Siberian Large Igneous Province: a combination of rift and platform magmatism during its formation

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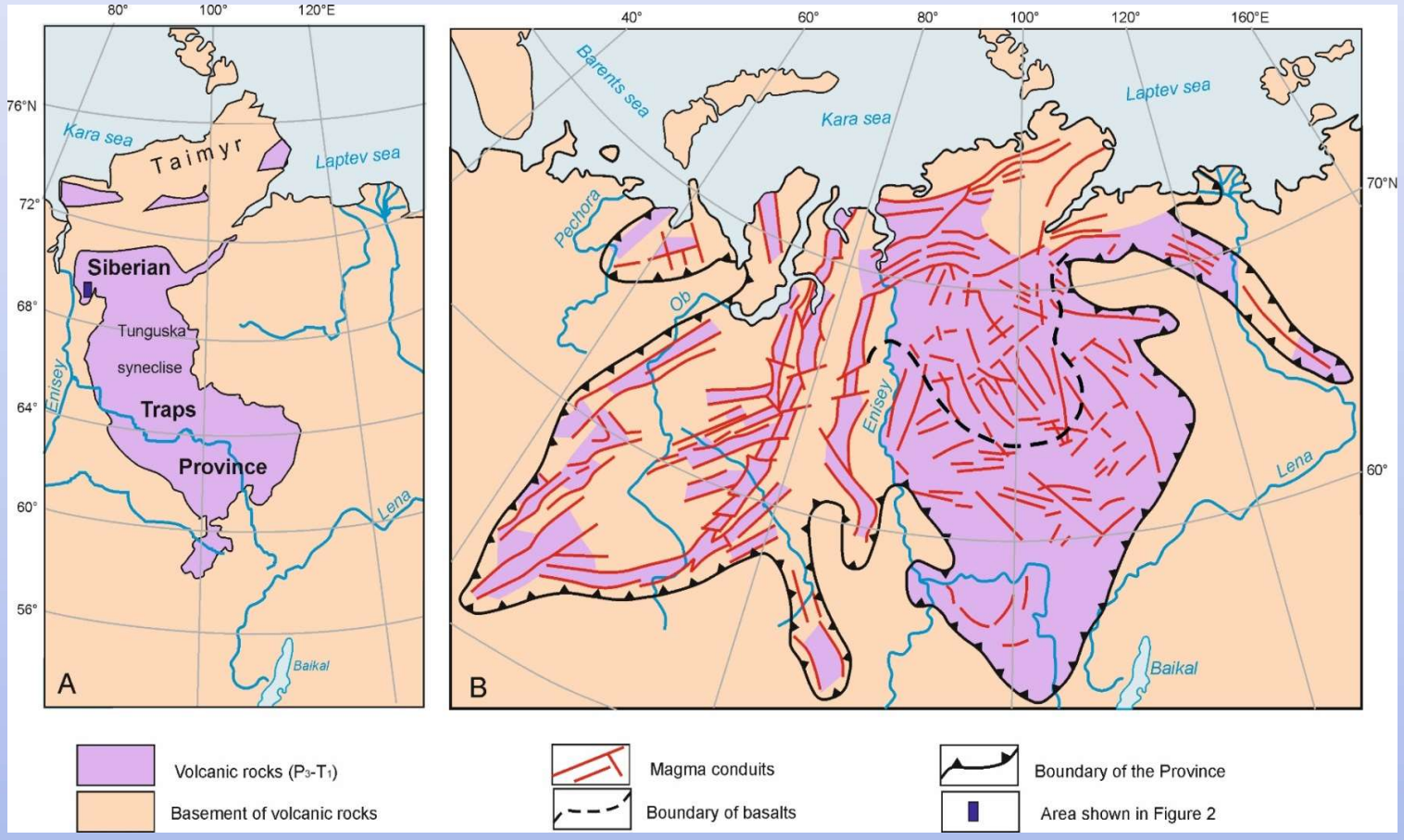
The goal of our study: To understand an origin of the Siberian Large Igneous Province

Approach: study of magmatic evolution within the province on the basis of the geochemical features of volcanic and intrusive rocks and their setting in the tectonic

structures

Terminology



(Zolotukhin et al., 1976, 1984)

