STARDUST HUNTERS

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In this activity students will examine different types of micrometeorites and learn their characteristics. They will conduct a micrometeorite hunt at the schoolyard and follow the procedure that scientists do when they hunt for micrometeorites.

EDUCATIONAL CONTEXT

AGE
12.5 – 15 yrs.

DURATION
4 didactical hours

PREREQUISITES
No prior knowledge

EDUCATIONAL OBJECTIVES

WHAT DO YOU AIM FOR YOUR STUDENTS TO LEARN THROUGH THIS ACTIVITY

COGNITIVE OBJECTIVES
Students will learn about asteroids, comets and meteors. They could distinguish meteors from meteorites.

AFFECTIVE OBJECTIVES
Students will experience the everyday procedure that a meteoriticist follows in order to gain new knowledge and answer questions about the cosmos.

PSYCHOMOTOR OBJECTIVES
They will conduct their own investigation hunting micrometeorites and studying them. They will gather data by observing, meteorites. They will record observations, analyze data, compare samples of similar materials; apply geometric properties and relationships to meteorite hunting.

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CONNECTION TO THE CURRICULA

- **Motion-Kinetic energy (Physics)**
- **Metrics (Math)**
- **Chemical elements and compounds (Chemistry)**

EDUCATIONAL APPROACH

Inquiry based learning

ORIENTING & ASKING QUESTIONS

- Ask students what they think a meteorite is.
- Give them a set of meteorites specimen to observe.
- Explain them what meteorites are and where they come from.

HYPOTHESIS GENERATION AND DESIGN

QUESTION: ***Could we find micrometeorites in the schoolyard?***

Ask students to make a hypothesis:……

PLANNING AND INVESTIGATION

MATERIALS

- Hand lenses
- Plastic trays
- A meteorites kit
- Microscopes
- Microscope slides with meteorite sample
- Microscope slides
- Dissection tweezers
- Magnet
- Sandwich bag
- Clear tape

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PROCEDURE

In class:

1. Examine micrometeorite samples under microscopes and try to identify different types of micrometeorites using the given table (see Appendix).
2. Observe their shapes, colors of the given samples and take notes.

In the schoolyard:

3. Place the magnet inside the sandwich bag.
4. Go to the schoolyard and find a crack or seam in the cement/blacktop.
5. Run the magnet along the crack or seam in order to pick up iron filings. The bag is in place to prevent the iron filings from sticking directly to the magnet.

In class:

6. Return to the classroom and pull the sandwich bag off the magnet onto a tray.
7. Carefully spread the iron filings onto a microscope slide and place the slide under a microscope set to low power.
8. Look through the microscope until you find an iron file that appears to range from an almost spherical shape to a perfectly round sphere. That could be a micrometeorite. We call it prospect micrometeorite.
9. Observe and describe the color and shape of your prospect micrometeorite. Calculate its diameter. Use the following table (see appendix 1 different types of micrometeorites) to describe your observations. Record your data.
10. Using your tweezers, carefully lift the prospect micrometeorite, put it on your Micrometeorite page (see appendix 2) and stick it with your tape. Glue your Micrometeorite page into your Science Notebook.
11. Take pictures of your best candidates by hold a mobile phone camera in front of the eyepiece of your microscope with your teacher's help.

ANALYSIS & INTERPRETATION

Students will answer the following questions using their notes:
Number of meteorites found:
Where the dust was collected? Describe the place in detail.
Describe the method for finding the meteorites: (Include Microscope + other tools)
What kind are your prospect meteorites? (Stony or Iron/ Melted or unmelted)
Describe the color, shape and size of your prospect meteorites (use a clear plastic ruler, under the microscope)

CONCLUSION & EVALUATION

Write a paragraph presenting your findings and answer the answer the following questions.

- Is your prospect meteorites stony or iron ones? Why is that happened?
- How could you improve the method that you followed?

Present your results to the class and communicate your results.
Do other teams have different results? How can you comment their findings?
In class, try to answer which of the prospect meteorites have a strong possibility to be real ones.
Discuss with your classmates and make a conclusion.

