

HAAKON FOSSEN

CURRICULUM VITAE



Nationality: Norwegian

Born: Dec. 26, 1961

Position: Professor of geology
University of Bergen, Department of Geoscience, Box 7803
N-5020 Bergen, Norway (haakon.fossen@geo.uib.no).

Education: *Doctor of Philosophy* (PhD) in structural geology, June 1992, University of Minnesota. Advisors: Prof. Peter J. Hudleston, Christian Teyssier, and Timothy B. Holst.
Cand. scient. degree in geology, University of Bergen, Feb. 1986. Advisors: Prof. Brian A. Sturt and Asbjørn Thon.
Cand. mag. degree in geology, University of Bergen, 1984.

Website: folk.uib.no/nglhe

Appointments:

1996-present: Professor of Geology, University of Bergen
2005-2013: Principal Researcher (adjunctive 20% position), Centre of Integrated Petroleum Research, University of Bergen.

1992-1996: Geophysicist, senior geologist, Statoil ASA
1989-1992: PhD scholarship recipient, NAVF (the Norwegian Research Council for Science and the Humanities), University of Minnesota, USA ¹.

1988-1989: Staff geologist, Statoil.

1987-1988: Social service, Geological Survey of Norway ¹.

1986-1987: Geophysicist, Statoil.

1986: Research assistant, Dept. of Geology, University of Oslo.

Sabbaticals:

Utah State University (2009-2010).

University of Utah (2002-2003).

Fields of research:

Salt tectonics: North Sea, W African/E South American margins, Paradox basin (Utah).

Caledonides: Creation and destruction (extensional collapse) of the Caledonian orogen in Scandinavia. Field studies supplied with K-Ar and Ar-Ar isotope work.

Post-Caledonian deformation: Studies of brittle deformation structures in SW Norway by means of field, AFT and isotope analysis.

North Sea rift system: Evolution of the northern North Sea rift. Seismic interpretation, core studies. Regional and reservoir-scale structural geology.

Deformation of siliclastic rocks: Notably highly porous sandstones in Utah, Colorado and Nevada, with focus on subseismic structures (deformation bands) and fault geometry.

Funded ongoing projects:

Uplift, burial and fault reactivation across the Norwegian margin: a Viking Graben – Utsira High – Haugesund – Hardangervidda thermochronological transect. VISTA funded. With J. Jacobs and Anna Ksienzyk

MultiRift: Petromax/Statoil funded. With R. Gawthorpe, R. Huismans, P. Cowie, A. Rotevatn. J.I. Faleide and others.

COPS (Contraction of porous sandstones): Statoil/CIPR funded. With A. Rotevatn, R. Soliva.

Impact: Petromax, P.I. Anita Torabi.

Graduate students:

Cand. mag./Master students:

Astri Rørnes (1994), Paul Valle (1998), Petter Bjørgen (1998), Bjørn Cato Ellingsen (1999), Alf E. Torgersen (not completed), Magne Tillung (2000), Tord Erlend Skjeie Johansen (2000), Kristin Bergseth (2002), Petrine Skjervheim (2002), Kari-Janne Høyland (2003), Karoline Aga (2003), Ole Barstad (2003), Tor Svendsen (2009), Mari M. Schjeldsøe Berg (2012), Oliver Queck² (2012), Eivind Susort² (2013), Jon Rasmussen (2013), Christian Rønnevik (2013), Daniel Åsheim² (2013), Maiken Haugvaldstad² (2014), Christine Andersen² (2014), Elisa Christensen² (2014), Christine Andersen (2014), Marita Thommassen (2015), Ragnhild Tunheim (2015), Mette Lundberg (2015), Linn Heienberg (2015), Maria Seim (2015), Marie Djupevåg Eri (2015), Margrethe Sæterdal Bøyum (2015), Martine Johnsen (2015), Ester Cobles (2015),

¹. On leave from Statoil. ² Co-adviser.

Ingvild Blækkan (2016), Renate Eimind Tveit (2016), Synne Skaar Ågotnes (2016), Marte Refvem (2016), Johannes Vik Seljebotten (2016).

