

# SEDIMENTARY INFILL OF THE GARDNOS IMPACT CRATER – A FIELD REPORT

E.Kalleson<sup>1</sup>, H.Dypvik<sup>2</sup>, J.Naterstad<sup>1</sup>. <sup>1</sup> Natural History Museum, University of Oslo, Oslo, Norway ([elinkal@nhm.uio.no](mailto:elinkal@nhm.uio.no), [johan.naterstad@nhm.uio.no](mailto:johan.naterstad@nhm.uio.no)), <sup>2</sup> Department of Geosciences, University of Oslo, Oslo, Norway ([henning.dypvik@geo.uio.no](mailto:henning.dypvik@geo.uio.no))

**Background:** The Gardnos impact structure in Hallingdal (Fig.1) is one of only two (at present) confirmed impact craters in Norway [1], the other being the Mjølnir crater in the Barents Sea [2,3].  $Ar^{40}/Ar^{39}$ -dating failed due to Caledonian overprint [4], but the age of this impact crater is probably late Precambrian, based on field information. The exact timing of the impact event is still a topic for further research. As it appears today, the Gardnos structure is roughly circular with a diameter of about 5 km. The structure is exposed through Tertiary and recent regional uplift, weathering and erosion. During Quaternary time the area was repeatedly covered by glaciers and consequently large parts of the crater structure is covered by moraine. There are however, good exposures at steep hillsides and along river beds.

A 400 m long core was drilled within the Gardnos structure in 1992, penetrating sediments and impactites (suevite and Gardnos breccia). The main focus so far in the investigation of the Gardnos structure has been the geochemistry of the impactites [5, 6].

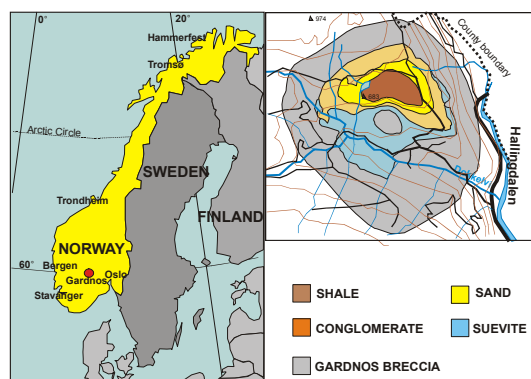


Figure 1. Location of the Gardnos impact structure. The close-up map shows the distribution of the impactites and the main lithologies of the sedimentary infill deposits.

## Methods:

Field work (in 2004) focused on the sedimentary post-impact deposits. Exposures were mapped with GPS, several sections were logged, and a number of exposures studied in detail (Fig.2).

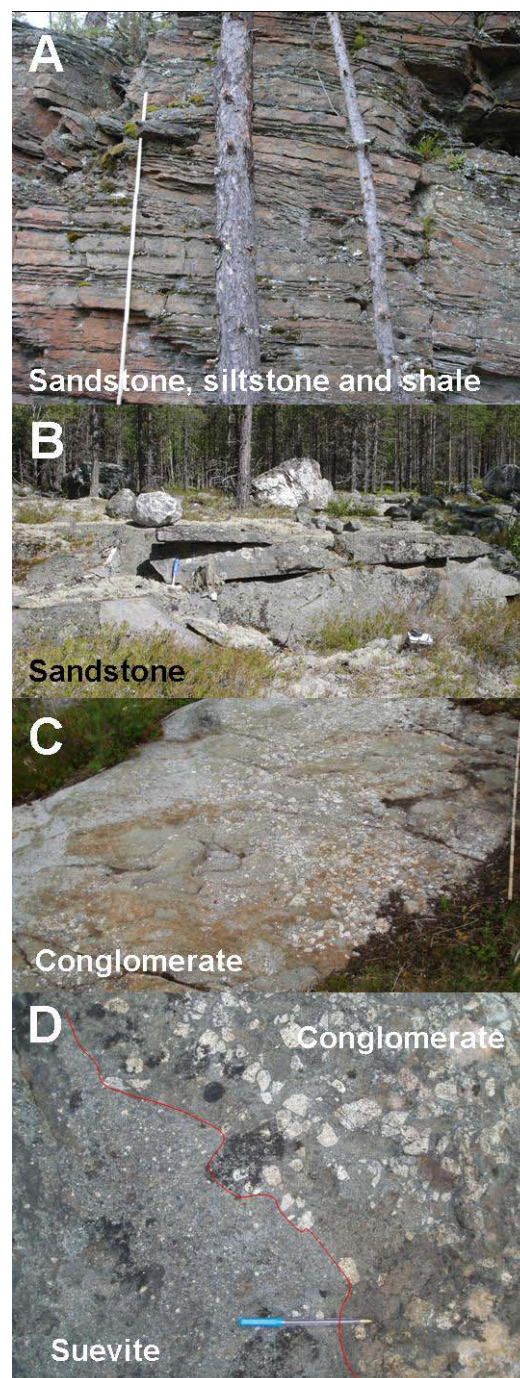


Figure 2. Examples of exposures of the different lithologies in field. Thin red line in picture D marks the transition between suevite and overlying sedimentary deposits.