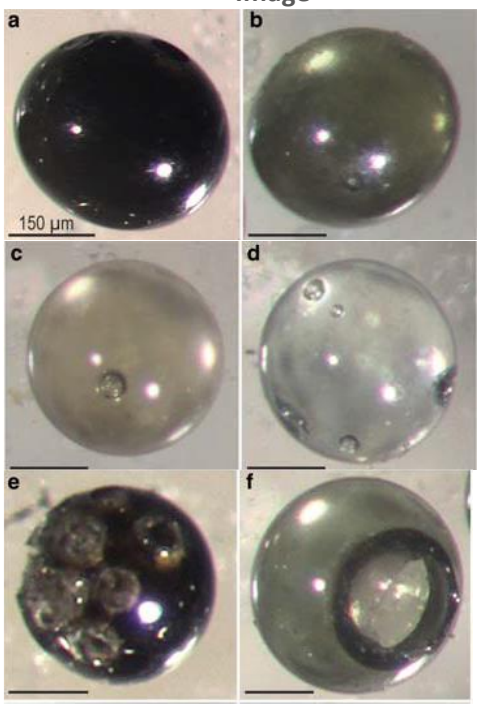
EXTENSION

Students could research the origins of the solar system's asteroids and meteorites and write a one-page summary describing the differences between them, where they come from, how they are studied, and what information they can reveal about the universe.

Appendix: 1.

Different types of Micrometeorites

Based on the amount of iron metal and silicate minerals in the meteorite, meteorites are classified into stony, iron, and stony-iron types. Almost all meteorites contain extraterrestrial nickel and iron, and those that contain no iron at all are pretty rare. Meteorites survive atmospheric entry in two forms: melted and unmelted. Melted micrometeorites undergo transformational changes due to heating during atmospheric entries which obliterate evidences regarding their precursors. Unmelted micrometeorites survive atmospheric entry with minimal alteration, they provide direct evidence for their parent bodies.

Image	Type
	(a–f) **Glass Melted micrometeorites** Glass cosmic spherules showing the most common range of colors and variable vesicularity.

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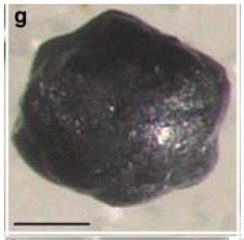
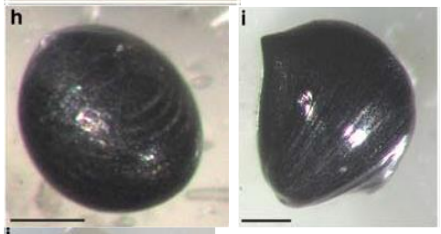
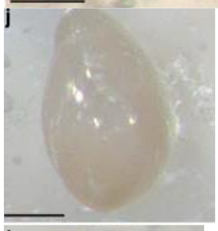
StAnD



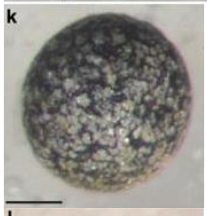
(g) **Cryptocrystalline Melted micrometeorites** or Cryptocrystalline Cosmic spherule with characteristic turtle-back (polyhedral-like) morphology.



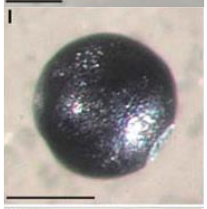
(h–i) **Melted micrometeorites** or Cosmic spherules**,** barred olivine showing characteristic striations.



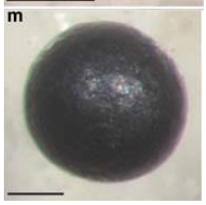
(j) CAT **Melted micrometeorites** or cosmic spherule with its characteristic milky white color.



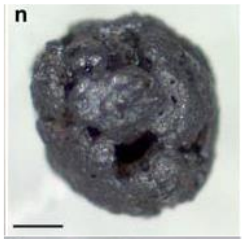
(k) **Porphyritic Melted micrometeorites or Porphyritic cosmic spherule**.



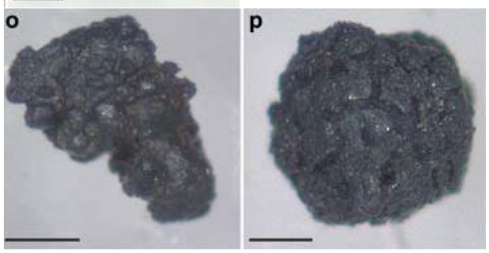
(l) **Melted micrometeorites Iron -** Iron type cosmic spherule with its characteristic metallic lustre.



