GMT examples:

# Plotting tectonic/geological content (Fennoscandia)

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## General information

Files containing the coordinates and contours of tectonic units, faults and shear zones (after Wylegalla et al., 1999; Gorbatchev, 2004; Korja & Heikkinen, 2005) used in this example are included in the download package (`scan_tectonic` `scan_STZ` and `scan_shear_zones.dat`, digitized with Didger ® Golden Software, LLC). If you make use of the content presented in this manual please give reference to my disseration in which a slightly modified version of the presented map is included:

> Grund, M. (2019), *Exploring geodynamics at different depths with shear wave splitting*, Karlsruhe Institute of Technology (KIT), doi:10.5445/IR/1000091425.

## 1 Plotting the map

All content shown in the following is based on the bash-script `Scan_plotcont.gmt` that can be downloaded from https://github.com/michaelgrund/GMT-plotting. If GMT 5.2.1 (or higher, Wessel et al., 2013) is installed on your (Linux) system you can directly reproduce the whole content shown in this manual by running `Scan_plotcont.gmt` via command line. In the following the individual steps to get the final figure are lined out.

### 1.1 Basic settings and map parameters

```
#!/bin/bash

gmtset  MAP_GRID_PEN_PRIMARY  0.3p,dimgrey        \
        PROJ_LENGTH_UNIT          c          \
        MAP_ANNOT_OBLIQUE         30         \
        MAP_ANNOT_OFFSET          5p         \
        MAP_ANNOT_OFFSET_PRIMARY  5p      \
        MAP_ANNOT_OFFSET_SECONDARY  5p    \
        MAP_LABEL_OFFSET  5.5p \
        COLOR_MODEL       rgb       \
        FONT_ANNOT_PRIMARY  10p,Helvetica          \
        FONT_LABEL  8 \
        MAP_FRAME_TYPE  plain \
        MAP_FRAME_WIDTH  2p \
```

```
  MAP_TICK_LENGTH_PRIMARY 5p \
        MAP_FRAME_PEN 3.1p

################################################################################################
# GMT (5.2.1) script to plot geological/tectonic units and shear zones of Fennoscandia
################################################################################################

# 2019, Michael Grund (KIT Karlsruhe, Geophysical Institute),
# Franz Lutz (KIT Karlsruhe, now at University of Auckland, School of Environment)

# Content was partly digitised using Didger (R) (Golden Software, LLC) based on the
# following references:

# Geological units are modified after Fig. 1 of:
#      >> Hoegdahl et al., 2004, Geological Survey of Finland, Special Paper 37 <<
#      >> The Transscandinavian Igneous Belt (TIB) in Sweden: a review of its
#       character and evolution <<
# Tornquist zone is modified from paper:
#      >> Wylegalla et al.,1999, Tectonophysics 314, <<
#      >> Anisotropy across the Sorgenfrei-Tornquist Zone from shear wave splitting <<
# Major shear zones, faults and inferred paleo-subduction zones are modified after
#      Figs. 1 & 2 of:
#      >> Korja & Heikkinen, Precambrian Research 136 (2005) 241-268 <<
#      >> The accretionary Svecofennian orogen-insight from the BABEL profiles <<
#
################################################################################################
# If you use the content of this script or the accompanying files that include the digitised
# geological units etc. please acknowledge GMT, the references listed above as well as my
# PhD thesis (DOI: 10.5445/IR/1000091425) in which a modified version of the generated
# map is included.
################################################################################################

##################################
## settings

# region
projR=3.5/36.5/54/71.5
# projection
projJ=m1:24000000
# output file
ps=Scan_plotcont_MAP.ps

##################################
```

## 1.2 Plot raw map

```

##########
# Fig. 1 # plot geographic content first
##########

pscoast -J$projJ -R$projR -Bx5 -By5 -Wthinnest -Swhite -Dh -P -K -A20/0/1 > $ps

################################################################################################
```

