Bedrock ballast stones in Flanders

First evidence for the presence of Baltic glacial erratic boulders and their historical re-use in Belgium

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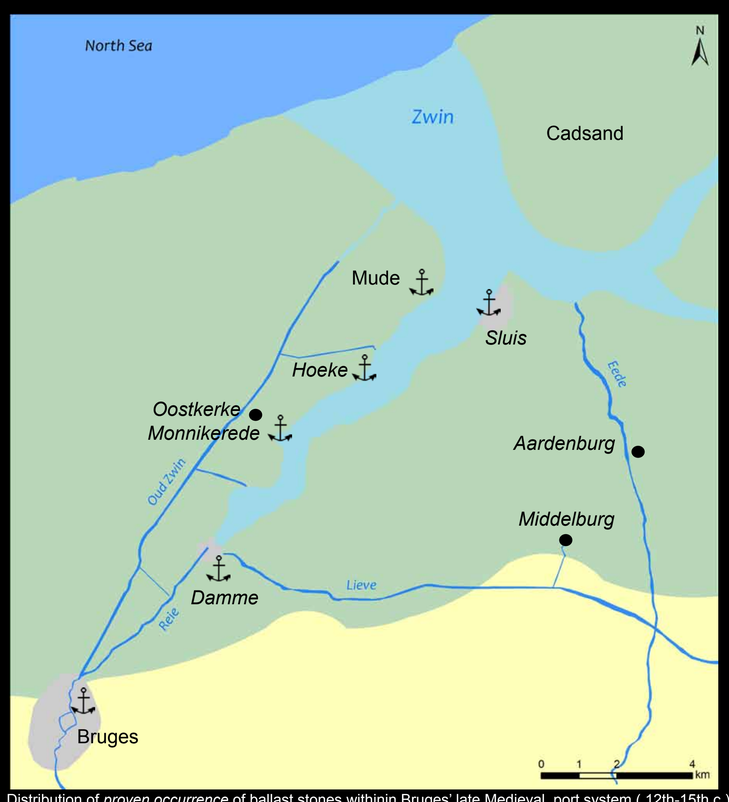
Exotic cobbles found In Bruges' outports



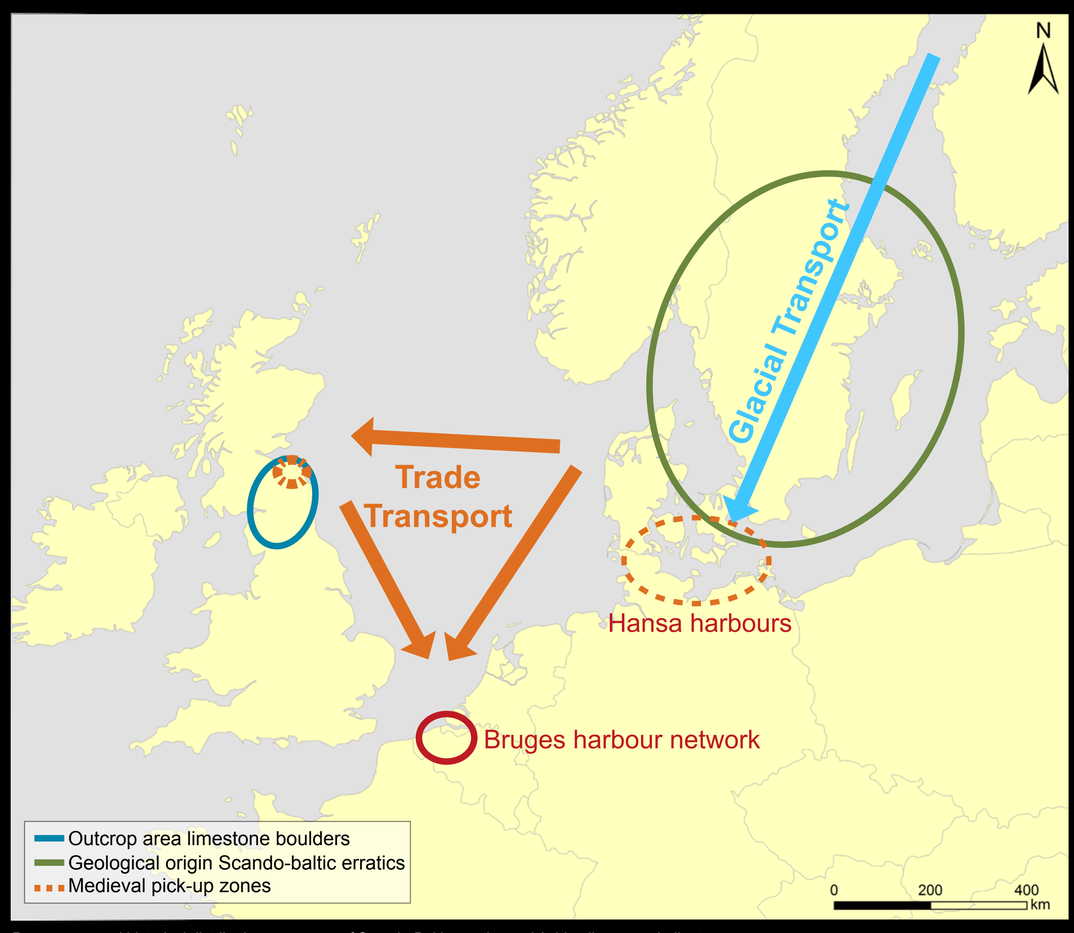
Distribution of *proven occurrence* of ballast stones withinin Bruges' late Medieval port system (12th-15th c.)

