

---

# Understanding the variation of bedrock material properties with metamorphic conditions

SGU Forskning och Utveckling dag

November 11, 2020

Cindy Lizeth Urueña, PhD student



LUND UNIVERSITY

---

# Agenda

01 Team

02 Introduction

03 Results from last year

04 Our findings

05 What's next

# 01 Team

Cindy Lizeth Urueña Suarez  
**PhD student**



Main supervisor  
Charlotte Möller  
LUND UNIVERSITY



Co-supervisors  
Jenny Andersson & Mattias Göransson  
GEOLOGICAL SURVEY OF SWEDEN, UPPSALA



Jan Erik Lindqvist  
RESEARCH INSTITUTES OF SWEDEN AB



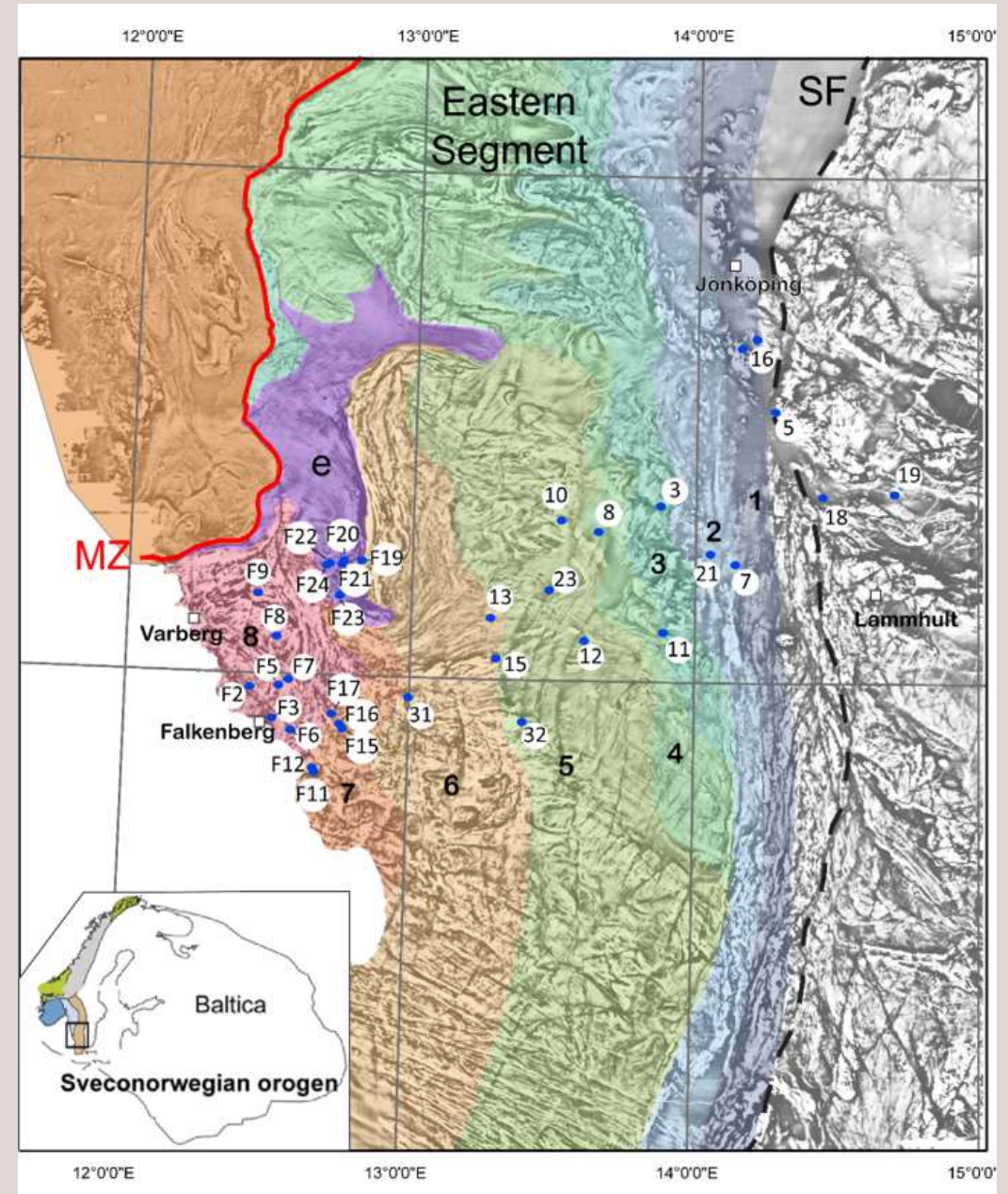
Urban Åkeson  
SWEDISH TRANSPORT ADMINISTRATION



