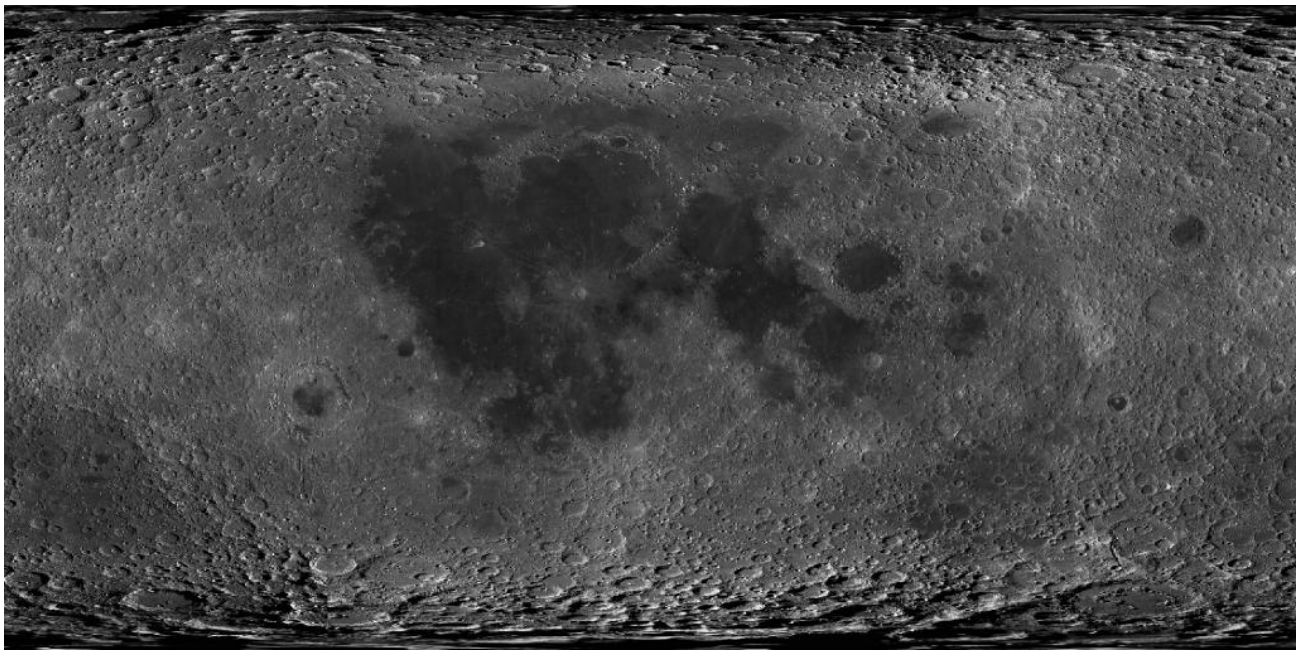
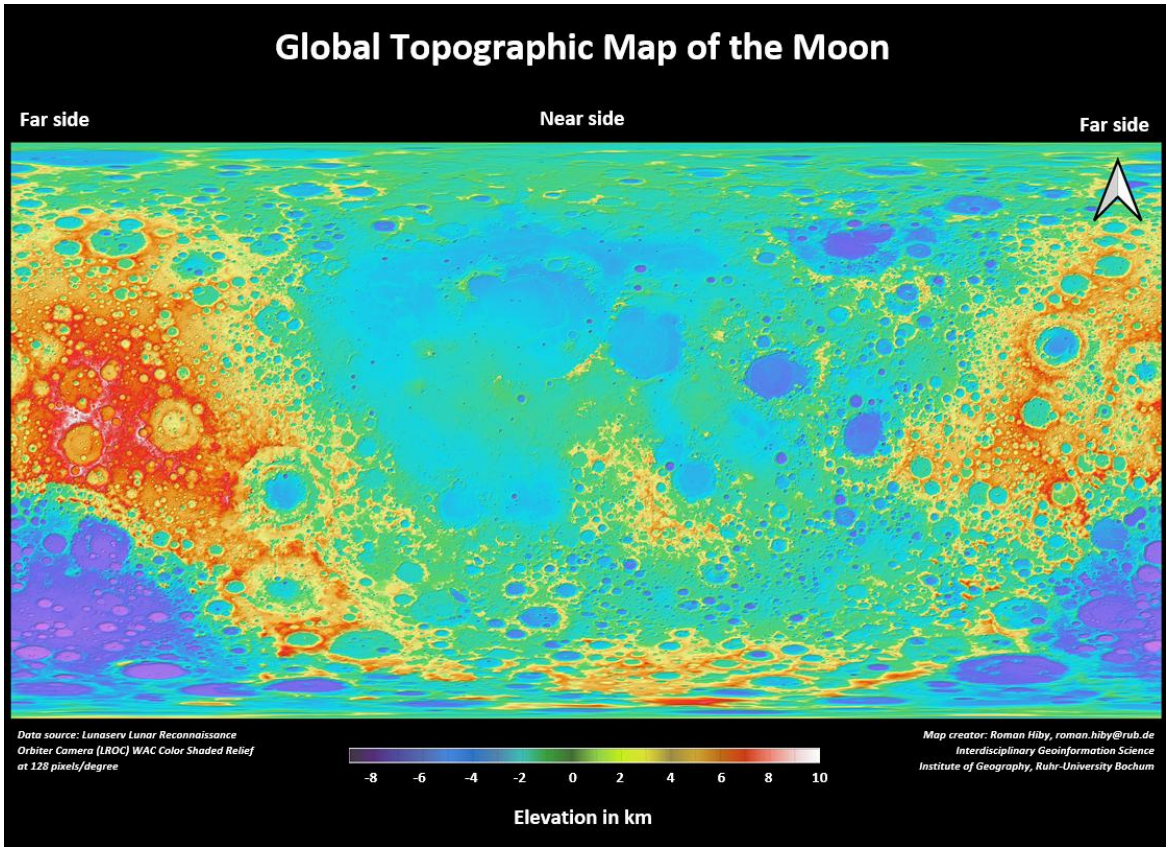
2.1.1. Afterwards, create a similar diagram of potential hard and soft location factors that you may already know about the Moon. The diagram will be completed at the end of the lesson. Pay particular attention to what is primarily needed on the Moon.

