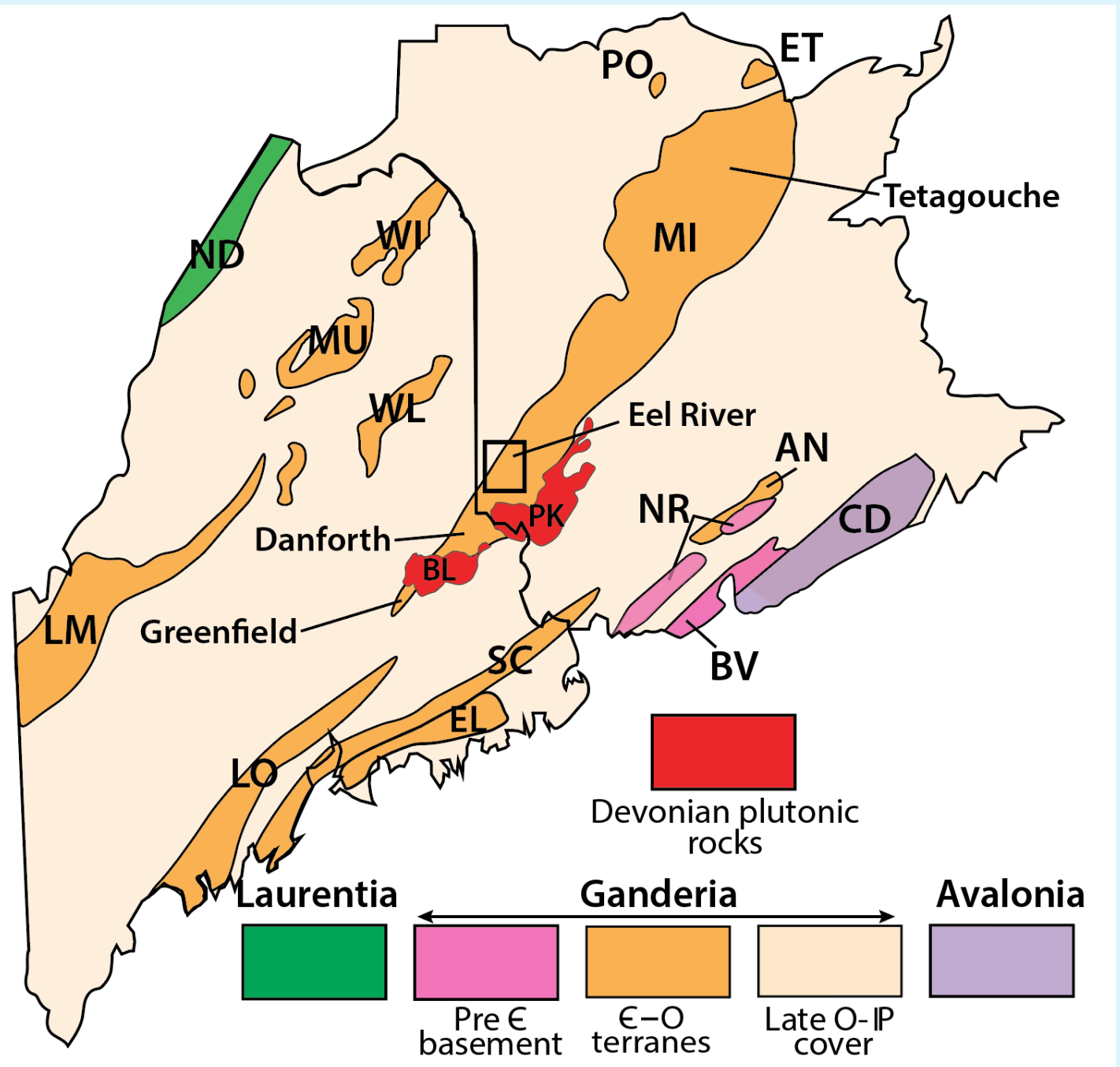


# **TIMING OF EARLY PALEOZOIC VOLCANISM IN NORTHEASTERN MAINE: RETHINKING REGIONAL TECTONIC MODELS.**

**Allan Ludman, Chunzeng Wang, Amber Whittaker,  
Paul O'Sullivan, and Christopher McFarlane**





## ***THE 50-YEAR MAPPING HIATUS HAS ENDED***

***We focus today on two major changes required by new work in northeastern