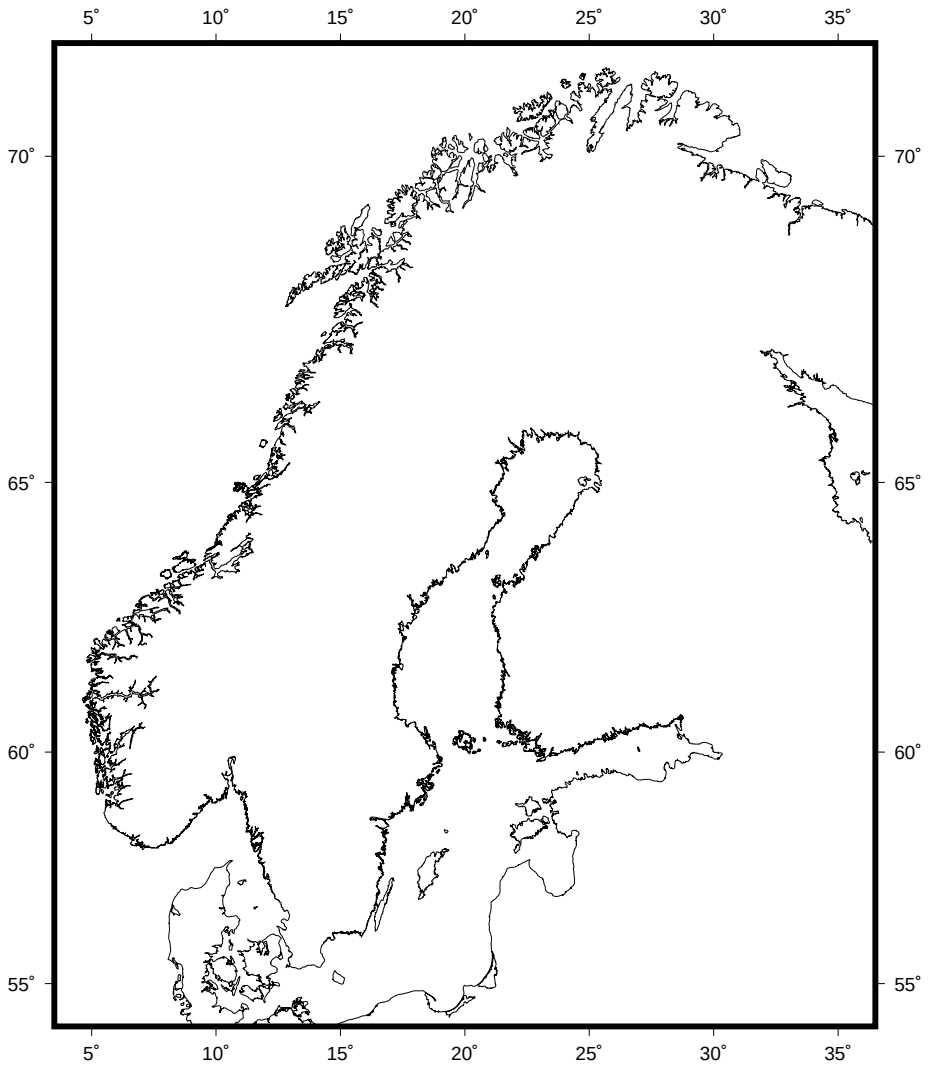


**Figure 1:** Plot a raw map of Fennoscandia.

## 1.3 Add digitized tectonic units

```
##########
# Fig. 2 # plot "raw" geological units
##########

# input file with digitised units
infile=scan_tectonic.dat

# unit colors
col_sveco=248/188/203
col_rapa=darkgray
col_paleo=107/107/148
col_phanero=115/195/128
col_sveconor=238/106/80
col_arch=241/99/106
col_cale=249/190/75
col_TIB=149/116/83

awk '{if ($3 == "Phanerozoic2" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
     -G$col_phanero -P >> $ps
awk '{if ($3 == "Svecofennian" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
     -G$col_sveco -P >> $ps
```

```
awk '{if ($3 == "Rapaviki" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_rapa -P >> $ps
awk '{if ($3 == "Paleoproterozoic" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_paleo >> $ps
awk '{if ($3 == "Phanerozoic" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_phanero >> $ps
awk '{if ($3 == "Sveconorwegian" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_sveconor >> $ps
awk '{if ($3 == "Archean" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_arch >> $ps
awk '{if ($3 == "Caledonides" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_cale >> $ps
awk '{if ($3 == "TIB" || $2 == "") print $0}' $infile |psxy -J -R -O -K \
    -G$col_TIB >> $ps

##############################################################################################
```