2.2. Look at the surface of the Moon. Describe the terrain. Compare the surface of the Moon with that of Earth. Use the map material, also in the app, to help you.





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Discuss your findings with a partner and then with the whole class.

2.3. Analyze how extreme temperatures on the Moon come about and find out how long a day lasts on the Moon and why. Have a look at the 3D view of the Moon's rotation in the app.

Extreme surface temperature

- On the sun-facing side of the Moon, temperatures can reach up to 130 degrees Celsius, while on the side facing away from the sun, temperatures can drop to -160 degrees Celsius.
- The temperature refers to the surface temperature, e.g., of rocks such as regolith.
- The Earth's moon is in a "tidal locking": for every orbit around the Earth, it rotates once around its own axis – on Earth, this means that we always observe the same side of the Moon.
- No heat storage in the air → Surface regolith is the only heat store on the surface, and it is highly insulating (low thermal conductivity), which means that heat has difficulty penetrating more than a few centimeters through it.

2.4. Water availability and states of aggregation.

Assess whether there is water on the Moon and, if so, where and in what form. Also explain what happens to the boiling point of water when the pressure decreases. Use the illustration provided. To find out where water could be present, you should also use the app.

- The air pressure on the Moon is close to 0 bar (atm) because the Moon has only a minimal atmosphere. On Earth, the air pressure is 1.013 bar (atm).