(m) **G type Melted micrometeorites** or G-type cosmic spherule, consisting almost entirely of nearly equal amounts of Fe oxide dendrites and silicate glass. They often contain Fe, Ni metal beads



(n) **Partially melted** micrometeorite with characteristic scoriaceous structure.



(o–p) **Unmelted** micrometeorites with characteristic angular to sub-angular shapes.

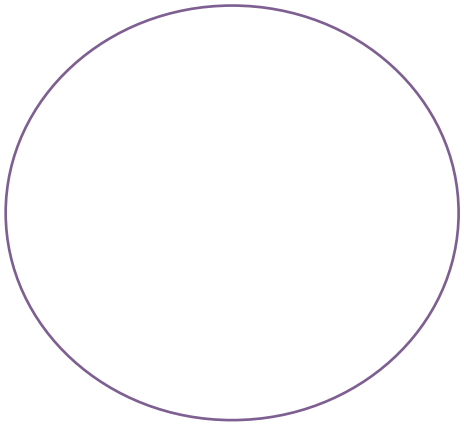
Scale bars 150 mm.
All micrometeorites are from the Transantarctic Mountain collection.

Luigi Folco ,Università di Pisa, Carole Cordier, Université Grenoble Alpes ,Micrometeorites Chapter *in* European Mineralogical Union Notes in Mineralogy · January 2015, DOI: 10.1180/EMU-notes.15.9
https://www.researchgate.net/publication/293805392_Micrometeorites#pf2

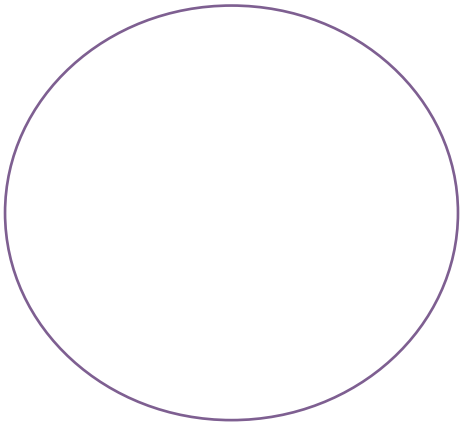
Appendix: 2.

Micrometeorite data sheet

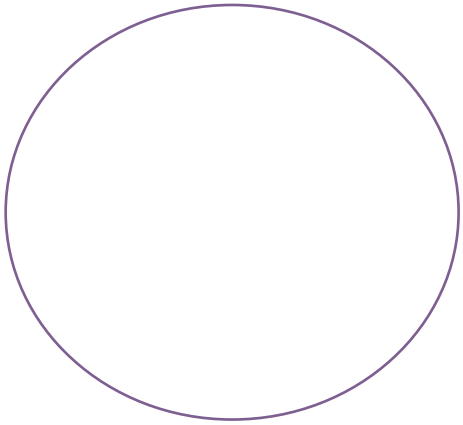
Micrometeorite



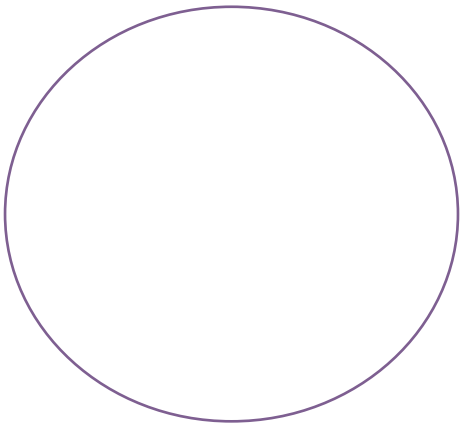
Micrometeorite



Micrometeorite



Micrometeorite



What is your micrometeorite shape (Melted, partially melted, unmelted)? What color does your micrometeorite have?

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Vocabulary

Asteroids are chucks of rock that orbit the Sun between Mars and Jupiter.

When asteroids collide they break into small pieces known as meteoroids.

If a meteoroid does indeed fall into the atmosphere and produce a streak of light it is now called a meteor.

If the meteor happens to survive the plunge through the atmosphere it is now a meteorite.

Meteorites which measure no more than a millimeter across and weigh less than a gram are called micrometeorites. They land on Earth at a rate of about 30,000 tons per year!