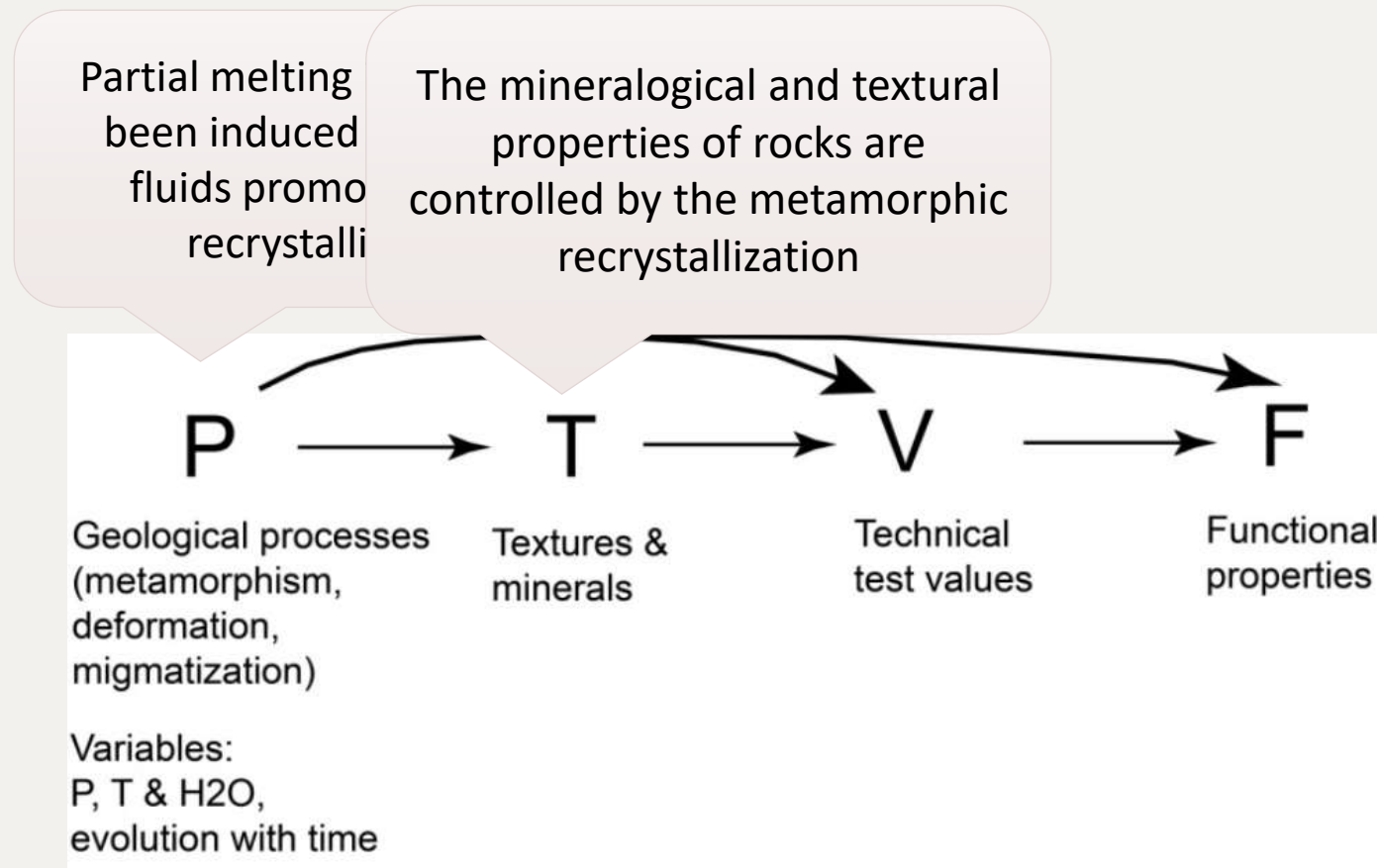
# 02 Introduction

The aim of this research project is to assess the variations of technical properties (mechanical behaviour) with the metamorphic conditions (pressure, temperature, time, deformation), in the Precambrian shield in southern Sweden (Eastern Segment of the Sveconorwegian Province).

