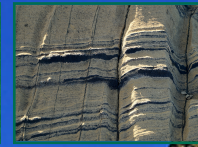


Leka - Støypet

Teacher's Sheet

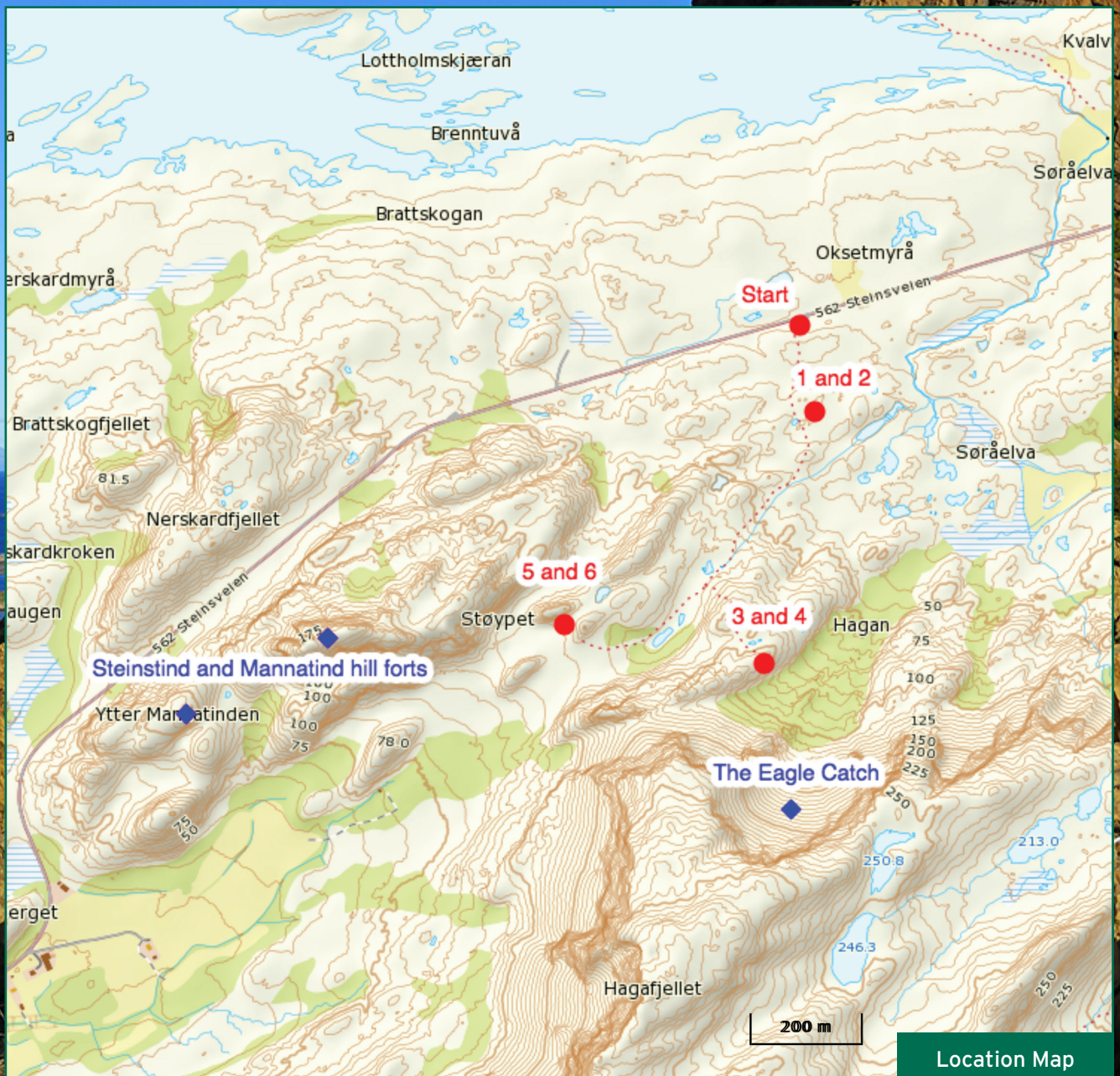
Location Map (Map created from www.norgeskart.no)



Start: Park in designated area at the start of Støypet hiking trail.