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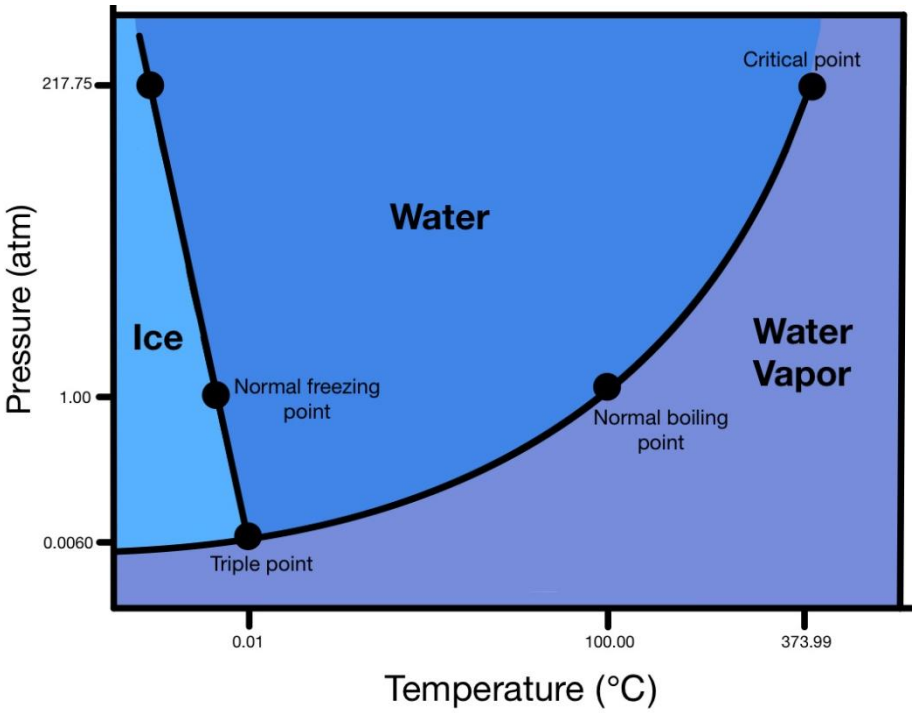

2.5. Resource availability and geological activity.

Assess, where on the Moon, apart from water, other raw materials can be used. Pay particular attention to where water sources and other raw materials are located. Use the additional map material and the 3D view in the app to help you.