and east-central Maine***

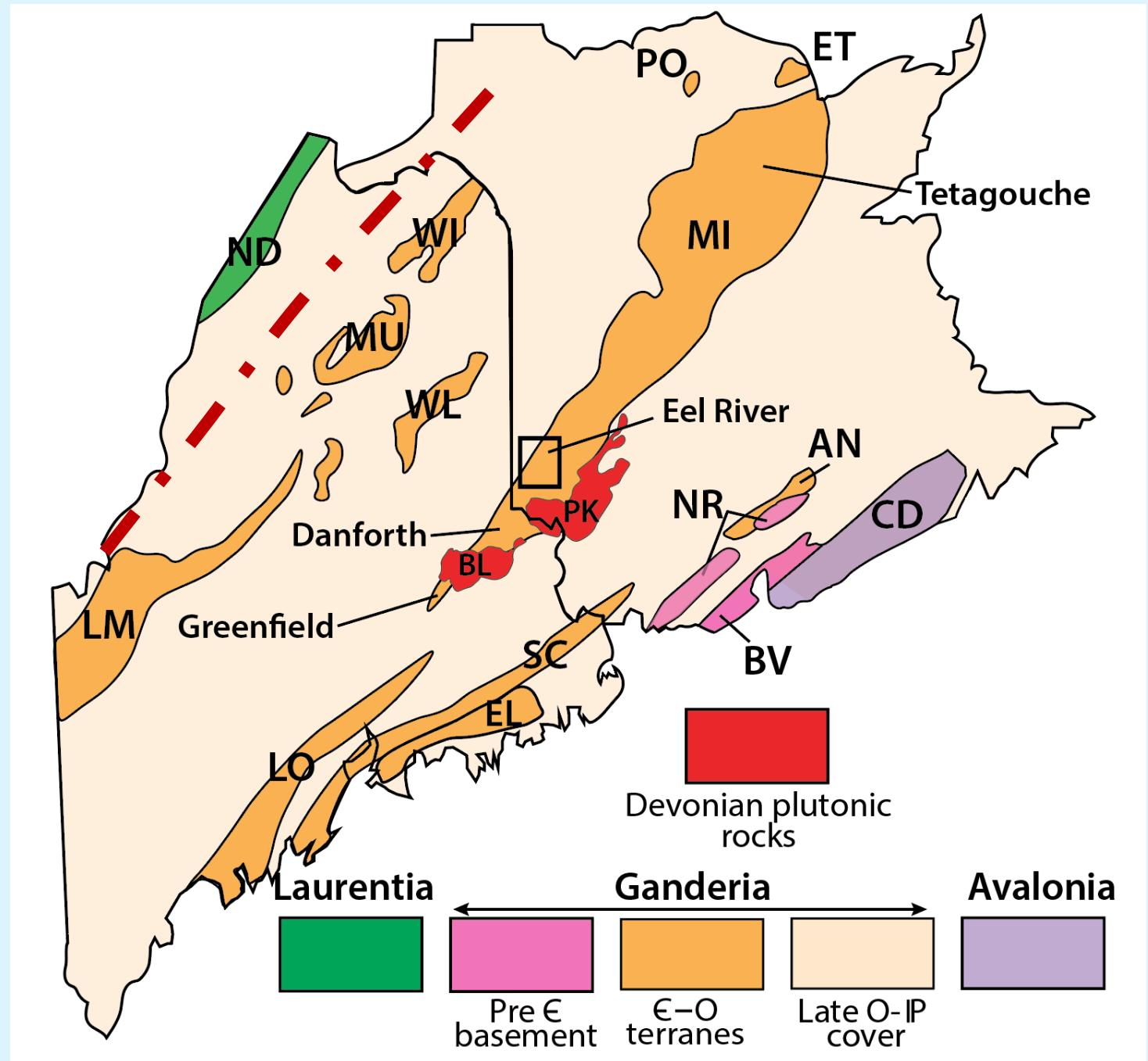
- ***Relocate the Laurentia-Ganderia boundary***
- ***Introduce a new (Number Nine Mountain) terrane with Silurian mélange***

➤ ***24 new ages of Ordovician volcanic rocks from the Munsungun-Winterville, Weeksboro- Lunksoos Lake, and Miramichi terranes suggest a revised tectonic model***