Primary the Siberian trap province means areal of tholeiitic basalts in Eastern Siberia

(Masaitis, 1983; Saunders et al., 2009)

Later Siberian trap province combined all rocks Within Eastern and Western Siberia basalts

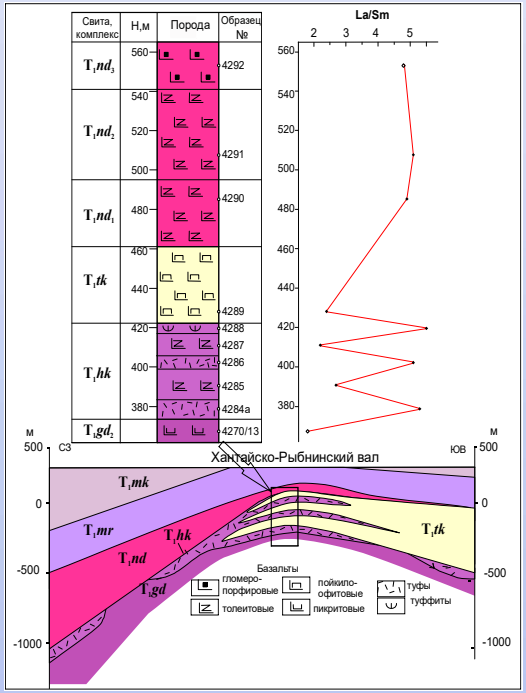
Indeed Siberian igneous province includes two rock types: traps *per si* and rift basalts

These rocks are different in structure (thickness and area of widespread), composition (only tholeiitic or picrites – alkaline basalts) and setting (platform or rift)

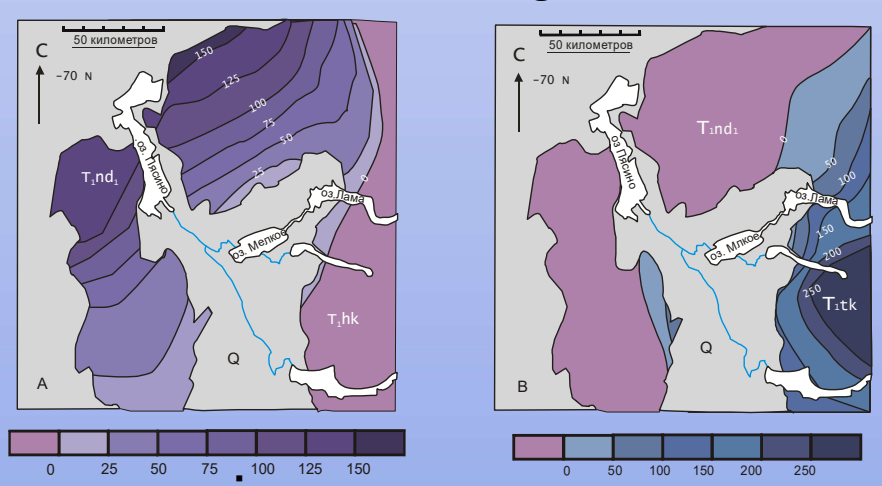
The most important area for magmatism study is the Norilsk area where effusive rocks have maximum thickness and different composition

Khakanchansky Formation

Formation	Index	Sub-formation
Samoedsky	T_1sm	T_1sm
Kumginsky	T_1km	T_1km
		$T_1hr_2^2$
Kharaelakhsky	T_1hr	$T_1hr_2^1$
		$T_1hr_1^2$
		$T_1hr_1^1$
Mokulaevsky	T_1mk	T_1mk_2
		T_1mk_1
Morongovsky	T_1mr	T_1mr_2
		T_1mr_1
Nadezhdinsky	T_1nd	T_1nd_3
		T_1nd_2
		T_1nd_1
Tuklonsky	T_1tk	T_1tk
Khakanchansky	T_1hk	T_1hk
		T_1gd_3
Gudchikhinky	T_1gd	T_1gd_2
		T_1gd_1
Syverminsky	T_1sv	T_1sv
Ivakinsky	P_2iv	P_2iv_1
		P_2iv_1



The most important result in the Norilsk area:
discovery of two rocks types Belonging to two different sources in one section.
There were two sources Of magmas at the same time – Nadezhdinsky (NW) and Tuklonsky (E).
Thus, rift and platform magmatism operated together.