This area offers a possibility to do large scale studies of the systematic dependence of functional properties of granitic (and mafic) aggregates on metamorphism, deformation, and partial melting.



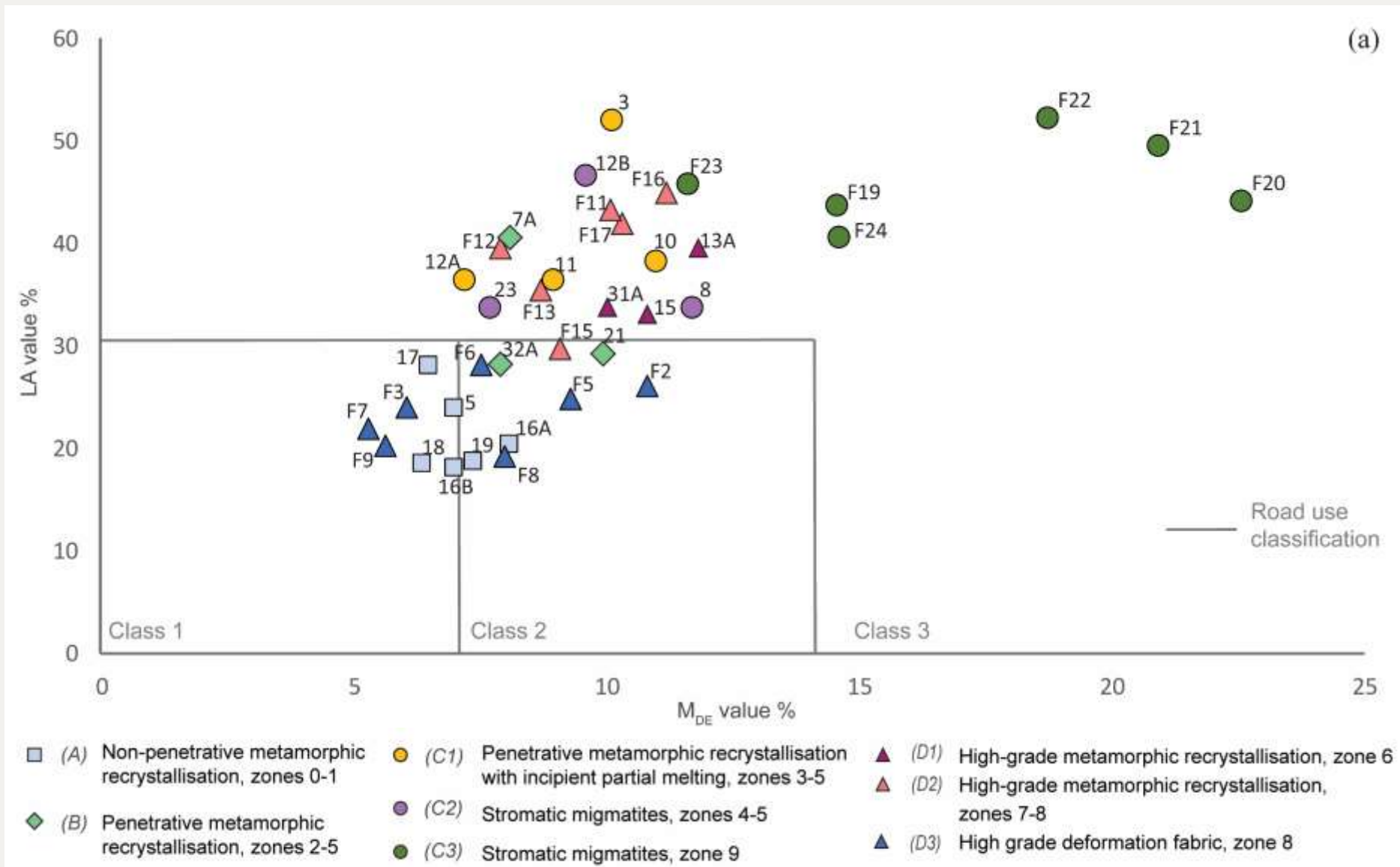
# Towards a sustainable aggregate production



