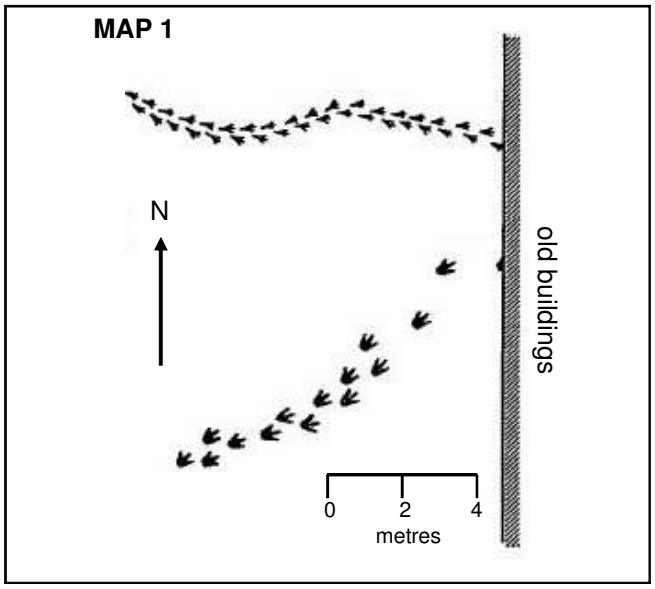
The meeting of the dinosaurs - 100 million years ago

The evidence given by dinosaur footprints

Show the pupils **Map 1.** (Keep maps 2 and 3 hidden). Ask them to imagine that the ground near their school is being dug up to build a new football pitch. As the old buildings are removed, the footprints shown on the map are discovered in the rocks below.



Explain that 100 million years ago this area was a mudflat on the edge of a lake. Large reptiles called dinosaurs often came down to the lake and left their footprints in the mud. The mud dried out and became hard. Then it was buried by more mud. Finally this mud became a hard rock - mudstone. The footprints became fossils and are preserved as fossil tracks. The old buildings shown by the line on the east of the map are being slowly cleared and, as the rubble is removed, so more fossil footprints can be seen in the mudstone.

Ask the pupils:

- What do you think the footprints shown in Map 1 tell you about the two dinosaurs?
- What do you think happened to the two dinosaurs where the ground is hidden by the buildings in the east? Ask older pupils to suggest three different ideas.
- What evidence in support of your ideas would you expect to see when more of the footprints have been uncovered? Ask older pupils to provide evidence for each of their three different ideas.

Show the pupils **Map 2** where the buildings have been cleared 10m further back.

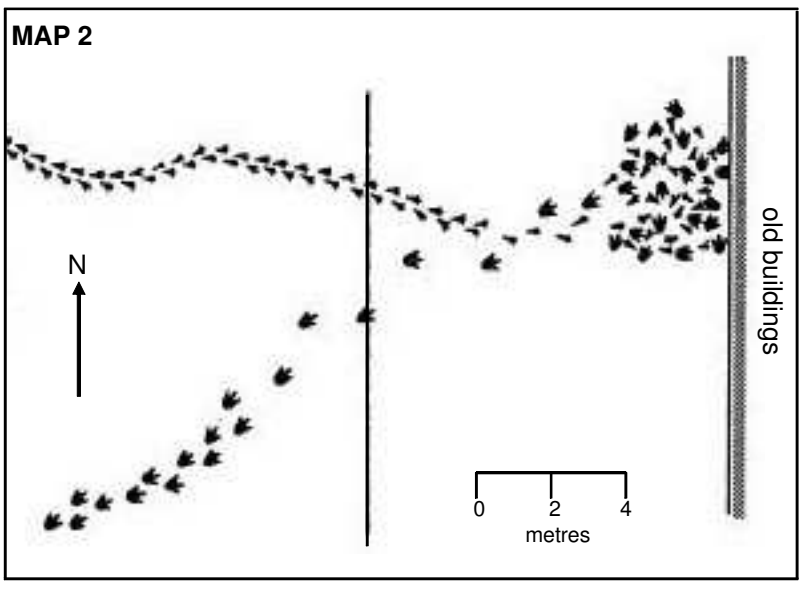
Ask the pupils:

- Which of your previous ideas best fits the new evidence?
- What do you think happened to the two dinosaurs in the ground which is still hidden by the old buildings in the east? Try to suggest three different ideas.
- What evidence in support of your ideas would you expect to see when more of the footprints have been uncovered?
- Why do you think the dinosaurs came to this mudflat in the first place?