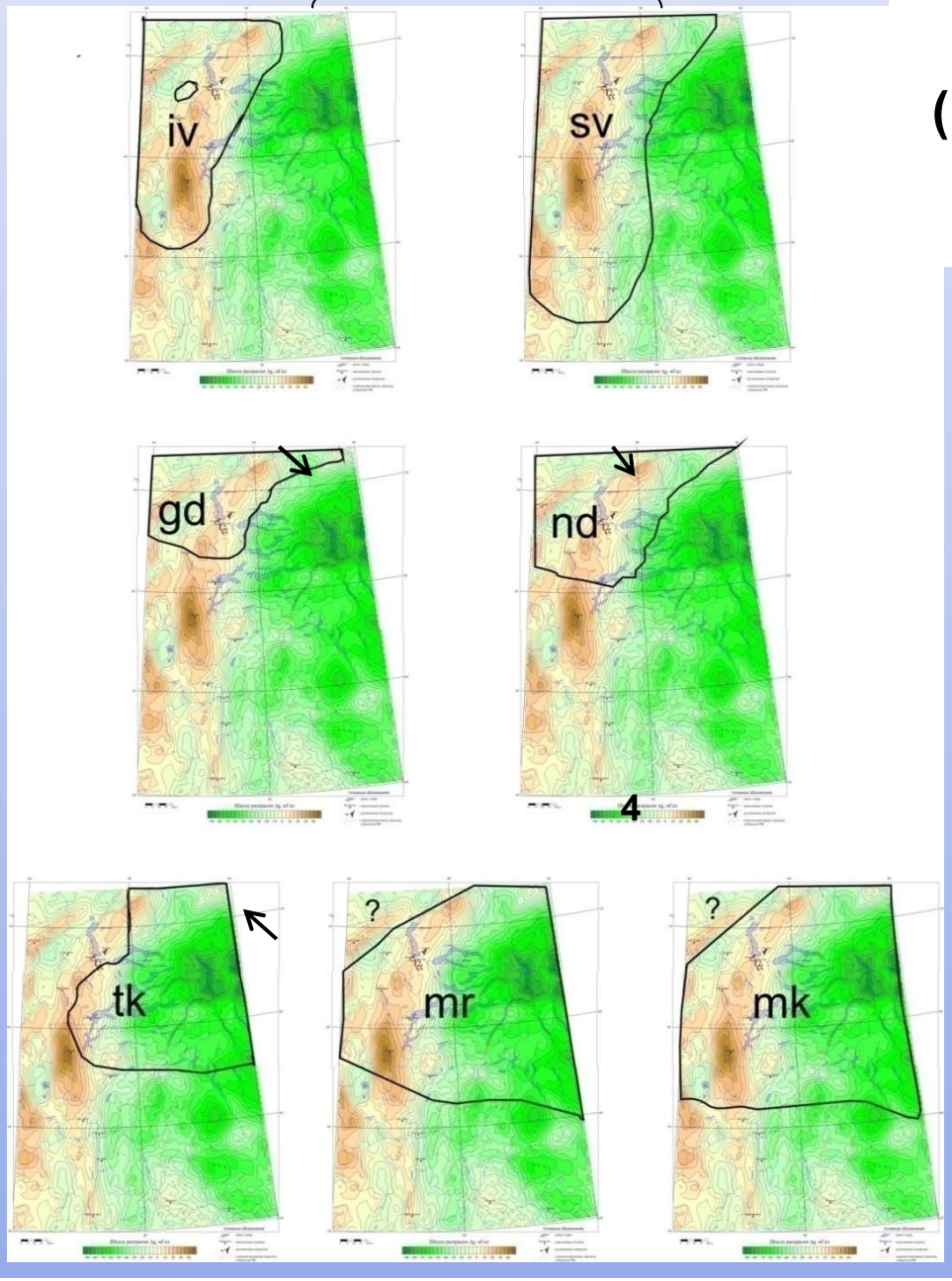
(Krivolutskaya et al., 2019)