- ✓ Field relations, and macrofabrics
- ✓ Petrographic parameters
- ✓ Geochemistry

03 Results from last year

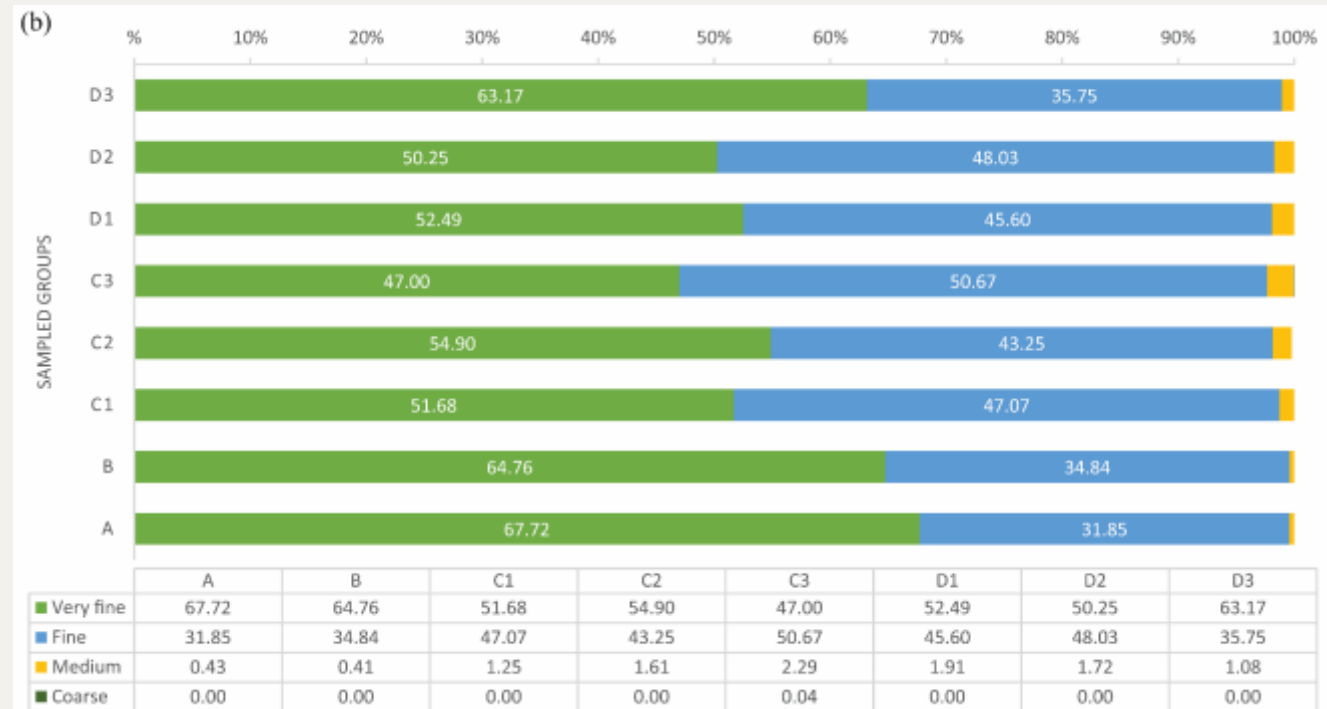
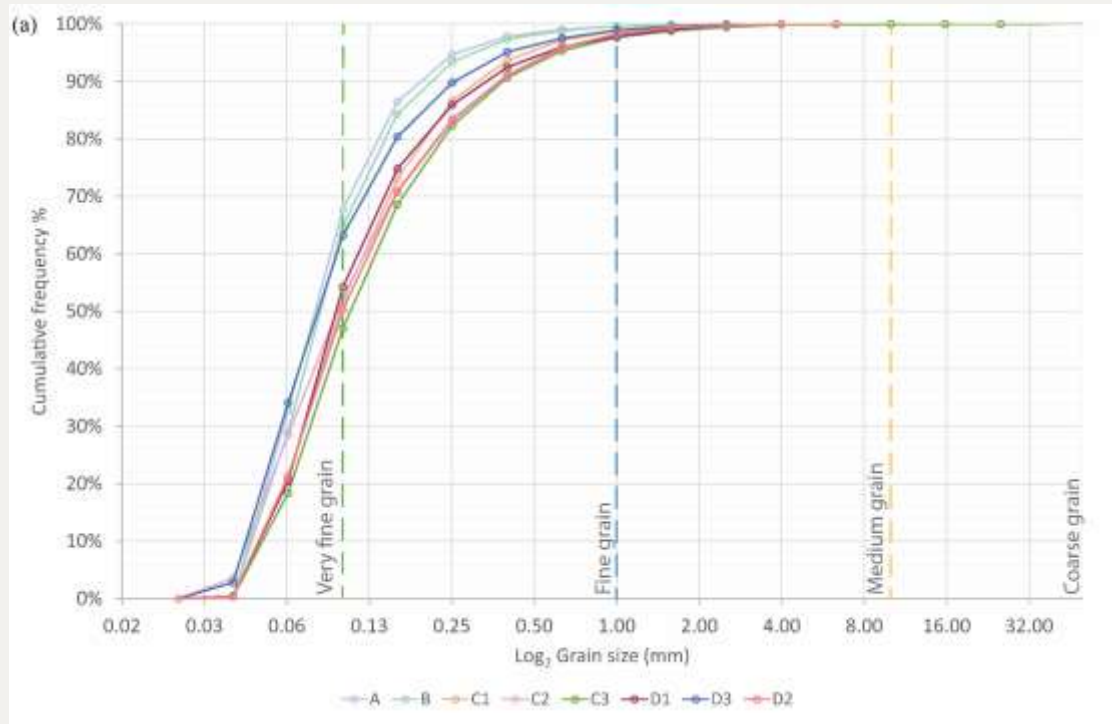
# Technical Properties