Show the pupils **Map 3** *(page 2)* when the buildings have been cleared 10m further back .

Ask the pupils:

- Which of your ideas best fits the new evidence?
- Does this evidence change your ideas about why the dinosaurs came to the mudflat? If so, why?



The back up:

Title: The meeting of the dinosaurs - 100 million years ago

Subtitle: The evidence given by dinosaur footprints.

Topic: Fossil tracks, such as footprints, can provide a great deal of evidence about the environment at the time when they were made and about how the animals lived and moved.

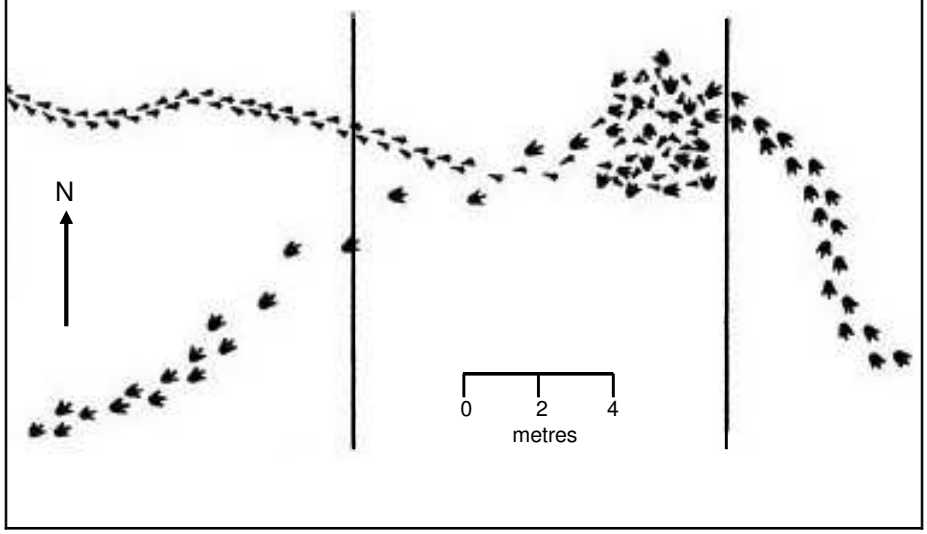
Age range of pupils: 10 - 18 years.

Time needed to complete activity: 10 - 30 minutes depending on the age of the pupils.

Pupil learning outcomes:
Pupils can:

- explain that these footprints were made by dinosaurs that lived near their school 100 million years ago;
- use evidence to reconstruct an ancient environment and the activities of some of the animals;
- suggest what types of dinosaurs made the footprints - herbivores or carnivores;
- predict what will happen when more evidence is revealed;
- state what evidence will be needed to support their ideas of what happened;
- suggest that there may be more than one correct answer;
- measure distances using the scale bar;
- refer to compass directions using the North arrow;
- outline the meaning of 'scientific hypothesis' and how hypotheses can be tested.

MAP 3



Context: The activity could form part of a lesson about looking for the evidence to reconstruct ancient environments and the animals that lived in them. It could form the core of a lesson on scientific hypotheses and how these are developed and tested; by seeking more evidence.

- What do you think the footprints shown in Map 1 tell you about the two dinosaurs?
  - The footprints tell us that both dinosaurs had three toes.
  - One dinosaur was bigger than the other.
  - There could have been two types of dinosaur or one could have been a juvenile. We can't tell whether they were both herbivores (plant-eaters) or both carnivores (meat-eaters) or if there was one of each.
  - The map suggests that both dinosaurs were heading for a site which is currently under the old buildings.
  - After about 6m of tracks, the large footprints are about 2m apart indicating that the large dinosaur may have started to run. It could have started to run because it had seen or smelled the small dinosaur about 6m away. However, the small dinosaur does not run away. Perhaps the large dinosaur wanted to reach the site under the old buildings before the small dinosaur?