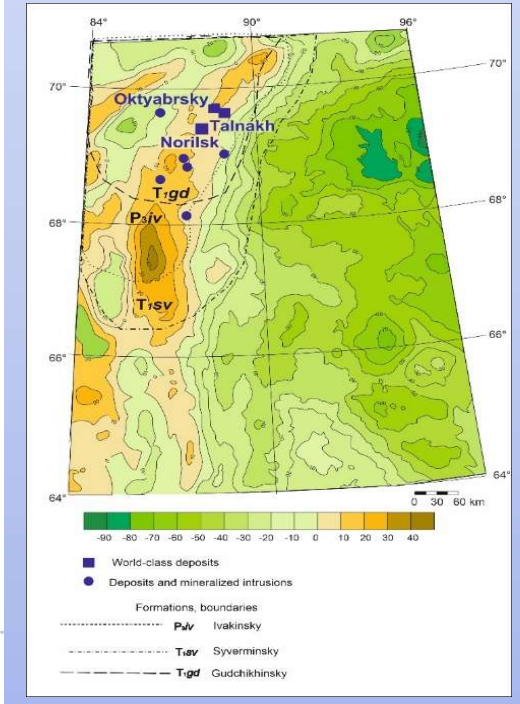
Areas of different formations (NW Siberian Platform)