PhD students:

Jonny Hesthammer: Dr. scient. thesis on the structural geology of the Gullfaks Field, northern North Sea. Dr. scient. 1999.

Øystein Larsen: Dr. scient. thesis on post-Caledonian evolution of W. Norway with emphasis on paleostress history. Dr. scient. 2001.

Atle Rotevatn: Tectonic deformation and fault interaction in porous siliclastic rocks, with particular emphasis on relay ramps. PhD 2007.

Vegard V. Vetti: Structural development of the Håsteinen Devonian Massif, its Caledonian substrate and the subjacent Nordfjord-Sogn Detachment Zone. Dr. scient. 2008.

Anita Torabi: Deformation bands in porous sandstones, their microstructure and petrophysical properties. PhD 2008.

Tord Erlend Skeie Johansen: Extensional deformation of sandstone reservoirs.

Anna Ksienzyk²: From mountains to basins: geochronological case studies from southwestern Norway, Western Australia and East Antarctica. PhD 2012

Vaneeda Allken²: Styles of rift interaction: a three-dimensional numerical study.

Elin Skurtveit²: sandstone deformation experiments. ault interaction.

Anette Tvedt²: Salt tectonics. 2011- 2014.

Luisa Fernanda Zuluaga Valencia: Contractual deformation of porous sandstones. 2011-2014.

Antje Lenhart²: Tectono-stratigraphic evolution of multi-phase rift basins. Main advisor: Christopher Jackson. Institution: Imperial College.

Rosa Polanco-Ferrer: Northern North Sea rift system, with emphasis on the Tampen area.

Chao Deng (PhD, U of Bergen): North Sea Rift, modeling.

Editorial experience:

Advisory editor, *J. Geological Society of London*, from 2009.

Subject Editor, *J. Geological Society*, 2001-2004.

Editorial Board, *Journal of Structural Geology*, from 1999.

Editorial Board member, *Tectonophysics*, from 1998.

Selected publications:

Complete list: folk.uib.no/nglhe/Publications.html

Fossen, H. 2010. *Structural geology*. Cambridge University Press. ISBN 978-0-521-51664-8. 463 pp.

- (10) Fossen, H. 1992: The role of extensional tectonics in the Caledonides of South Norway. *Journal of Structural Geology*, **14**, 1033-1046.
- (18) Fossen, H. & Tikoff, B. 1993: The deformation matrix for simultaneous simple shearing, pure shearing, and volume change, and its application to transpression/transension tectonics. *Journal of Structural Geology* **15**, 413-422.
- (24) Fossen, H. & Rørnes, A. 1996: Properties of fault populations in the Gullfaks Field, northern North Sea. *Journal of Structural Geology* **18**, 179-190.