# Grain size distribution

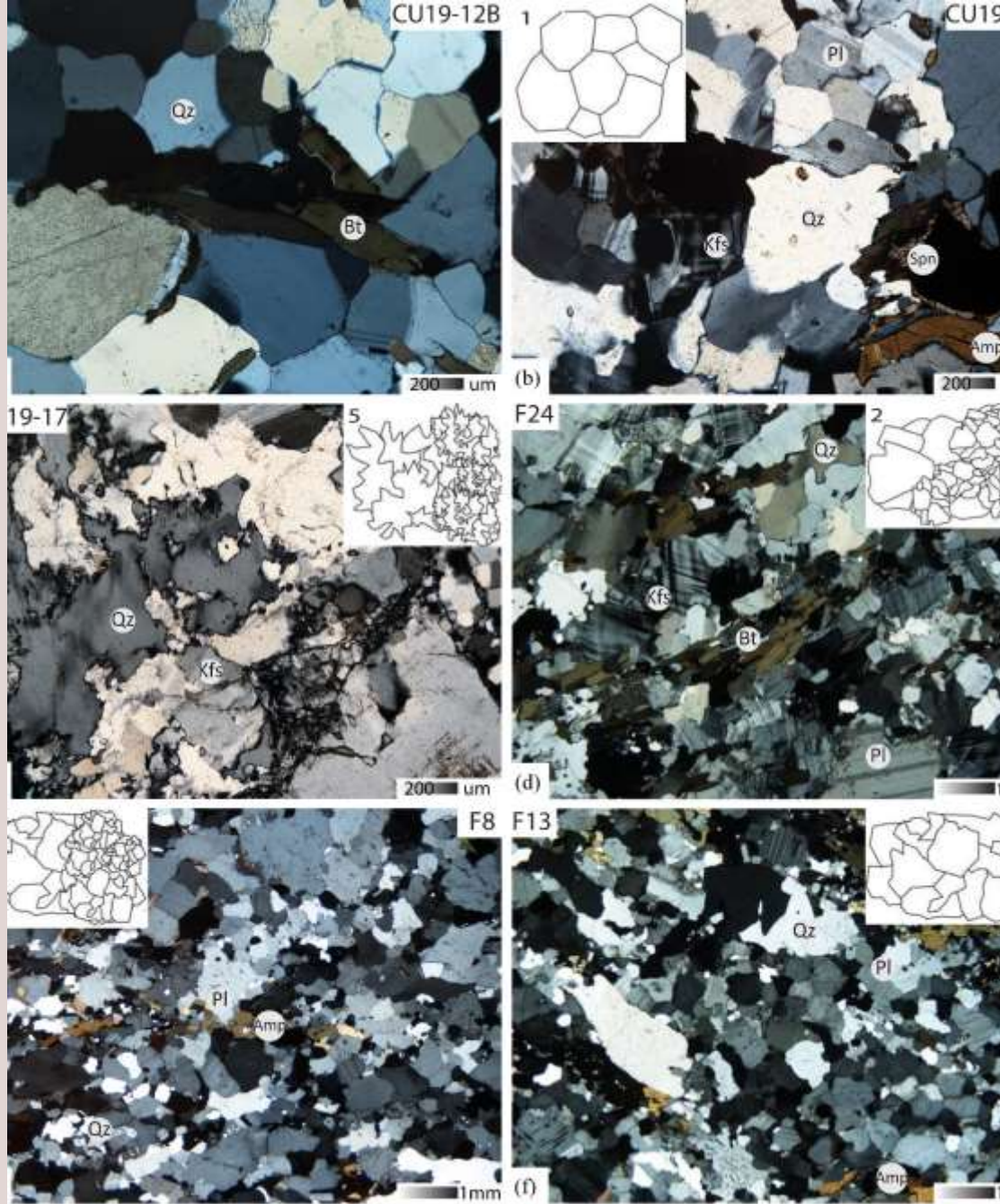
Cumulative grain size distribution.