Riftogen magmatism

Rift

Platform

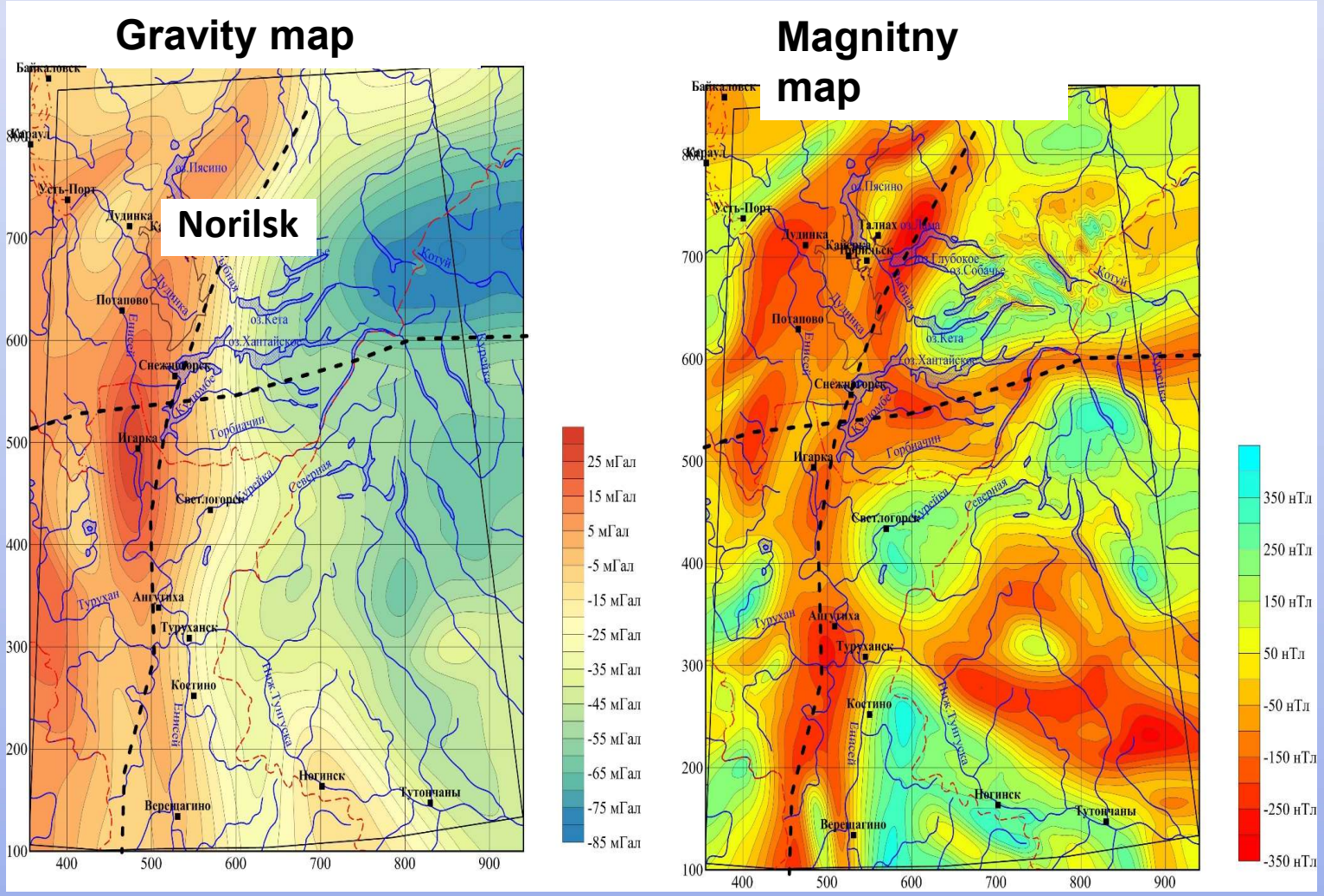




Magma movement

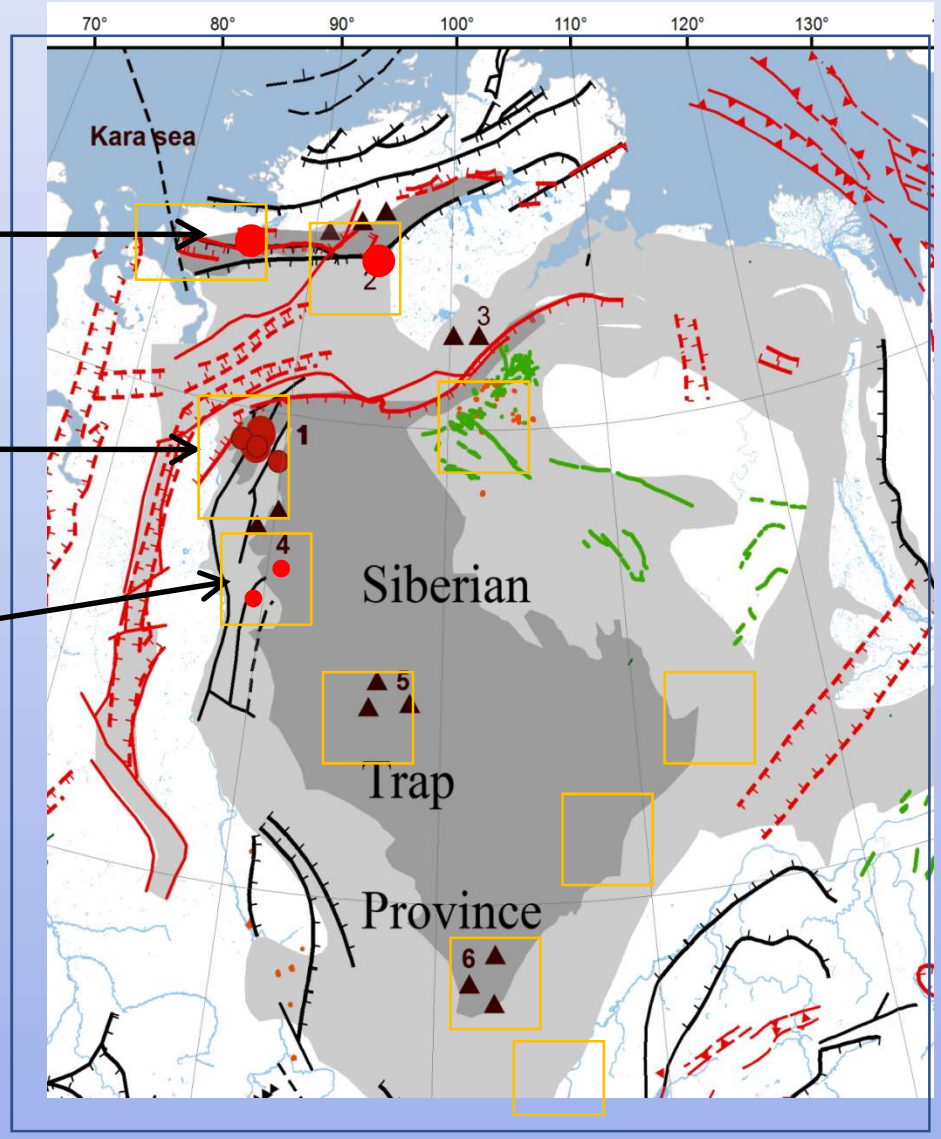
Norilsk – Igarka paleorift zone

Geophysical data on rift structure



(Dolgal, 2019)