- (25) Fossen, H. & Gabrielsen, R.H. 1996: Experimental modeling of extensional fault systems. *Journal of Structural Geology* **18**, 673-687.
- (35) Fossen, H. & Hesthammer, J. 1998: Structural geology of the Gullfaks Field. In: Coward, M.P., Johnson, H. & Daltaban, T.S. (eds.), *Structural geology in reservoir characterization*, *Geol. Soc. Lond. Spec. Publ.*, **127**, 231-261.
- (45) Fossen, H., Odinsen, T., Gabrielsen, R.H. & Færseth, R.B. 2000: Detachments and low angle faults in the northern North Sea rift system. In: Nøttvedt, A. et al. (eds.), *Dynamics of the Norwegian margin*. *Geol. Soc. Lond. Spec. Publ.* **167**, 105-131.
- (47) Fossen, H. 2000: Extensional tectonics in the Caledonides: synorogenic or postorogenic? *Tectonics* **19**, 213-224.
- (64) Fossen, H. & Hurich, C.A. 2005: The Hardangerfjord Shear Zone in SW Norway and the North Sea: a large-scale shear zone in the Baltic crust. *Journal of the Geological Society* **162**, 675-687.
- (66) Fossen, H., Johansen, T.E.S., Rotevatn, A. & Hesthammer, J.: Fault interaction in porous sandstones. *AAPG Bulletin* **89**, 1593-1606.
- (68) Rotevatn, A., Fossen, H., Hesthammer, J., Aas, T.E. & Howell, J. 2007: Are relay ramps conduits for fluid flow? Structural analysis of a relay ramp in Arches National Park, Utah. In: Lonergan, L., Jolly, R.H.J., Rawnsley, K. & Sanderson, D. (eds.), *Fractured reservoirs*. *Geol. Soc. Lond. Spec. Publ.* **270**, 55-71.
- (70) Fossen, H., Schultz, R., Shipton, Z. & Mair, K. 2007: Deformation bands in sandstone – a review. *Geol. Soc. Lond.* **164**, 755-769.
- (71) Fossen, H. & Bale, A. 2007: Deformation bands and their influence on fluid flow. *AAPG Bull.* **91**, 1685-1700.
- (72) Johansen, T.E.S. & Fossen, H. 2008: Internal deformation of fault damage zones in interbedded siliclastic rocks. In: Wibberley, C. A. J., Kurtz, W., Imber, J., Holdsworth, R. E. & Collettini, C. (eds), *The internal structure of fault zones: implications for mechanical and fluid-flow properties*. *Geol. Soc. Lond. Spec. Publ.* **299**, 35-56.
- (73) Schultz, R.A. & Fossen, H. 2008: Terminology for structural discontinuities. *AAPG Bulletin* **92**, 853-867.
- (74) Gee, D.G., Fossen, H., Henriksen, N. and Higgins, A.K. 2008: From the early Paleozoic platforms of Baltica and Laurentia to the Caledonide orogen of Scandinavia and Greenland. *Episodes* **31**, 44-51.
- (77) Schultz, R.A., Soliva, R., Fossen, H., Okubo, C.H. & Reeves, D.M. 2008: Displacement-length scaling relations for geologic structural discontinuities and implications for near-tip processes. *Journal of Structural Geology* **30**, 1405-1411.
- (85) Fossen, H., Schultz, R.A., Rundhovde, E., Rotevatn, A. & Buckley, S.J. 2010: Fault linkage and graben transfer in Canyonlands and the North Sea Viking Graben: a comparison. *AAPG Bulletin* **94**, 597-613.
- (86) Fossen, H. 2010: Extensional tectonics in the North Atlantic Caledonides: A regional view. In: Law, R., Butler, R., Holdsworth, B., Krabbendam, M. & Strachan, R.A. (eds), *Continental tectonics and mountain building: the legacy of Peach and Horn*. *Geological Society Special Publication* **335**, 767-793.
- (89) Rotevatn, A. & Fossen, H. 2011: Simulating the effect of subseismic fault tails and process zones in a siliclastic reservoir analogue: implications for aquifer