Re-used ballast stones (granites and amphibolites) in the Saint-Guthago church tower at Oostkerke.

Re-used and ploughed-up erratic ballast stones at the lost medieval harbour site of Hoeke.

From the 12th cent. onwards Flanders grew into a prime commercial region establishing trade connections with both S and N Europe. The city of Bruges developed into an extended linear economic network of small towns and landing sites situated along the tidal channel (Zwin) leading from the sea to the town. Foreign merchants such as Germans (Hanseatic league) established permanent settlements in this portuary network.

The study of re-used **natural rock fragments** in 13th century churches and monuments in the Bruges area, has lead to the discovery of exotic building stones interpreted as **ballast**, testifying of the intensive trade of the Hanseatic League in Flanders. For instance, the trade post site of the Hanseatic league at Hoeke (near Bruges), which had a landing site and ship yard, yielded hundreds of ballast stones.



Provenance and historical distribution processes of Scando-Baltic erratics and Asbian limestone ballast.

Lithological & petrographical analysis

Macro

Larkivite, iridescent blue-grey monzonite from the Oslo area

Ring-quartz porphyry, Aaland archipelago, SW Finland

Kalmarsund sandstone, Early Cambrian, between S-Sweden & Öland Island

Baltic sea quartz porphyry, sea floor SE of Stockholm, Sweden

Asbian bioclastic limestone with pholad borings, Northumberland

Rapaviki granites, Aaland archipelago, SW Finland

Micro

Bradyina rotula

Archaediscus ex. gr. karreri

Siphonodendron pauciradiale

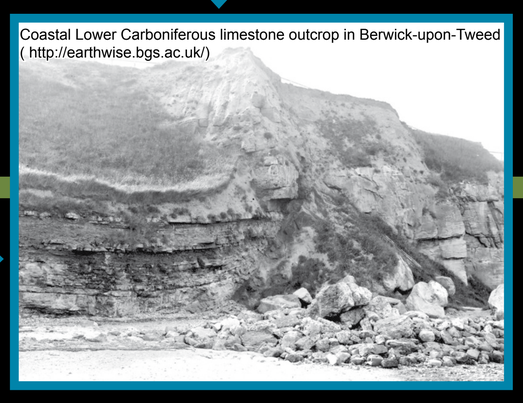
Besides glacial erratics, several **limestone boulders** have been identified showing a quite different geological origin. The latter are composed of bioclastic wacke/packstones enclosing index foraminifera and small rugose corals, pointing to a Late Visean (Biozone MFZ14; Asbian) age. Their overall microfacies characteristics and the presence of pholad borings, suggests coastal outcrops of Lower Carboniferous limestones, most likely along the eastern coast of the UK, near Berwick-Upon-Tweed.

The morphology and lithological composition of the assemblage point to a Scandinavian glacial erratic origin, most probably indicating a Southwestern Baltic coastal origin. Diagnostics include well-rounded Proterozoic-Palaeozoic igneous rocks (granites, porphyries, ignimbrites), metamorphic rocks (quartzites, gneiss, amphibolites, phyllites) and sedimentary rocks (flints, sandstones, conglomerates). Particular key erratic boulders point to specific provenances (prior to glacial transport), including: Larvikite (Oslo area), Ostsee quartz porphyries (Baltic sea floor), Kalmarsund sandstone (Sweden), and Rapakivi granites (Aaland).

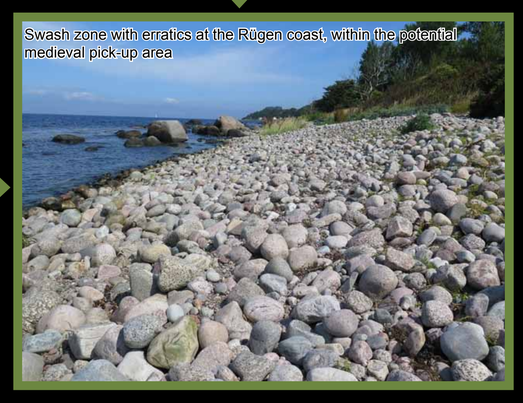
Provenance >>> Pick-up zones

Probable provenance area (North Berwick area) of Lower Carboniferous limestone boulders with pholad borings.

Geological origin of index erratics prior to glacial transport and historical pick-up area in the Scando-Baltic region.



Coastal Lower Carboniferous limestone outcrop in Berwick-upon-Tweed (http://earthwise.bgs.ac.uk/)



Swash zone with erratics at the Rügen coast, within the potential medieval pick-up area

The study of ballast stones provides ample evidence of the historically Hanseatic attested trading connections between the Bruges area and coastal areas in the Baltic Sea and the eastern coast of the UK. The occurrence of exotic boulders on the surfaces of the fields of the lost Zwin towns, as well as their re-use within monuments and road pavements of the same area, constitutes an unique element within the Belgian geological heritage, referring to a historically important but short lapse of time during the Middle Ages.

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