# Maine-New Brunswick Lithotectonic setting:

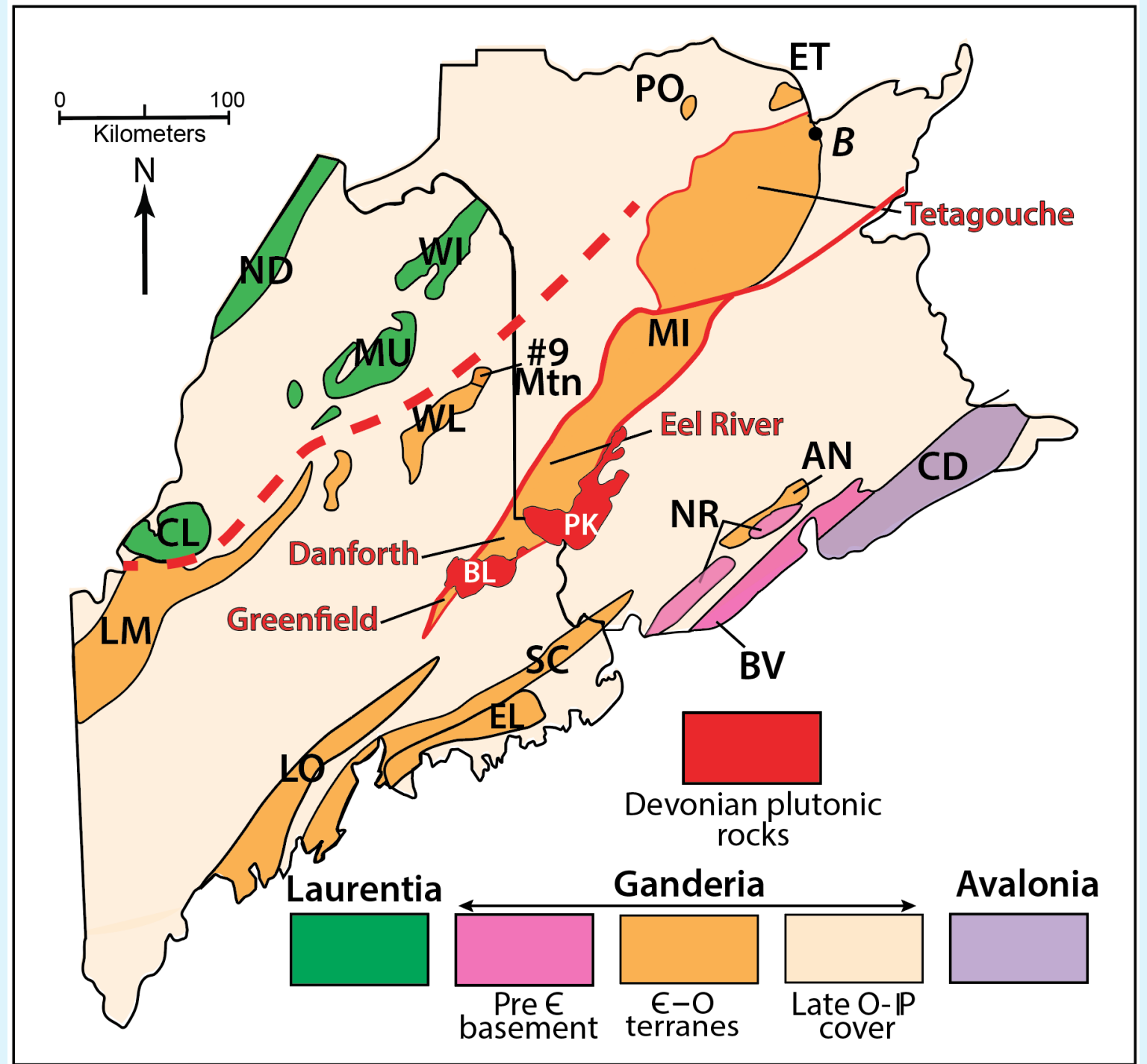
## The traditional view

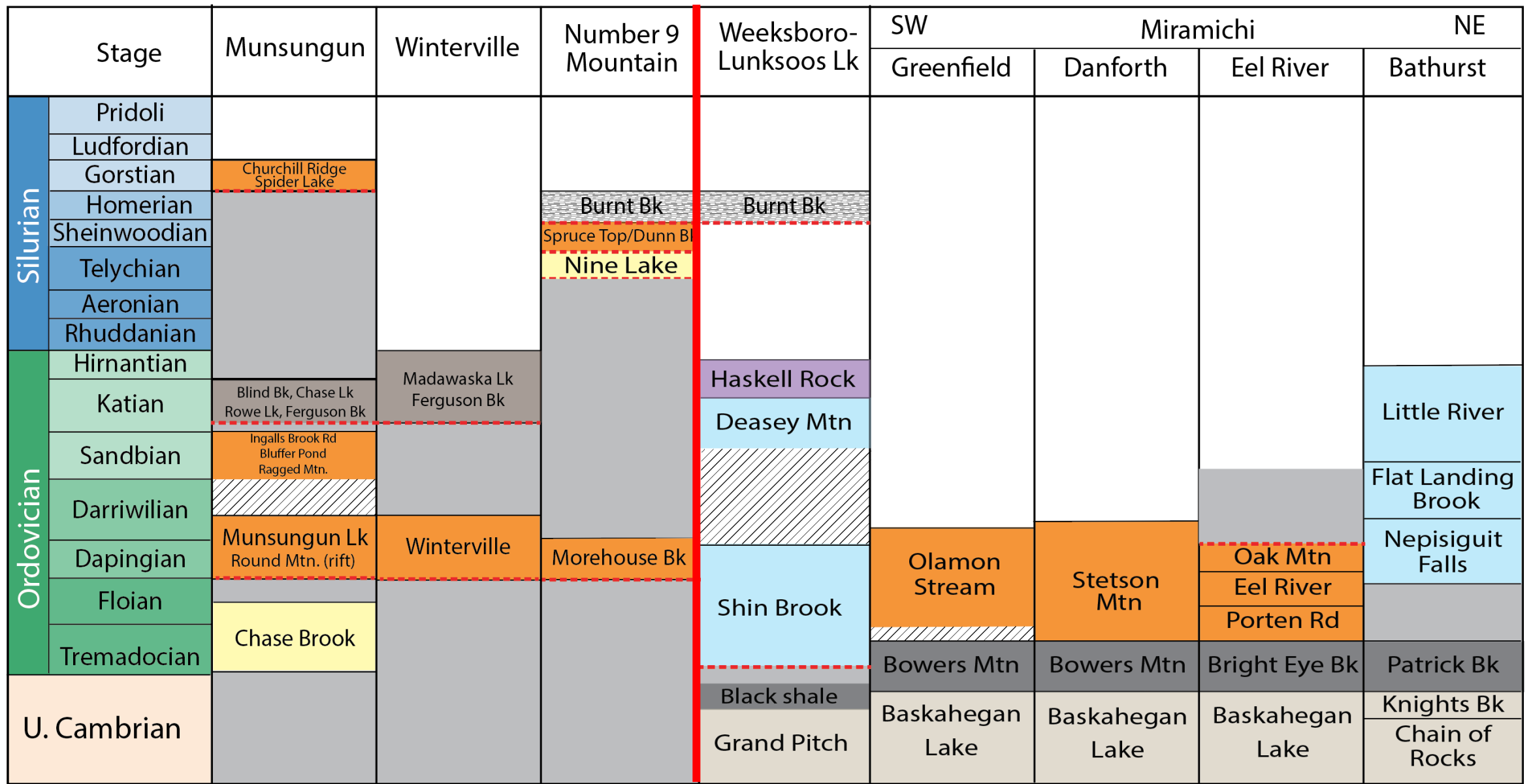
 Laurentia-Gander suture



**Revised  
Maine-New Brunswick  
Lithotectonic setting:**