Key areas of the the Siberian province studied by the authors



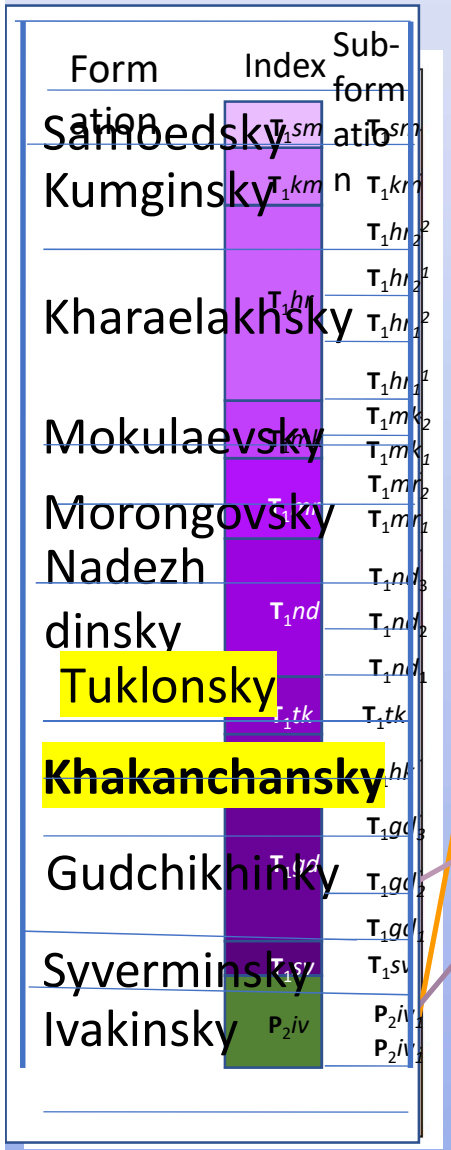
Cu-Ni deposits

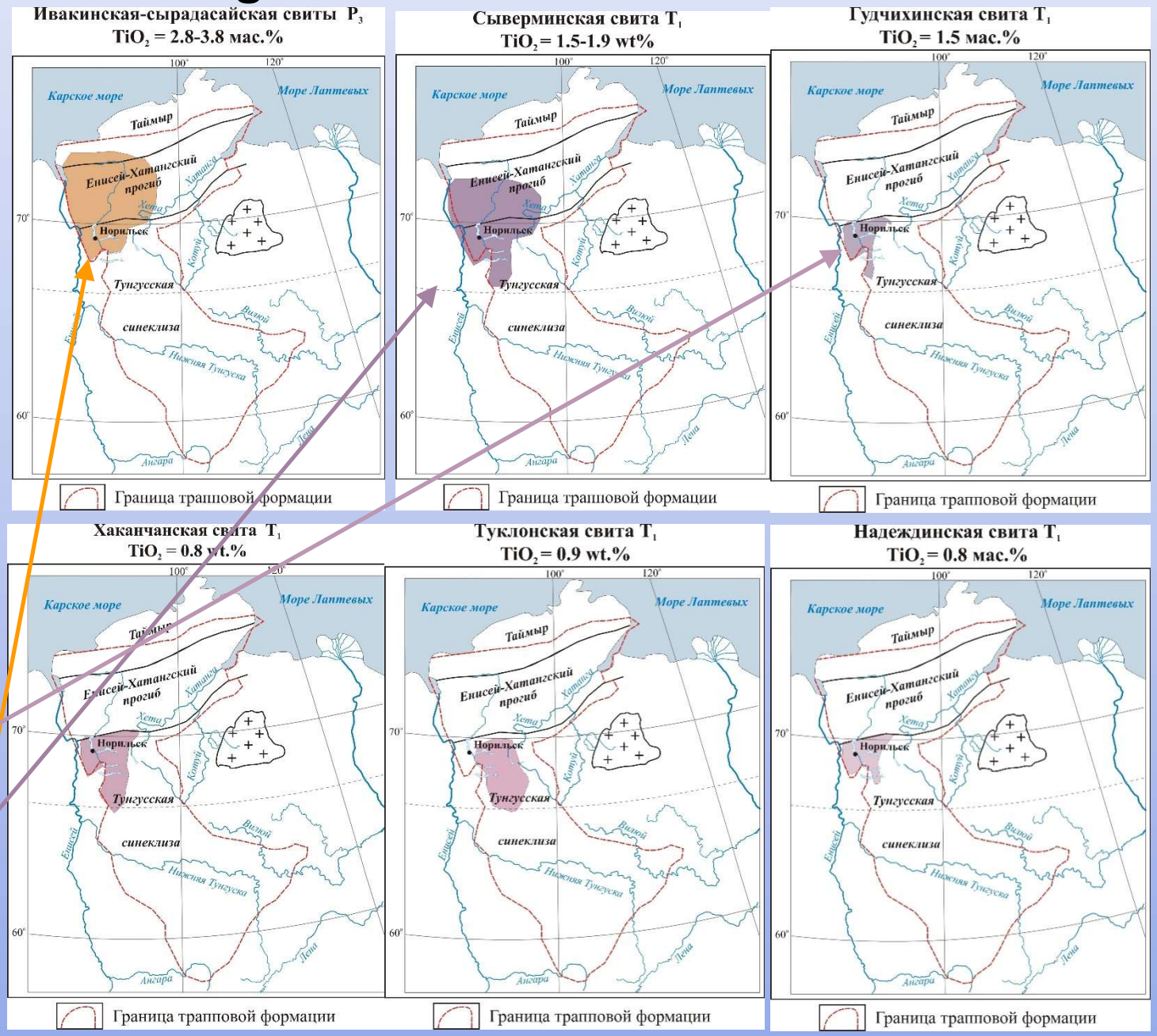
● discovered before 1970

● discovered in 1990-th

2480 analyses of volcanic and intrusive rocks (XRF+ICP-MS) + 85 isotope analyses (Sr, Nd, Pb)).