The percentage of very fine grains,  $\leq 0.10$  mm in size, is highest in groups A, B and D3 at 63-65%.

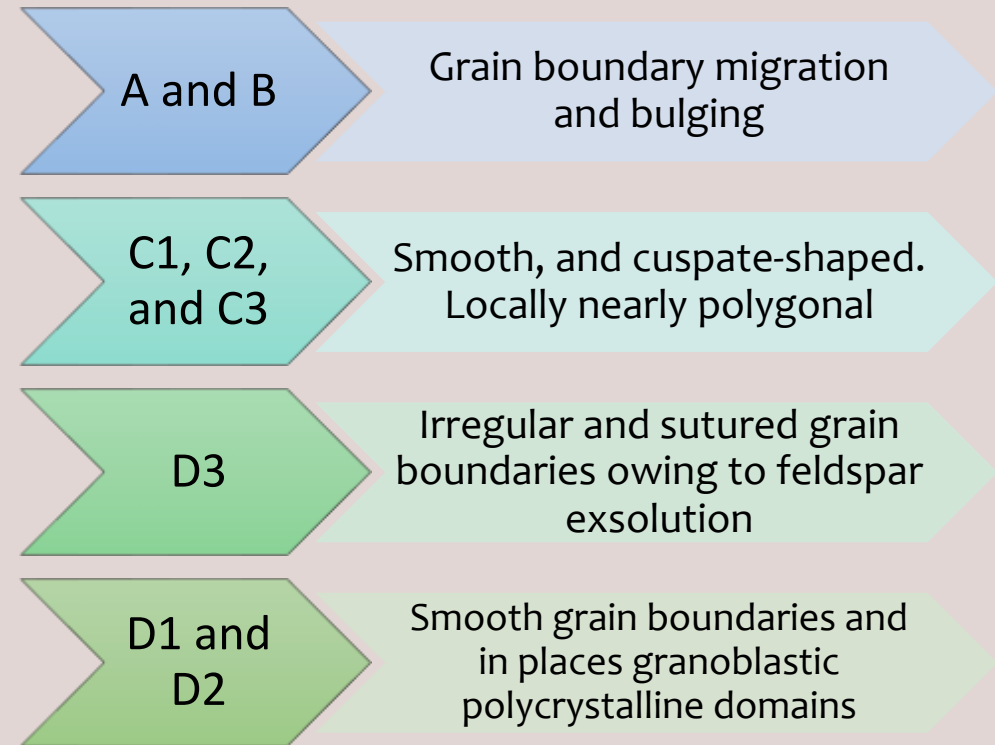


➤ Bar charts and data table showing the proportions of different grain size.