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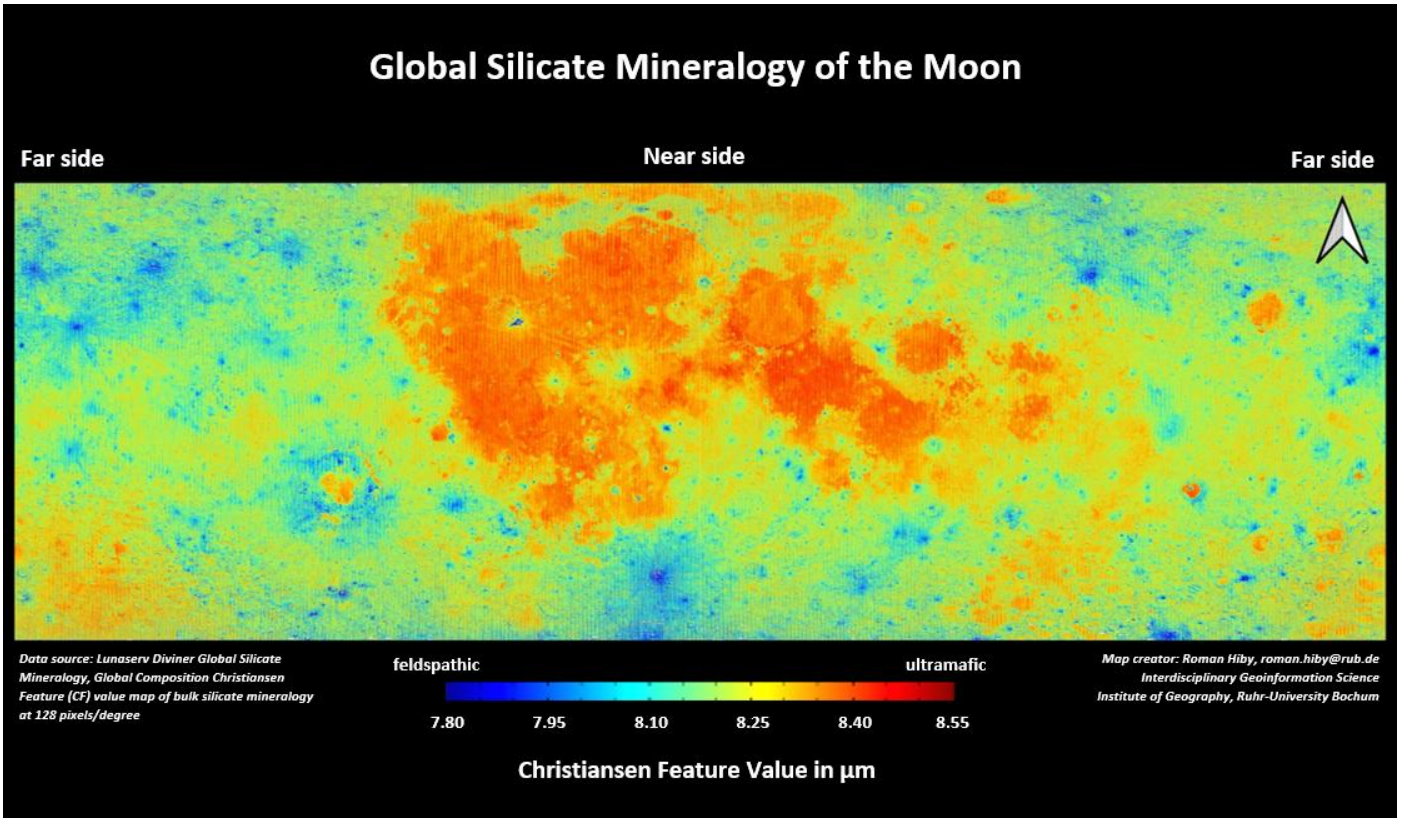

