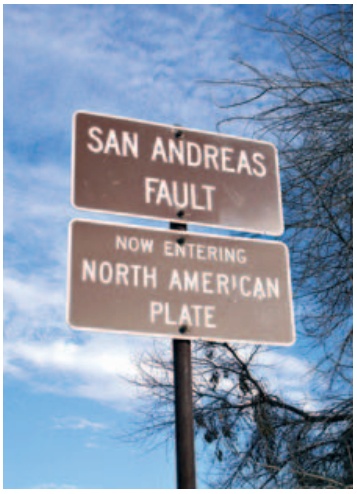
SGS-USA-Excursion 4.–23.9.2009

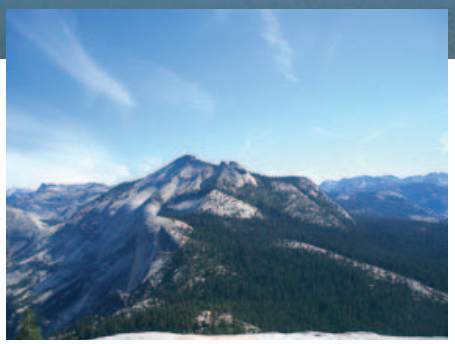
27 People, 20 Days, 4 States, 6438 km and 10 Hotels, plus Geology from the Precambrian until the present day.



Water reservoir on the San Andreas Fault.

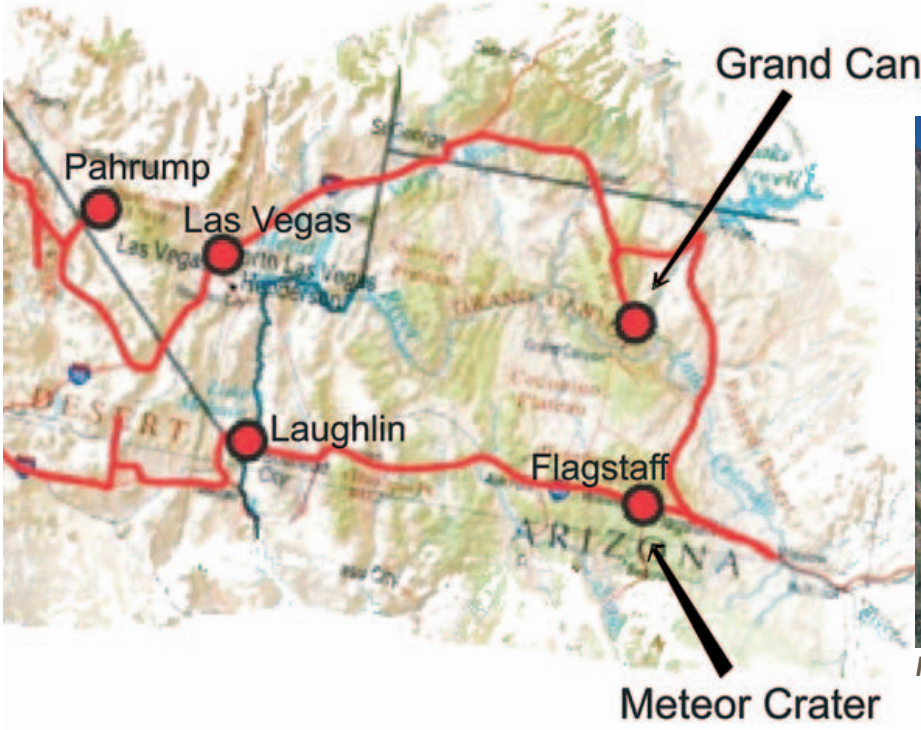
View over Death Valley from Dante´s View.

Tufa mounds at Mono Lake.



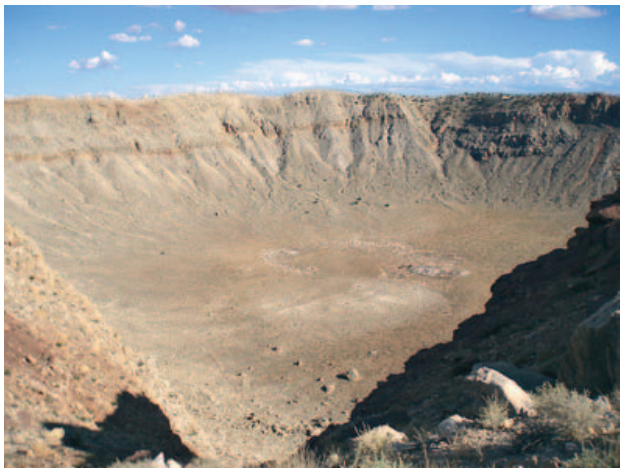
View over Yosemite.

View into the Yosemite Valley.



Inside the Grand Canyon.

Inside Death Valley.



The Meteor Crater.