Stop 1 and 2: This is a good spot to speak about Chromite and metals (1) and Leka Ophiolite Complex (2)

Stop 3 and 4: Here you rest by the foot of the mountain Steindstind (5) and you can learn more about the land uplift and the raised shoreline at Støypet (6).



Teacher's Notes

SUGGESTED STOPS	POINTS TO NOTE
Access:	<p>Park in designated area at the start of Støypet hiking trail.</p> <p>The suggested route for this site visit is to follow the marked trail to Støypet (an easy hike) via the return trail to The Eagle Catch (Ørnerovsposten).</p>
1	<p>Along the first 400m of the path you will notice rock of various colours. The yellow looking rock is called dunite and is usually found in the deepest part of oceanic crust, just above the mantle and several kilometres below the sea floor.</p> <p>The noticeable black stripes in the dunite are a mineral called chromite from which chromium can be extracted and used for a variety of purposes e.g.. Gold, platinum, palladium, osmium, iridium, ruthenium and rhodium have been identified in these veins but are not considered economically recoverable.</p> <p>It is worth noting that Norway's richest source of Platinum is contained in these veins on Leka and the heaviest elements present are osmium and iridium. Metals like the variety found here are incredibly important in modern society as they have many high-tech applications such as use in mobile telephones, rust protection, catalysts, electrodes, jewellery, etc.</p>
2	<p>Take note of the landscape around you, specifically the colourful mountains. When you walk from the start of the path along the river you are essentially walking towards the centre of the ancient earth!</p> <p>The rock types you have been walking past are normally only found at the furthest depths of the Earth's oceanic crust. These would have formed during the late Cambrian and early Ordovician when an ancient supercontinent known as Rodinia was breaking apart. At this time present day areas of Scotland, the north of Ireland, Greenland and North America formed part of a continent known as Laurentia. A shallow sea grew as a result of rifting. This new ocean became known as the Iapetus, and formed between Laurentia and another large continent known as Gondwana. Two smaller continents existed between Laurentia and Gondwana, known as Siberia and Baltica, the latter of which now forms Scandinavia.</p> <p>By around 500 million years ago, the Iapetus Ocean had reached its maximum width of up to 5,000km (similar in scale to today's Atlantic Ocean). The process of ocean closure is not a straightforward one and over a period of 200 million years, the Iapetus Ocean closed slowly as Baltica moved northwards and collided with Laurentia, leading to the formation of the Rheic Ocean. Ocean closure was enabled by subduction of the ocean floor. The ophiolite seen here formed when oceanic crust was thrust on top of continental crust.</p> <p>Take a closer look at the yellow, grey-black and near red veins in the rocks. When these stripes were created they were actually lying horizontally one on top of the other, like layers of a cake. The original order is as follows: yellow, grey, red (repeated).</p> <p>Each new layer of yellow rock represents a pulse of magma rising from the Earth's mantle into a magma chamber below a spreading ocean ridge. Regular volcanic eruptions have pushed magma out of the magma chamber onto the ocean floor. Pulses of magma into a magma chamber can be large or quite small. Some layers evident here are up to 100 metres wide while others measure only a few centimetres. This demonstrates the different volumes of magma injected into the magma chamber from the Earth's mantle.</p> <p>As the rocks rust (or oxidise), each layer takes on colours reflective of the dominant minerals. Olivine results in a yellow colour, clinopyroxene results in grey-black colour while orthopyroxene results in the red colour. Colour strength varies depending on the quantity of minerals present.</p>
3	<p>The Story of the Eagle's Catch</p> <p>People have lived in this area for more than 10,000 years and their lives have been shaped by the dramatic landscape which surrounds them. Svanhild Hartvigsen disappeared on 5th June 1932 when she was 3 ½ years old. A full-scale search was launched from the sea to the nearby hillsides. One of her shoes and a handkerchief were found six hours later near a hill called Galten. Three men climbed up the steep scree on neighbouring Hagafjellet, and Svanhild was found unhurt on an almost inaccessible ledge near the red mark you can see. This was very close to a white-tailed eagle's nest. No child of her age could get onto the ledge by herself. The only explanation was that an eagle lifted Svanhild and placed her there.</p>