(Krivolutskaya et al., 2020; Krivolutskaya et al., 2021)

Magmatic evolution





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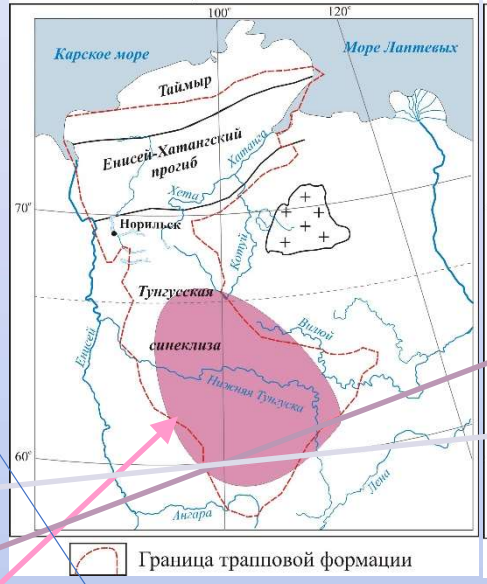
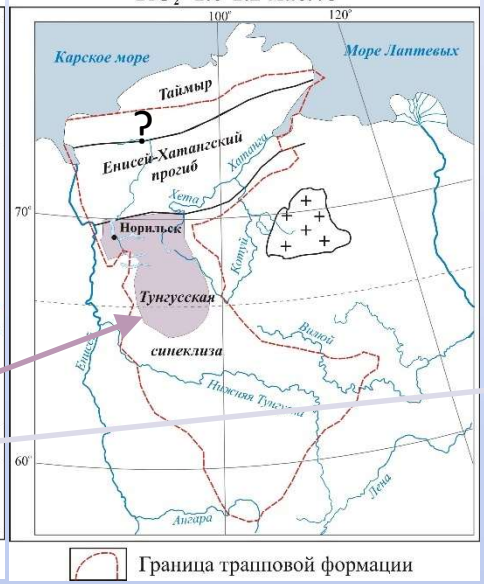
Корвунчанская свита (туфы) T_1
TiO_2 = 1.0-1.2wt.%