- support and trap definition. *Marine and Petroleum Geology* **28**, 1648-1662.
- (90) Fossen, H., Schultz, R. & Torabi, A. 2011: Conditions and implications for compaction band formation in the Navajo Sandstone, Utah. *Journal of structural geology* **33**, 1477-1490.
- (93) Vetti & Fossen 2012: Origin of contrasting Devonian supradetachment basin types in the Scandinavian Caledonides. *Geology*, **40**, 571-574.
- (94) Allken, V., Huismans, R., Fossen, H., Thieulot, C. 2013: 3D numerical modelling of graben interaction and linkage: a case study of the Canyonlands grabens, Utah. *Basin Research* **25**, 14 p. doi: 10.1111/bre.12010.
- (95) Gregory Ballas, G., Soliva, R., Sizunb, J-P., Fossen, H., Benedicto, A., & Skurtveit, E. 2013: Shear-enhanced compaction bands formed at shallow burial conditions; implications for fluid flow (Provence, France). *Journal of Structural Geology* **47**, 3-15.
- (96) Torabi, A., Fossen, H., & Braathen, A. 2013: Insight into petrophysical properties of deformed sandstone reservoirs. *AAPG Bulletin* **97**, 619-637.
- (97) Schultz, R.A., Klimczak, C., Fossen, H., Olson, J., Exner, U., Reeves, D.M. & Soliva, R. 2013: Statistical tests of scaling relationships for geologic structures. *Journal of Structural Geology* **48**, 85-94.
- (98) Gordon, S.M., Whitney, D., Teyssier, C. & Fossen, H. 2013: U-Pb dates and trace-element geochemistry of zircon from migmatite hosting eclogite inclusions, Western Gneiss Region, Norway: significance for history of partial melting in continental subduction. *Lithos* **170-171**, 35-53.
- (99) Rotevatn, A., Sandve, T.H., Keilegavlen, E., Kolyukhin, D. & Fossen, H. 2013.: Deformation bands and their impact on fluid flow in sandstone reservoirs: the role of natural thickness variations. *Geofluids*, **13** p. doi: 10.1111/gfl.12030.
- (100) Schueller, S., Braathen, A., Fossen, H. & Tveranger, J. 2013: Spatial distribution of deformation bands in damage zones of extensional faults in porous sandstone: statistical analysis of field data. *Journal of Structural Geology*, **52**-148-162.
- (101) Tvedt, A. B. M., Rotevatn, A., Jackson, C. A. L., Fossen, H. & Gawthorpe, R. L. 2013. Growth of normal faults in multilayer sequences: A 3D seismic case study from the Egersund Basin, Norwegian North Sea. *Journal of Structural Geology* **55**, 1-20.
- (102) Fossen, H., Teyssier, C. & Whitney, D.L. 2013: Trans-tensional folding. *Journal of Structural Geology* **56**, 89-102.
- (103) Ksienzyk, A. K., Dunkl, I., Jacobs, J., Fossen, H., Kohlmann, F. 2014. From orogen to passive margin: constraints from fission track and (U-Th)/He analyses on Mesozoic uplift and fault reactivation in SW Norway. In: Corfu, F., Gasser, D., Chew, D.M. (eds.) *New Perspectives on the Caledonides of Scandinavia and Related Areas*. Geological Society, London, Special Publications **390**, <http://dx.doi.org/10.1144/SP390.27>.
- (104) Folkestad, A., Odinsen, T., Fossen, H. & Pearce, M.A. 2014: Tectonic influence on the Jurassic sedimentary architecture in the northern North Sea with focus on the Brent Group. *IAS Special Publications* (Wiley-Blackwell), in press.
- (105) Fossen, H., Gabrielsen, R.H., Faleide, J.I. & Hurich, C.A. 2014: Crustal stretching in the Scandinavian Caledonides as revealed by deep seismic data. *Geology*, in press doi:10.1130/G35842.1106. Renedo, R., Nachlas, W.O., Whitney, D.L., Teyssier, C., Piazzolo, S., Gordon, S.M. & Fossen, H. 2014: Fabric development during exhumation from ultrahigh-pressure in an eclogite-bearing shear zone, Western Gneiss Region, Norway. *Journal of Structural Geology*, in press.
- (107) Skurtveit, E., Ballas, G., Fossen, H., Torabi, A., Soliva, R., & Peyret, M. : Sand textural control on shear-enhanced compaction band development in poorly-lithified sandstone. *Journal of geological resource and engineering* **2**, in press.

E-learning modules:

19 e-learning modules for my Structural Geology book, available online at <http://folk.uib.no/nglhe/StructuralGeoBook.html>

Books:

- Fossen, H. *Structural Geology*. Cambridge University Press. 463 p.
- Fossen, H. 2008: *Innføring i geologi: stein, mineraler, fosiler og olje*. Fagbokforlaget, 169 p.
- Fossen, H. & Gabrielsen, R.H., 2005, *Strukturgeologi*. Fagbokforlaget, 375 p.

Recognition:

- Nordic Geoscientist Award**, at Nordic Geological Winter Meeting, January 2012
- Outstanding Paper Award 2011**, Structural Geology and Tectonics Division of the Geological Society of America, with Basil Tikoff.
- Geological Society of America Fellow** (elected April 2011).