# Grain boundary complexity

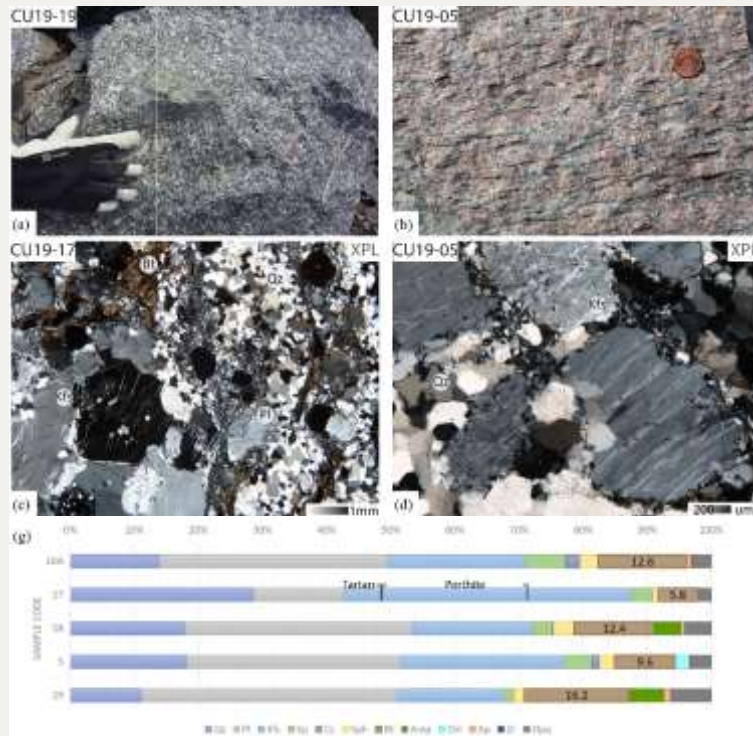


- Grain boundary morphologies in representative samples of the different groups. The schematic figures illustrate assessment of the grade of irregularity of grain boundaries, numbered according to the scale (Hellman, Åkesson, & Eliasson, 2011).