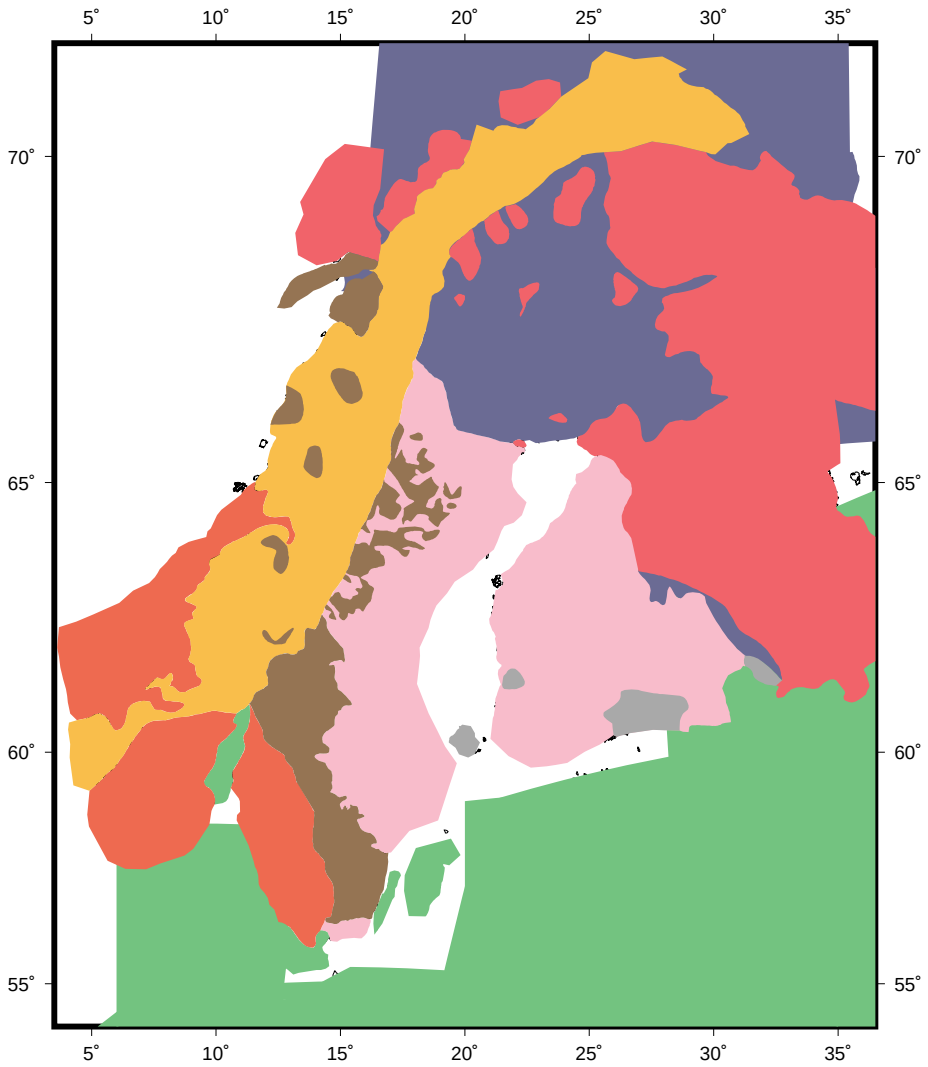


**Figure 2:** Add digitized tectonic units after Gorbatchev (2004).

## 1.4 Plot water areas and national boundaries

```
##########
# Fig. 3 # coastlines etc on top of "geological units" with water areas filled white
##########

pscoast -J -R -Dh -Wthinnest -A20/0/1 -Swhite -O -K >> $ps
## plot again to avoid visible "grid lines" in water areas and add scale bar
pscoast -J -R -Dh -Wthinnest -A20/0/1 -Swhite -N1/0.55p,- -O -K -Lf8.3/70.3/56/400+lkm+jt \
    >> $ps

#############################################################################################
```

