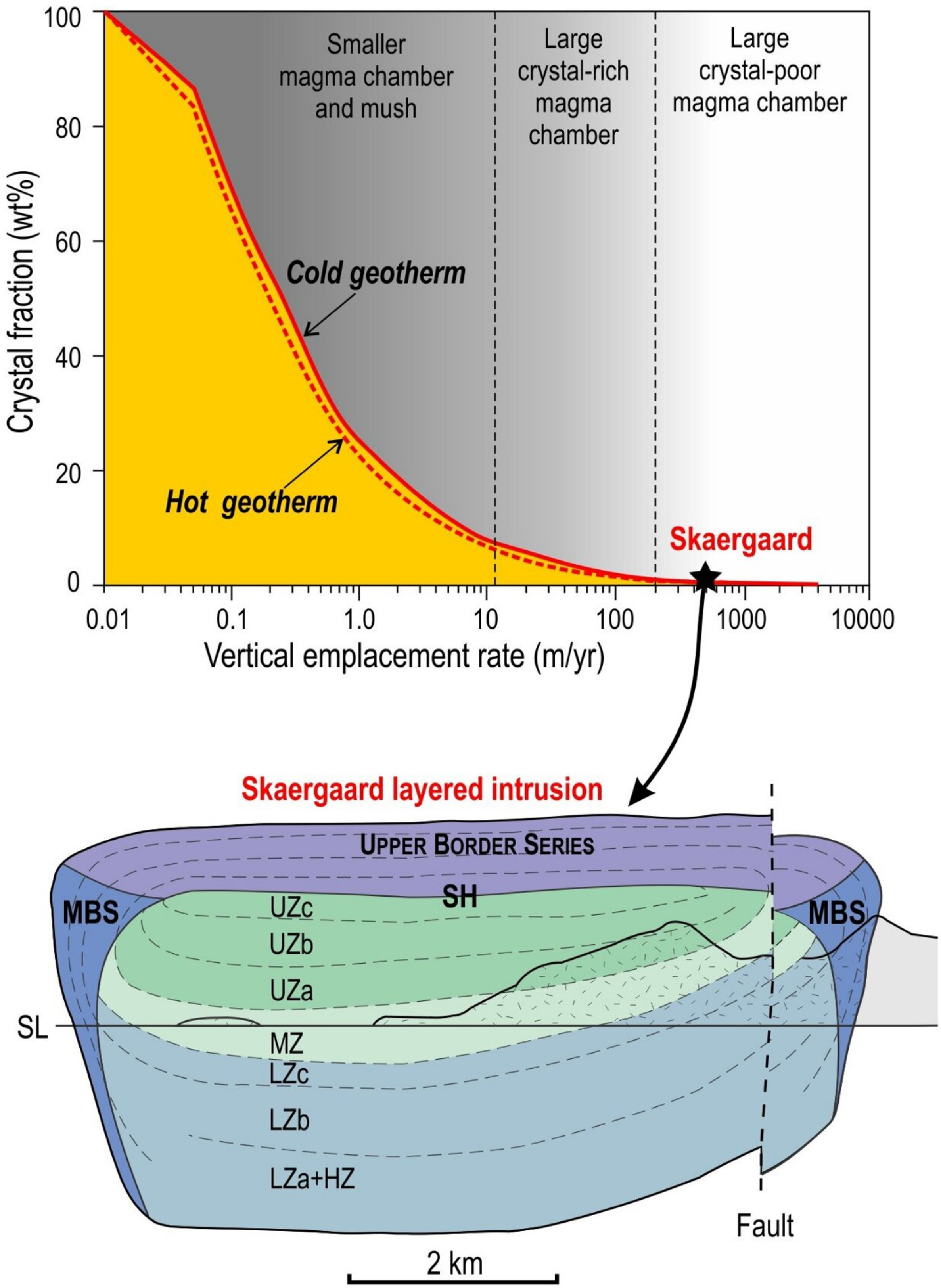
Basaltic magma chambers may grow catastrophically fast

September 26 2022



100
80
60
40
20
0
Crystal fraction (wt%)
0.01
0.1
1.0
10
100
1000
10000
Vertical emplacement rate (m/yr)
Smaller magma chamber and mush
Large crystal-rich magma chamber
Large crystal-poor magma chamber
Cold geotherm
Hot geotherm
Skaergaard
Skaergaard layered intrusion
UPPER BORDER SERIES
SH
MBS
UZc
UZb
UZa
SL
MZ
LZc
LZb
LZa+HZ
MBS
Fault
2 km

Numerical simulations indicating that the minimum vertical emplacement rate for the Skaergaard magma chamber in Greenland is of the order of several 100s to a few 1000s m/yr. Credit: *Science Advances* (2022). DOI: 10.1126/sciadv.abq0394

An international group of researchers involving geologists from Wits University (Prof. Rais Latypov and Dr. Sofya Chistyakova) in Johannesburg have come up with an unexpected conclusion that basaltic magma chambers can grow extremely rapidly—in months to years—making these chambers remarkable intrusive equivalents of caldera-forming eruptions associated with the Large Igneous Provinces. This research was published as a paper in *Science Advances*.

Professor Rais Latypov says that "the vertical rate at which magma chambers grow via magma emplacement is highly debated. Based on high-precision zircon dating and surface deformation measurements, most plutons are currently thought to be emplaced very slowly (a few cm/year). Such slow rates are, however, difficult to reconcile with the existence of large, well-differentiated intrusions which appear to form only if emplacement rates are very high. A key question we tried to address is which rate of magma emplacement is required to keep the growing chamber entirely molten?"

To answer this question, the researchers used a novel approach taking the classical Skaergaard intrusion in Greenland which started crystallizing from all margins inwards only after it had been completely filled with nearly crystal-free magma.

"This fundamental physical constraint provides a unique opportunity to estimate the minimum rate of magma emplacement that was required to keep the Skaergaard magma body in a largely molten state (

Citation: Basaltic magma chambers may grow catastrophically fast (2022, September 26) retrieved 7 May 2024 from https://phys.org/news/2022-09-basaltic-magma-chambers-catastrophically-fast.html