# 04 Our findings

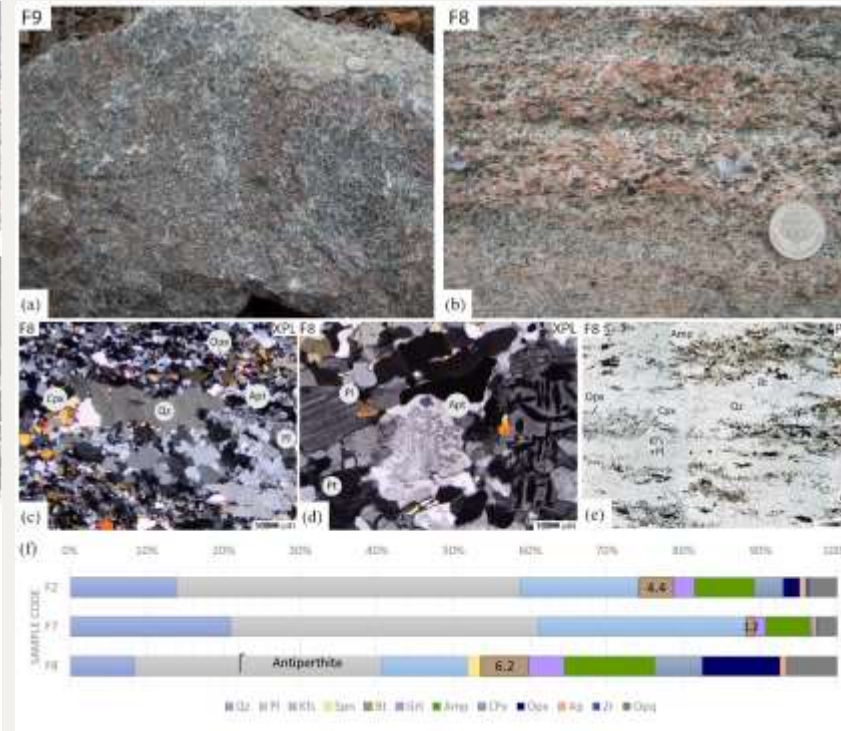
# Main differences

## Group A



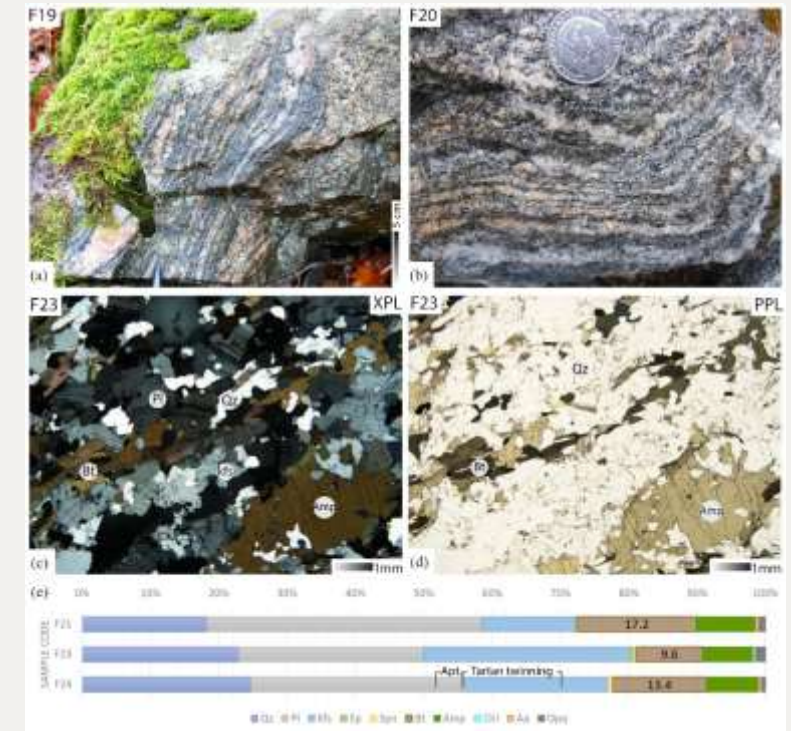
Granite, Qz-monzonite, Qz-monzodiorite

## Group D3



Granite to Qz-monzodiorite

## Group C3



Granite, granodiorite, tonalite

---

# Points for discussion

## Correlations



Functional properties and tectonometamorphic conditions

- **Temperature**
- **Hydrous fluids**
- **Deformation**

Technical properties and textural parameters

- **Grain size distribution**
- **Grain boundary complexity**
- Microfractures

Technical properties and mineral microtextures

- In K-feldspar
- In plagioclase
- In quartz

# 05 What's next

- Publication plan

1. Variation of mechanical properties with metamorphic conditions: an investigation of felsic metagranites

Urueña, C; Möller, C; Andersson, J; Göransson, M; Lindqvist, J.E; Åkeson, U; Lundgren, L.

Journal: Bulletin of Engineering Geology and the Environment

2. Effect of metamorphic conditions on rock technical properties: low-silica metabasites performance for crushed rock aggregates

Urueña, C, Möller, C, Andersson, J, Göransson, M, Lindqvist, J.E, Åkeson, U.

Journal: Bulletin of Engineering Geology and the Environment/ Engineering Geology .



---

# Summary

Thank you for listening

Questions?

cindy.uruena@geol.lu.se

## Regional metamorphic zoning

The variation in functionality of roads aggregates follow the distribution of metamorphic zones.

## Technical tests

Rocks which have the best  $M_{DE}$  and Los Angeles (A and D3 groups) are suitable for *main course* aggregates (class 1-2) and even for asphalt in most countries of the world.

## Petrographic parameters

Meso- and micro-scale textures and structures, explain the rock quality variations.

## Prospecting for high-functionality road aggregates

Map data should include information on metamorphic index minerals and documentation of textures.