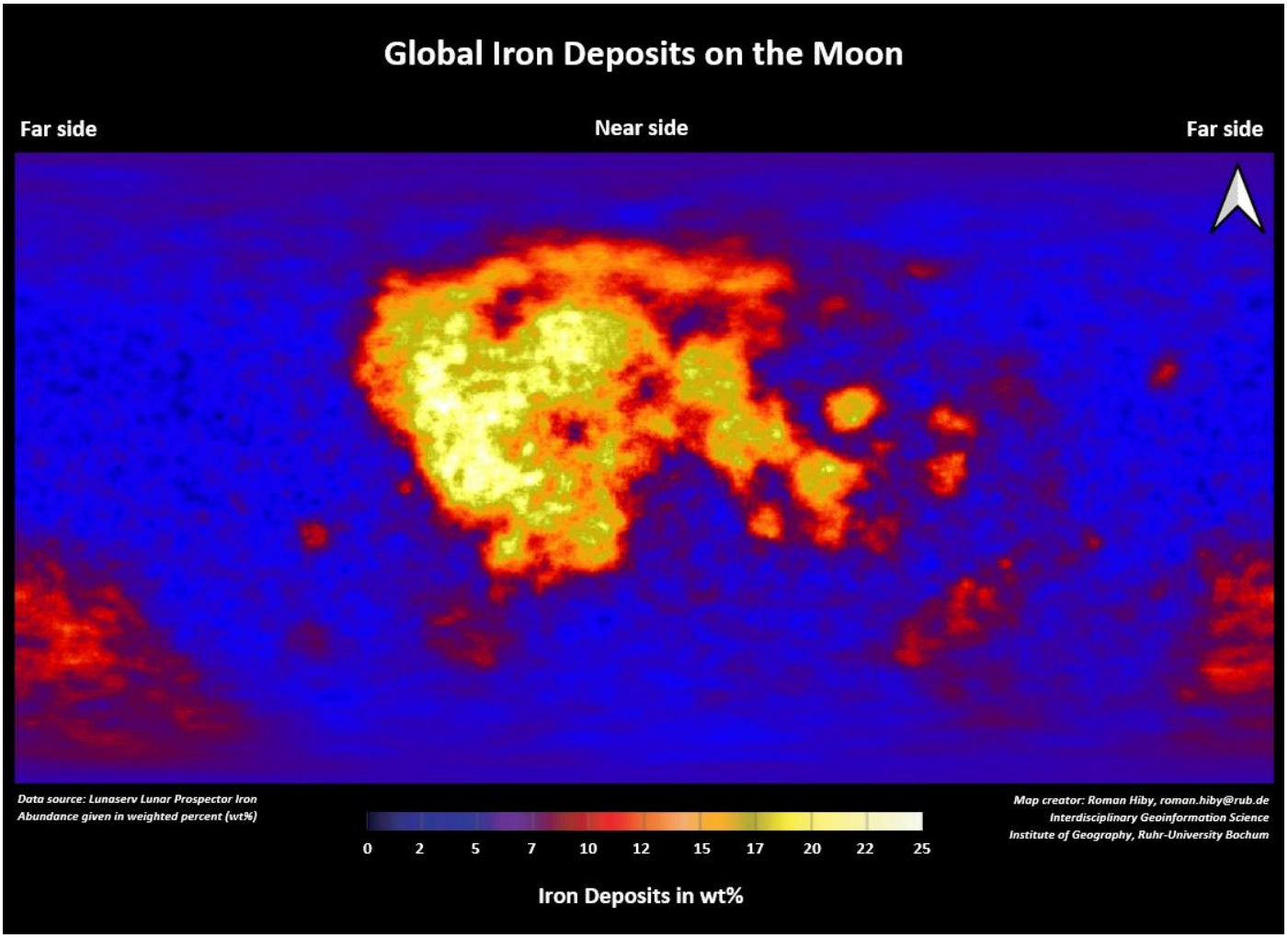

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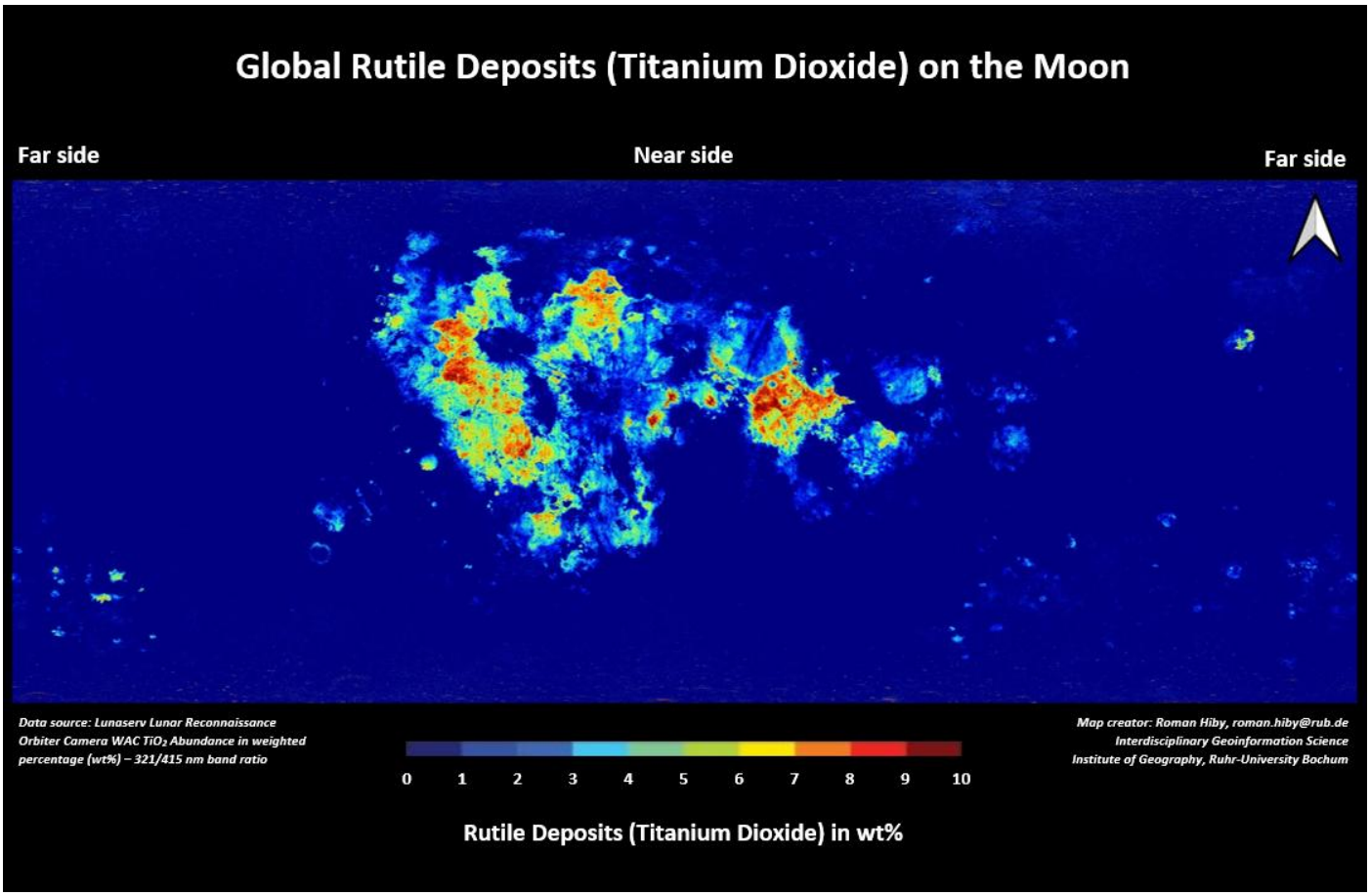

Please discuss the results so far in a group discussion.

3. **Name the locations that you consider most suitable for lunar colonization. Mark these locations on the map (2.2.) and then fill in the table below, adding additional parameters. To compare the individual locations, multiply the weighting and evaluation points for each location and then add them together for each location. The location with the highest score is the most suitable.**

Weighting: 1 = not important; 5 = very important

Location rating: 1 = hardly applies; 5 = applies completely

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Location factor	Weight	Location 1	Location 2	…	…
Topography					
Temperature and light					
Water					
Resources					
…					
…					
Total	-				

4. **Discuss your results with your partner/neighbor and prepare them so that you can present them to the whole class afterwards.**

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5. **Additional task: Together, think of further challenges that would need to be overcome in order to make long-term life on the Moon possible.**
6. **Additional task: Gravitational acceleration of the Moon and its effects on the human body: Calculate how much less you weigh on the moon.**

Physical conditions on the Moon:

- Distance between Earth and the Moon: 384,400 km (average, varies by +/- 20,000 km)
- The Moon has a mass of 1/81 of the Earth's mass
- Orbital inclination 5°
- Orbital period 27.3 days
- Orbital period from new moon to new moon: 29.5 days (difference due to Earth's orbit. The Moon takes longer to return to the same position)
- Orbital velocity (average): 1.022 km/s
- Albedo 0.12, very low albedo
- Diameter: 3,474 km (Earth: 12,756 km) – The points closest to and furthest from Earth have the largest diameter due to tidal forces
- Axial tilt: 6.68°
- Gravitational acceleration: 1.62 m/s2
- Surface temperature: 113K (-160°) to 403K (130°)

7. **Present your results to the class. Discuss your findings. Adjust your location factors and your Venn diagram from the beginning.**

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