SGS-USA-Excursion 4.–23.9.2009

FRAUKE KUBISCHTA

Basin and Range Province – Death Valley Area

The Basin and Range Province, which includes the Death Valley is bordered to the west by the Sierra Nevada Mountains and to the east by the Colorado Plateau. The Basin and range Province started to develop about 16 million years ago through crustal extension and thinning and has been stretched over 100 % of its original width in certain areas. The basins and ranges within the province are running roughly in a north-south direction, each range followed by a basin. The deepest on is the Death Valley, its' bottom lying 85 m below sea-level. Geologically speaking the Death Valley is a half-graben, with a major fault on one side of the valley, e.g. cutting an alluvial fan into two, it is a very young structure within the Basin and Range province, only approximately 2-3 million years old. The Death Valley is characterized by its extremely dry climate and high temperatures, saltpans, sand dunes, and after an occasional rain, a sea of flowers covering the otherwise dry and deserted valley floor.

The Meteor Crater

One of the world's best preserved meteor craters can be found just 70 km east of Flagstaff, Arizona. The crater has a diameter of about 1200 m, is around 170 m deep and rises 45 m above the surrounding north Arizona desert plains. It was formed ~50 ka ago by an impact of a nickel-iron meteorite that measured about 50 m across and impacted with a speed of nearly 13 km/s. First it was believed that the crater was created by a volcano, however later the opinion changed correctly to the view that the crater was caused by a meteorite impact. Even if the size of the meteorite and the speed with which it impacted was severely overestimated. Also it was then unknown that most of the meteorite evaporated on impact and the first owner of the crater thought he could make a fortune with mining all that iron from the meteorite. However, he was unsuccessful and only a few small fragments were found.

Grand Canyon – A truly amazing place on earth

Text-book geology as far as the eye can reach!

A walk through time from the Precambrian the Permian, approximately 1.6 billion years, and at the same time through 1.4 km vertical distance of geology: magmatic and metamorphic rocks, marine and terrestrial sediments, sedimentary structures such as cross-stratification, dish structures, graded bedding, groove casts and much more, fossils like trilobites, plant fossils, animal tracks, stromatolites. In the bottom of the canyon Precambrian magmatic and metamorphic rocks of the Vishnu Group are overlain with an angular unconformity by the Grand Canyon Series a succession of shallow marine, lake and river deposits. Some of the layers in the Grand Canyon Series contain fossils of protozoan microorganisms which have an age of around 1 Ga. The Grand Canyon Series is in turn again discordantly overlain by Cambrian sandstones, li-

mestones and shales, containing abundant trilobites. In this fashion marine and terrestrial sequences from the Cambrian to the Permian are following each other to the top of the succession. However, it is known from the biostratigraphy that unconformities have removed a lot of material from the rock formations and what we see today outcropping in the canyons is but a fraction of what used to be there. Compared to the rocks the canyon itself is a young structure, only 5-6 million years old.

The San Andreas Fault Zone

A right-lateral offset of 320 km in just 23 Ma along the San Andreas Fault Zone! Unbelievable but true, the offset can be proven by comparing the geology of the Pinnacles and Neenach Volcanic Fields to each other, which are part of the same volcanic complex. The action at the San Andreas Fault Zone started approximately 20-25 million years ago. The San Andreas Fault is a right-lateral strike-slip fault belonging to a network of faults which is stretching along the coastal area of California. The Pacific Plate is moving to the northwest and the American Plate southward. Today it is quite difficult to trace the fault in the terrain because most of it is overgrown or filled up with alluvium due to the time that has passed since it last moved. It can be best seen in the Carrizo Plains where scarps and pressure ridges can easily be made out in the otherwise empty desert and along river courses, where the stream channel are suddenly offset to the right when crossing the fault. The motion of the plates along each other in most parts is not a continuous one but instead the plates are resting for long periods, building up stress between them, which is unloaded in a sudden movement that triggers earthquakes with destructive results for the population. Other areas of the fault are creeping continuously in a slow motion alongside each other without any accompanying major earthquakes.

The Yosemite National Park

The prominent rock type in the Yosemite Valley is massive, unlayered granite. Over millions of years multiple intrusions of granitic magmas wide range of compositions from Granodiorite to Tonalite and Quartz diorite, intruded into each other. Most of the granitoids intruded during the Cretaceous into the then overlying older rocks which are nearly completely eroded away by today. Due to the different magmatic compositions the erosional behaviour of the different magmatic bodies is different which leads to a wide array of spectacular topographic features, such as the Half Dome and the El Capitan. The granitic rocks are mainly eroding along joints, which usually running more or less parallel to each other. In more siliceous rocks these joints are widely spaced from each-other, which creates landforms like the El Capitan, with a vertical wall, to the less siliceous rocks which are more easily eroded and crumble to pieces and developed into landforms. Another prominent erosional feature is sheeting of the granites which leads to rounded surfaces as seen at North Dome or Half Dome. The main erosional agents which were forming the Yosemite Valley in time were water and glaciers.

Lisää lukemista: http://suomenkuvalehti.fi/haku/asiasanat/SGS.

FRAUKE KUBISCHTA
Department of Geology
PO Box 64
00014 University of Helsinki
frauke.kubischta@helsinki.fi