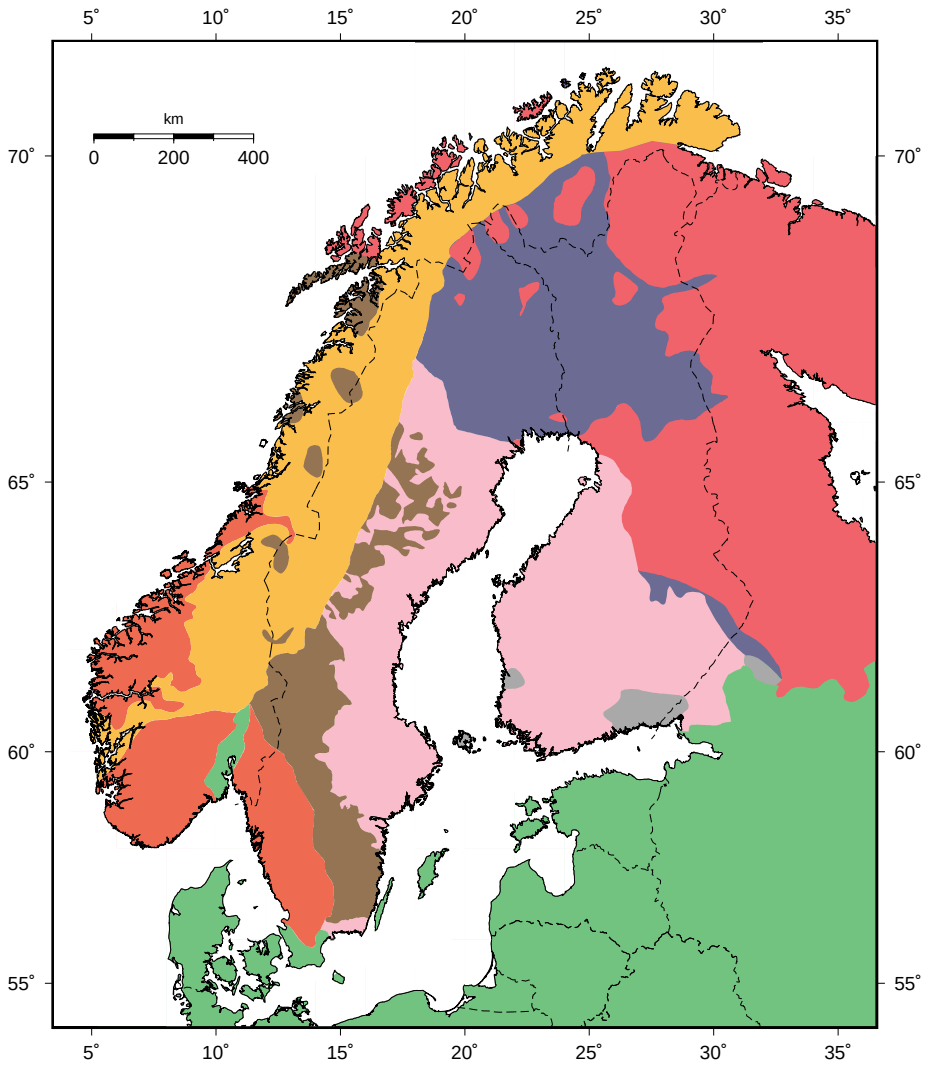


**Figure 3:** Plot water areas on top in white as well as add a scale and national borders.

## 1.5 Plot faults and shear zones

```
##########
# Fig. 4 # plot shear zones etc.
##########

infilefaults=scan_shear_zones.dat
awk 'NR > 4 {print $0}' $infilefaults | psxy -J -R -K -O -W1.1p,black >> $ps

#======================
### plot Tornquist zone
awk 'NR > 4 {print $0}' scan_STZ.dat | psxy -J -R -K -O -W1.1p,black >> $ps

### annotation Tornquist Zone (background transparent, -Gwhite@30)
pstext -R -J -F+f10p,red3 -Gwhite@30 -O -K <<EOF >>$ps
7.9 57.4 STZ
14.5 54.3 TTZ
EOF

#======================
## plot paleo-subductions
awk 'NR > 4 {if ($3 == "subductionzone" && $4 == "1" ) print $0}' $infilefaults | psxy -J -R \
     -K -O -Sf0.2/0.15+t+r -Wthinnest -Gblack >> $ps
awk 'NR > 4 {if ($3 == "subductionzone" && $4 == "2" ) print $0}' $infilefaults | psxy -J -R \
     -K -O -Sf0.2/0.15+t+l -Wthinnest -Gblack>> $ps
awk 'NR > 4 {if ($3 == "subductionzone" && $4 == "3" ) print $0}' $infilefaults | psxy -J -R \
     -K -O -Sf0.2/0.15+t+r -Wthinnest -Gblack >> $ps
awk 'NR > 4 {if ($3 == "subductionzone" && $4 == "4" ) print $0}' $infilefaults | psxy -J -R \
     -K -O -Sf0.2/0.15+t+r -Wthinnest -Gblack >> $ps
awk 'NR > 4 {if ($3 == "subductionzone" && $4 == "5" ) print $0}' $infilefaults | psxy -J -R \
     -K -O -Sf0.2/0.15+t+l -Wthinnest -Gblack >> $ps
#======================
#annotation countries
pstext -R -J -F+f14p -O -K -Gwhite@30 <<EOF >>$ps
26.3 61.3 Finland
15.5 63.5 Sweden
5.8 60.7 Norway
8 55 Denmark
33 60 Russia
EOF
#======================

#############################################################################################
```

