# Large-strain elastoplastic formulations for host-inclusion systems with applications to elasto-thermobarometry and geodynamic models

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Rocks and minerals experience a variety of pressures and temperatures during geological processes
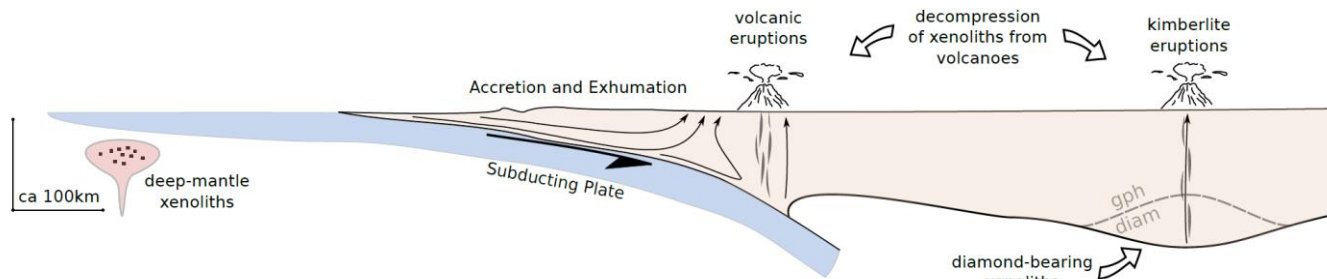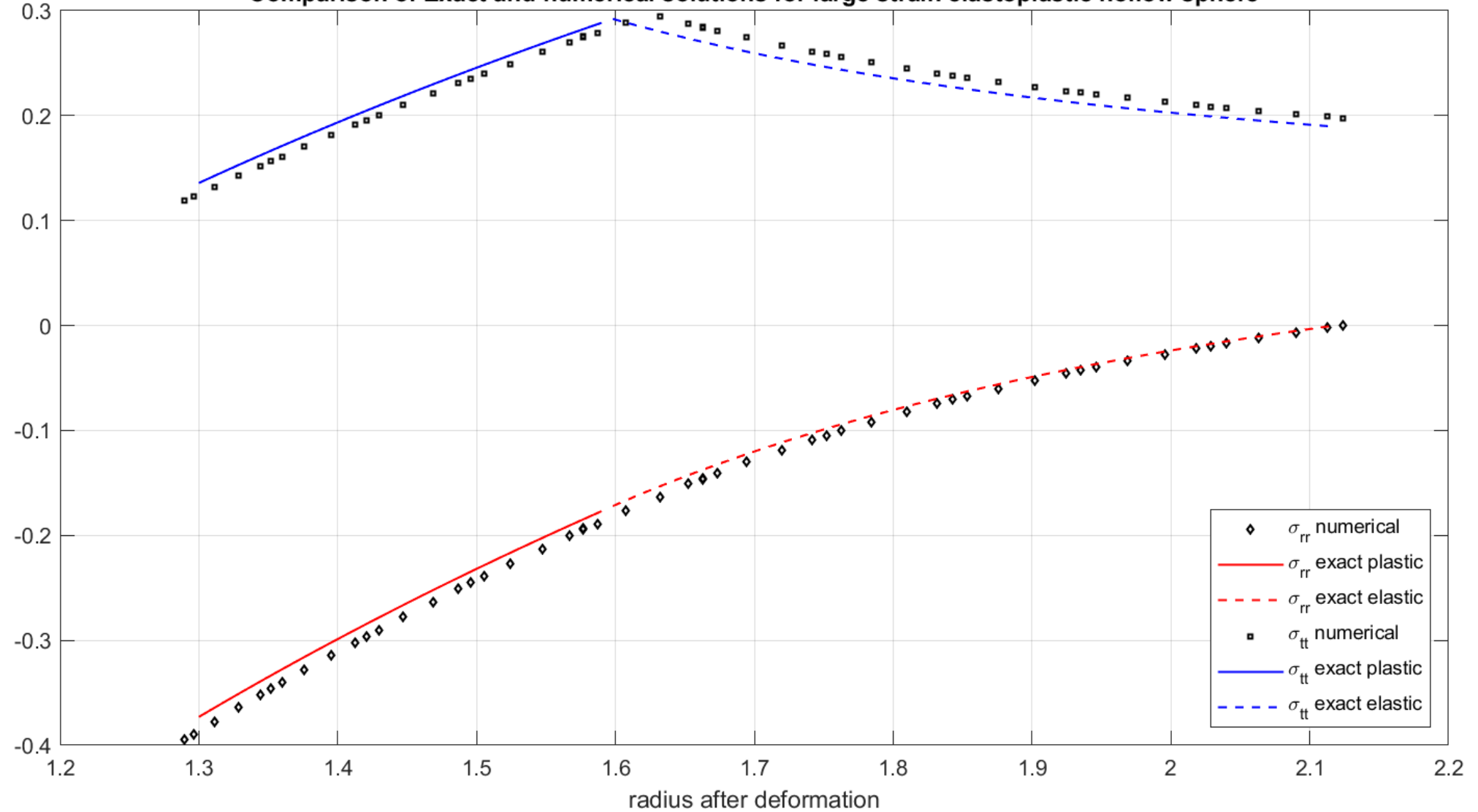