- What do you think happened to the two dinosaurs where the ground is hidden by the old buildings in the east? Try to suggest three different ideas.
  (1) The large dinosaur caught the smaller one and ate it.
  (2) The small dinosaur was joined by others in the pack and they all attacked the large dinosaur.
  (3) Both dinosaurs were moving towards the same spot - maybe towards prey that they both wanted.
  (4) This is the lake and they were going to drink.
  (5) The baby dinosaur joined its mother.
  (6) The large footprints cross over the smaller ones (or vice versa) so the dinosaurs did not walk here at the same time.
  (7) Both dinosaurs were walking on the mudflats and were not interested in each other.

- What evidence to support your ideas would you expect to see when more of the footprints have been uncovered?
  (1) Signs of a struggle in the mud with footprints overlapping and the mud disturbed.
  (2) The same as the above but with extra small footprints coming in.
  (3) If the prey was alive, then there would be signs of a struggle. If it were dead, then there would be fewer or no signs of a struggle. In both events there could be some remains of the prey - maybe fossil bones.
  (4) Both sets of footprints stop as the dinosaurs reach the water. There are more footprints as they walk away.
  (5) Both sets of footprints join and continue walking together.
  (6) The larger footprints would cover the smaller footprints (or vice versa), and would have smudged them.
  (7) The footprints continue towards the east and show no relationship to each other.

- **Having looked at Map 2**, which of your previous ideas best fits the new evidence? *The third idea best fits the new evidence as neither dinosaur ran away from the other.*

- What do you think happened to the two dinosaurs where the ground is still hidden by the old buildings in the east? Ask older pupils to suggest three different ideas.
  (1) The large dinosaur walked away having eaten the smaller one.
  (2) More small dinosaurs joined the struggle and killed the large dinosaur.
  (3) Both dinosaurs walked away.

(4) The fight continued to the east and both dinosaurs died in the fight leaving their remains.
(5) The fight attracted lots more dinosaurs.

- What evidence to support your ideas would you expect to see when more of the footprints have been uncovered? Ask older pupils to provide evidence for each of their three different ideas.
  (1) Only the large footprints would be seen and would be more closely spaced showing the dinosaur to be more sluggish than it was before.
  (2) More small footprints would be seen coming to the site and only these would be seen leaving.
  (3) The same two sets of footprints would be seen leaving. If they had fought, the animals may have been injured and there may be evidence for this in the footprints.
  (4) There would be more signs of the struggle but fossil bones of the two animals would also be found (unless they were scavenged).
  (5) There would be lots of different footprints.

- Why do you think the dinosaurs came to this mudflat in the first place? *The carnivores came to drink at the lake and to search for prey. The herbivores came to drink and graze.*

- **Having looked at Map 3**, which of your previous ideas best fits the new evidence? *The first idea best fits the new evidence.*

- Does this evidence change your ideas about why the dinosaurs came to the mudflat? If so, why?
  Map 3 suggests that the dinosaurs did come to the mudflat to search for prey. There is no evidence that they came to drink as well but it is likely that they did.

Following up the activity:
Search the web for images of real dinosaur tracks. Fossil footprints are one of many trace fossils. Others are burrows of worms and sea creatures or crawling marks on the sea bed. Even marks from dinosaurs' tails are trace fossils.
Try the Earthlearningidea to be published on 24th March about working out the weight of a dinosaur from its footprint.

Underlying principles:
- Tracks or traces of creatures are fossils just as are their shells and bones,
- Dinosaur footprints give clues to the lives of the animals of the past. They may give more clues to their lifestyles than the fossil bones themselves.
- Dinosaur footprints give clues about the ancient environments in which they lived.

Thinking skill development:
- understanding of emerging pattern (construction)
- different ideas, different sets of evidence (cognitive conflict)
- reasoning behind the answers (metacognition)
- all fossils and their traces in rocks can be used to tell a scientific story (bridging)

Resource list:
- three maps
- lots of imagination

Useful links:
http://www.enchantedlearning.com/subjects/dinosaurs/dinotemplates/Footprint.shtml
http://www.uc.edu/geology/geologylist/dinotracks.html
http://www.scienceviews.com/dinosaurs/dinotracks.html

Muenchehagen Quarry near Hannover, Germany.
140 million year-old Iguanadontid and theropod dinosaur tracks on a shoreline.

With permission from Dr. Oliver Wings, http://dinosaurhunter.org