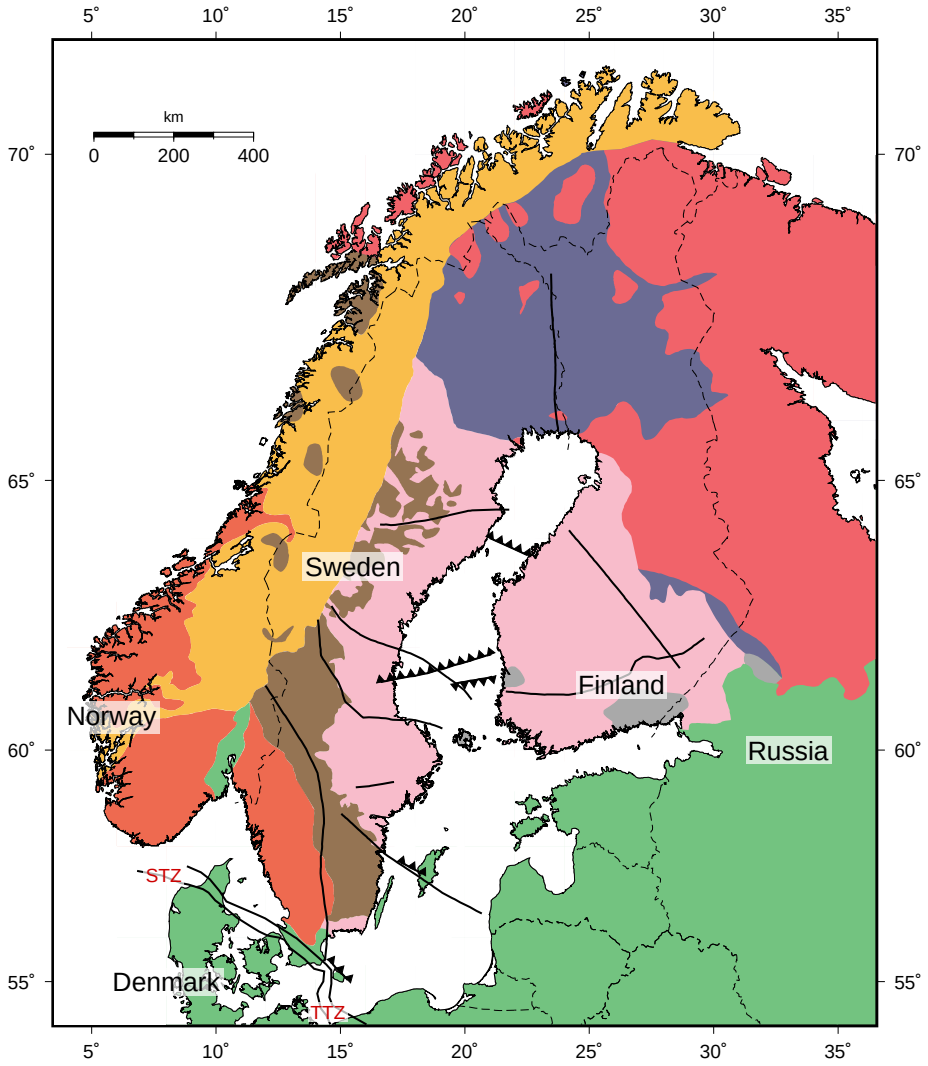


**Figure 4:** Add annotations, digitized faults and shear zones after Wylegalla et al. (1999) and Korja & Heikkinen (2005).

## 1.6 Plot legend

```
##########
# Fig. 5 # plot legend in right lower corner
##########

pslegend -R -J -Dx8.5/0.2/6.58c/2.4c/BL -F+r+plinen+glinen+gwhite+pblack+pthin -O -K \
    << EOF >> $ps
G 0.1c
N 2
S 0.35c s 0.45c  $col_sveco     thinnest              0.75c Svecofennian
S 0.55c s 0.45c  $col_rapa      thinnest              0.95c Rapaviki
G 0.1c
S 0.35c s 0.45c  $col_paleo     thinnest              0.75c Paleoproterozoic
S 0.55c s 0.45c  $col_phanero   thinnest               0.95c Phanerozoic
G 0.1c
S 0.35c s 0.45c  $col_sveconor     thinnest            0.75c Sveconorwegian
S 0.55c s 0.45c  $col_arch         thinnest            0.95c Archean
G 0.1c
S 0.35c s 0.45c  $col_cale         thinnest            0.75c Caledonides
S 0.55c s 0.45c  $col_TIB          thinnest            0.95c TIB
```

```
G 0.01i
EOF



########################
#gv $ps &
ps2pdf $ps $ps.pdf
pdfcrop $ps.pdf $ps.pdf
########################
```