Emphasize was placed on observations of sedimentary structures and systematic recording of various textural parameters. Thin sections were made of both field and core samples.

**Results:** The general map of the Gardnos impact structure has been updated and redrawn, with emphasis on the infill sediments.

Coarse grained beds on top of the suevite seem to have sunken into it, indicating that the suevite was not yet solidified when the first clastic deposition occurred. The clasts in these early deposits are dominated by very angular fragments of locally derived bedrock, of short transportation.

Matrix content and clast size distribution in the coarse-grained conglomerates show a range, probably reflecting different sedimentation processes.

The bedrock in the area is compounded, and so are the clasts in the conglomerates. The proportions of different clast types vary within the investigated area, and may reflect the various source areas.

**Preliminary conclusions:** A sedimentary infill history is proposed, describing the sedimentary processes acting in the fresh crater (Fig. 3).

During crater formation, sea water, sediment, and basement rock were excavated and ejected. On top of the autochthonous Gardnos breccia a sheet of melt-bearing polymict breccia (suevite) was found covering the crater floor (Fig. 3A). The basin might have been dry for a short while, with water partly shut out by the surrounding rim (Fig. 3B). Probably rock avalanches immediately occurred from the rim and central peak. In figure 3C the central peak is almost completely broken down, and the sediment supply was mainly from the rim in the form of density flows, triggered by increased water content. The coarser part of the flow settled where the slope was reduced, while the finer fractions may have been transported farther into the basin.

After some time the rim was eroded and the crater filled with water (Fig 3D). More quiet conditions prevailed, with deposition of fine sand, silt, and clay.

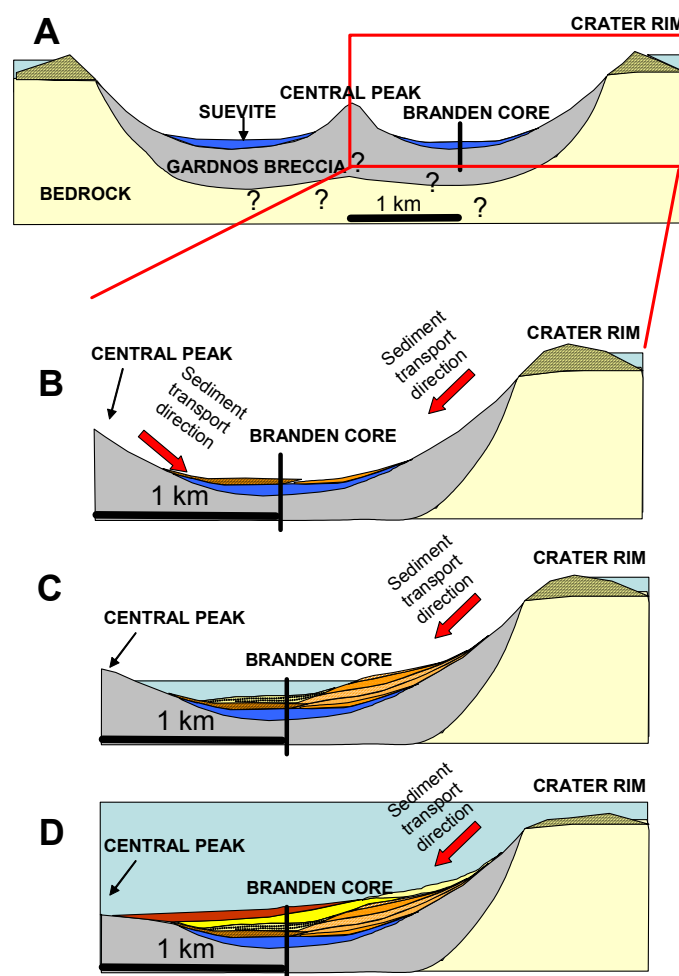


Figure 3. Model of sediment infill pattern in the Gardnos impact crater.

#### References:

- [1] Dons J.A. & Naterstad J. (1992), *Meteoritics* 27, 215 (abstr.). [2] Dypvik H. et al (1996), *Geology* 24, 779-782. [3] Gudlaugsson S. (1993), *Geology* 21, 291-294. [4] Grier et al. (1995), *Meteoritics* 30, 513-514 (abstr.) [5] French et al. (1997), *Geochimica et Cosmochimica Acta* 61, 873-904. [6] Gilmour et al. (2003), *Geochimica et Cosmochimica Acta* 67, 3889-3903.