4	<p>Strandflat is a geomorphological feature that has left its characteristic mark on the Norwegian coastline, in fact is it a Norwegian term introduced in 1894 by the Norwegian geologist Hans Reusch. The strandflat is a low, flat and wide platform which runs along the west coast of Norway and provides the distinctive coastline synonymous with the country. This terrestrial and off-shore platform supports thousands of stacks, skerries and other small islands, as well as shallow sea areas.</p> <p>The origin and formation of the strandflat landscape has puzzled scientists for centuries. Several hypotheses have been suggested, from preglacial abrasion, to glacial abrasion as well as frost weathering. One interpretation which is still being debated is that the strandflat is a result of deep tropical weathering of the country rock during the Mesozoic Era (250 - 70 million years ago), followed by preservation of the weathered surfaces and uplift during the neogene (70 - 2.6 million years ago). Throughout the quaternary this geomorphological feature has been subject to further erosion by a combination of coastal processes, freeze/thaw weathering and glaciations. It is thought this mix of erosion and change in climate may have contributed to the formation of strandflat formation.</p> <p>The strandflat has played a fundamental part in the human history of Norway. The strandflat coastline provides an excellent habitat for fish and marine mammals making it an excellent hunting and fishing ground, which the first dwellers utilised. Despite high latitudes, some of the islands also provided shelter and relatively lush pastures. The combination of fishing, hunting and agricultural opportunities provided by the geology of the area attracted human dwellers from early after deglaciation.</p>
5	<p>In the Steinstind area, numerous caves where people once lived have been found. Stone Age people lived at the top of Støppet about 10,000 years ago. At this time, the sea level was higher and Støppet was a narrow land bridge between the main island, Leka, and the mountain Steinstind. Støppet is a Norwegian geological and cultural monument. The traces of our forefathers can easily be destroyed, please show respect and do not disturb any stones, paths or wildlife.</p> <p>At the top of Steinstind and the neighbouring peak of Mannatind, there are archeological remains of forts built during a migration period 4-600 AD. These are protected as a cultural heritage sites.</p> <p>Together with Lekamøya, Steinstind is the most symbolic mountain on Leka, rising as a bright yellow peak. It is the best representative of the dunite massif in the ophiolite sequence found on Leka. Dunite is a green to brownish coarse-grained igneous rock consisting largely of olivine. The summit can be reached via a steep climb from Støppet. The views from the summit are wonderful. From here the layered ophiolite complex and an almost arid, lunar-like landscape coloured in bright yellow and red, together with the strandflat archipelago extends towards the horizon.</p> <p>On the north side of Steinstind, close to the road, there is a scientific test site where the University of Bergen (UiB) has collected samples for geobiology studies. An on-going project is studying microbial communities in ultramafic rocks and the dunite here at Leka provides a model system. For more information on this research please contact Professor Rolf Birger Pedersen at UiB.</p>
6	<p>The old road on Leka once went over Støppet, a large area with rounded stones in several raised shorelines. Over millennia waves have broken loose local rocks and reorganized the material into a blanket of pebbly stones. The number of present day storm lines / shoreline ridges are indicative of the enormous power of the waves, which predominantly come in from the southwest - large stones have been cast up into impressive ridges. Smaller particles such as gravel and sand have been washed back out to sea.</p> <p>In the past when sea levels were higher (perhaps up to 50m), waves rolled unimpeded toward land. Now, when sea levels are lower, waves break upon the skerries west of Stein. At the higher sea level, the waves had more power to move larger material, and at lower level, only fine sediments were deposited. The variation in grain size reflects this in an excellent manner - ranging from sorted stones in the heights up at Støppet to sand on the flat areas at Stein.</p> <p>Leka features several impressive landforms related to beach loss and wave erosion during isostatic uplift. Isostatic uplift is the rise of terrestrial landmasses following the removal of huge weight that was applied by ice sheets during the last glacial period, or ice age.</p> <p>Above Støppet you can easily see how various mountain formations have been shaped over millions of years e.g. wave abraded rocks, kettle holes and raised shorelines. Some of these impressive rock formations are raised sea-stacks, formed by frost shattering and sea-ice abrasion during a relative sea level standstill in Younger Dryas (a period of much colder climate from c.12,900 to c.11,700 years ago). The cold period resulted in extensive bedrock erosion on the entire island of Leka and this led to the formation of peculiar sea stacks.</p>