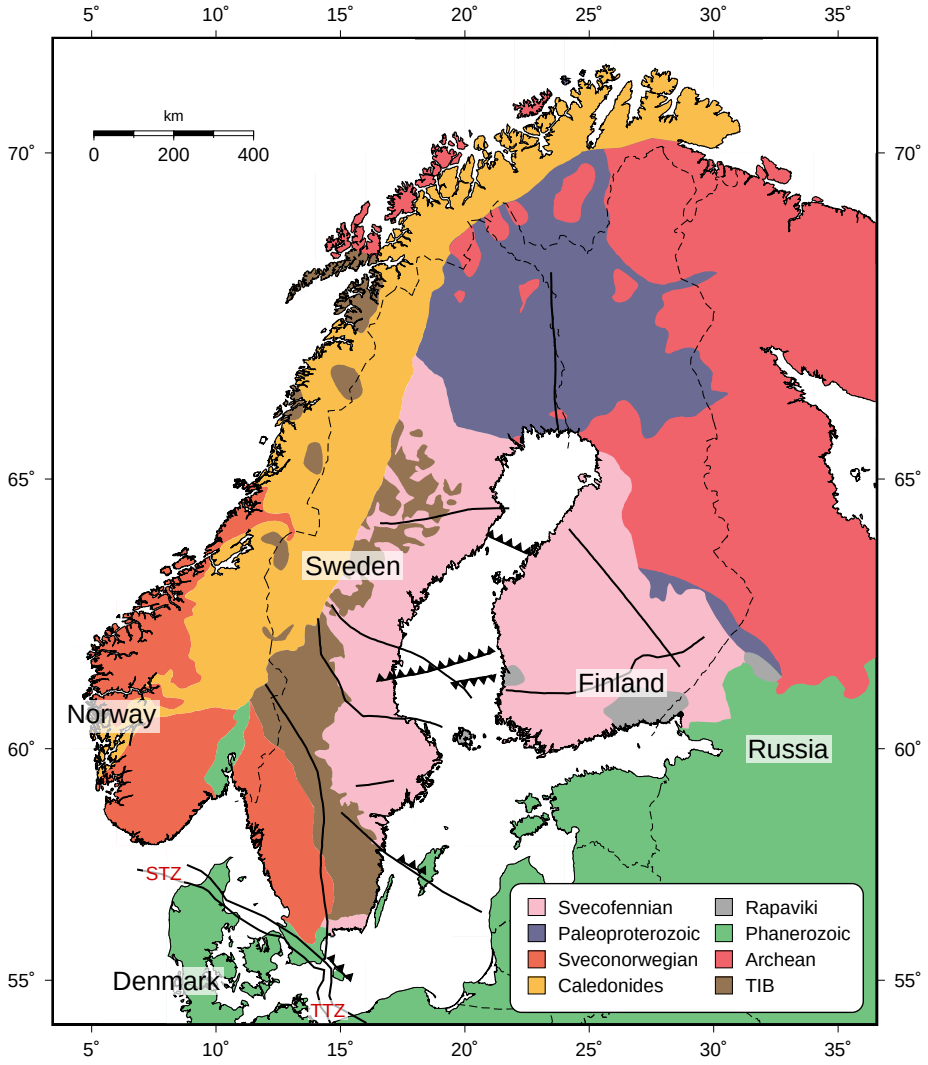


**Figure 5:** Add a legend in lower right corner.

## References


Gorbatchev, R., 2004. The Transscandinavian Igneous Belt – introduction and background, in *The Transscandinavian Igneous Belt (TIB) in Sweden: a Review of Its Character and Evolution. Geological Survey of Finland, Special Paper*, vol. 37, pp. 9–15, eds Högdahl, K., Andersson, U., & Eklund, O., Geological Survey of Finland.

Korja, A. & Heikkinen, P., 2005. The accretionary Svecofennian orogen-insight from the BABEL profiles, *Precambrian Res.*, **136**, 241–268.

Wessel, P., Smith, W. H. F., Scharroo, R., Luis, J., & Wobbe, F., 2013. Generic Mapping Tools: Improved version released, *Eos Trans. AGU*, **94(45)**, 409–420.

Wylegalla, K., Bock, G., Gossler, J., & Hanka, W., 1999. Anisotropy across the Sorgenfrei-Tornquist Zone from shear wave splitting, *Tectonophysics*, **314**, 335–350.