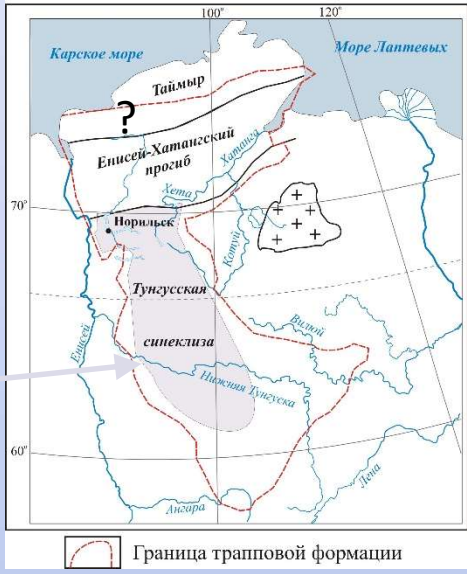
Граница трапповой формации

Моронговская свита T_1
TiO_2=1.0-1.2 мас.%



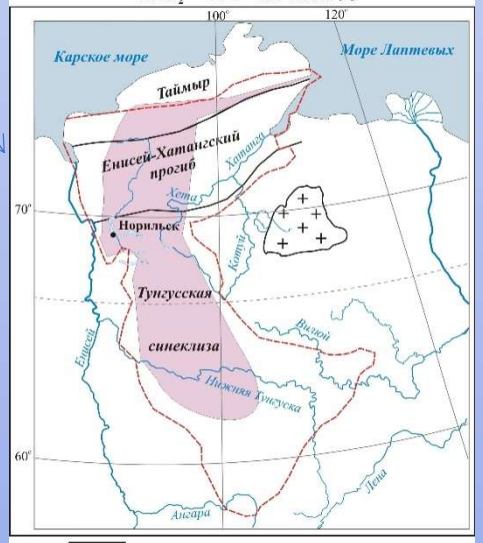
Граница трапповой формации

Мокулаевская свита T_1
TiO_2 = 1.2-1.4



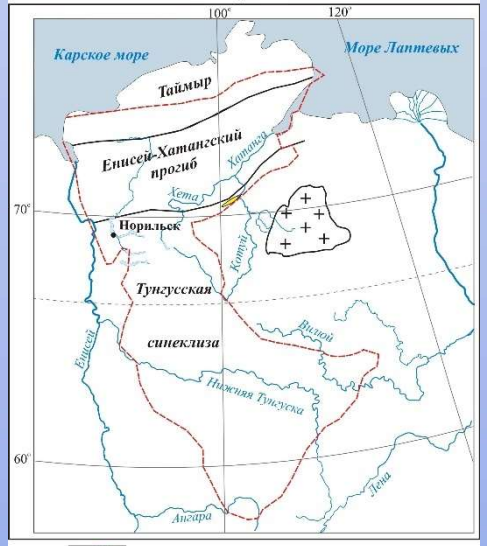
Граница трапповой формации

Хараелахская свита T_1
TiO_2 = 1.4 -1.6 мас.%



Граница трапповой формации

Дельканская-маймечинская свиты T_1
TiO_2= 1.3



Граница трапповой формации

Setting of mantle magmas within the province – location only within rift zones

How two types of magmatism – rift and platform - that operate together in time link ?

No one model (plume, delamination) does not give answer this question.

Conclusion:

A new concept of the formation of the Siberian Large Igneous Province is required to explain its geological structure!