In large pressure ranges, the elastic strain of minerals can be non-linear.
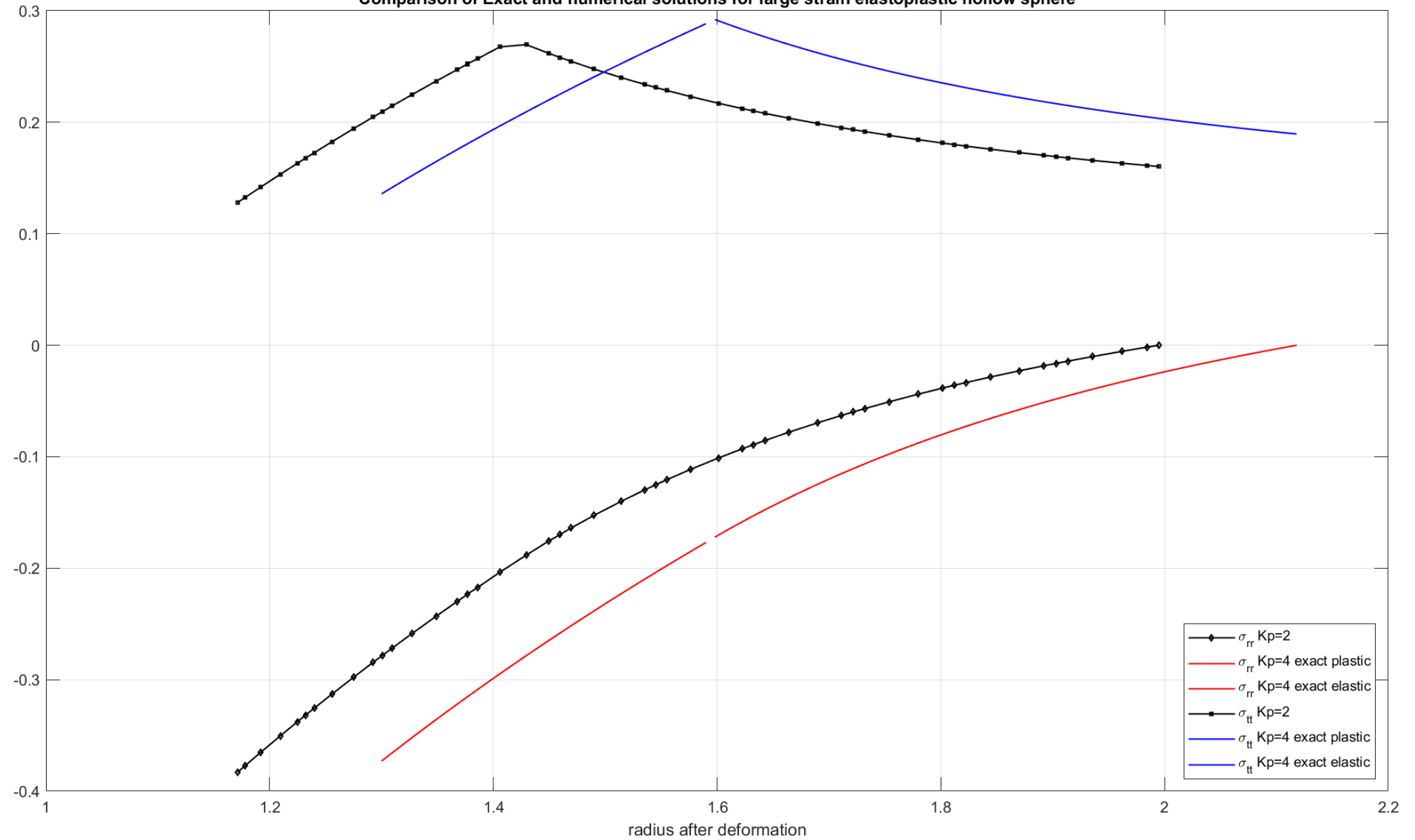
However, due to the large elastic moduli of minerals, small uncertainty in elastic strains can lead to large errors in pressure-stress calculations.
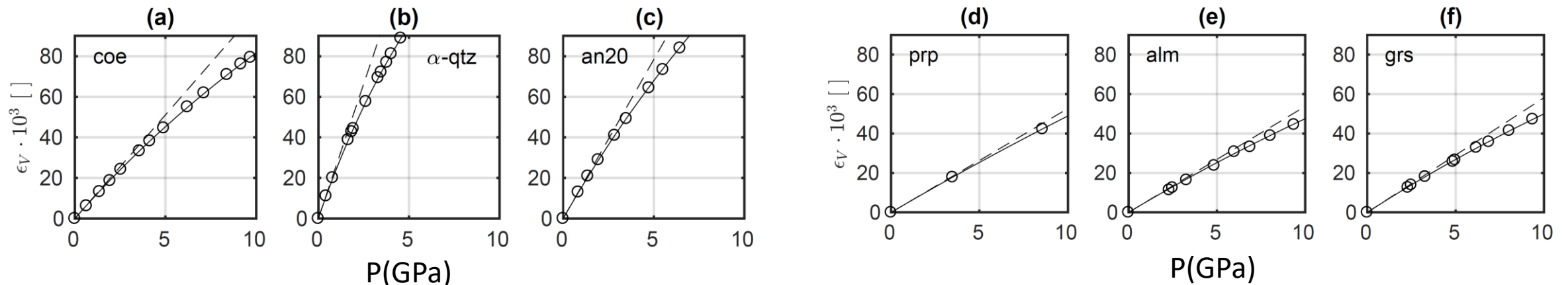
Comparison of Exact and numerical solutions for large strain elastoplastic hollow sphere

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radius after deformation

Legend:
- σ_{rr} Kp=2
- σ_{rr} Kp=4 exact plastic
- σ_{rr} Kp=4 exact elastic
- σ_{tt} Kp=2
- σ_{tt} Kp=4 exact plastic
- σ_{tt} Kp=4 exact elastic

Such problems have implications for larger-scale models that consider melting/phase transitions and large volumetric effects
(see Kiss et al.,
https://meetingorganizer.copernicus.org/EGU22/EGU22-8708.html)

Conclusions:

- We have shown the influence on the large-strain (geometrical non-linearity) and non-linear EOS (material non-linearity) on the elasto-plastic Lame problem.

- Due to the high strain that can be developed, simple solutions may not be adequate.

- Analytical solutions can serve as benchmarks for the next-generation geodynamic-model formulations