Laurentia-Gander suture



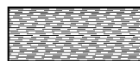
Sedimentary Rocks

Volcanic Suites

Uncertain

Missing

Unconformity

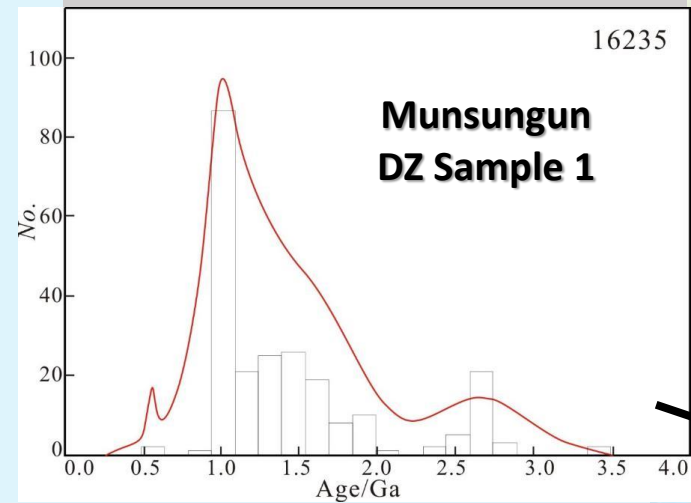




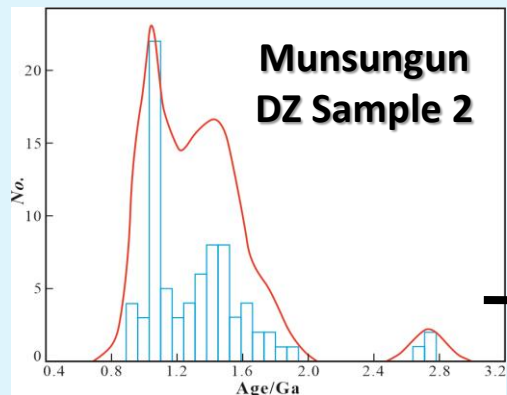
# Detrital Zircon Data

16235

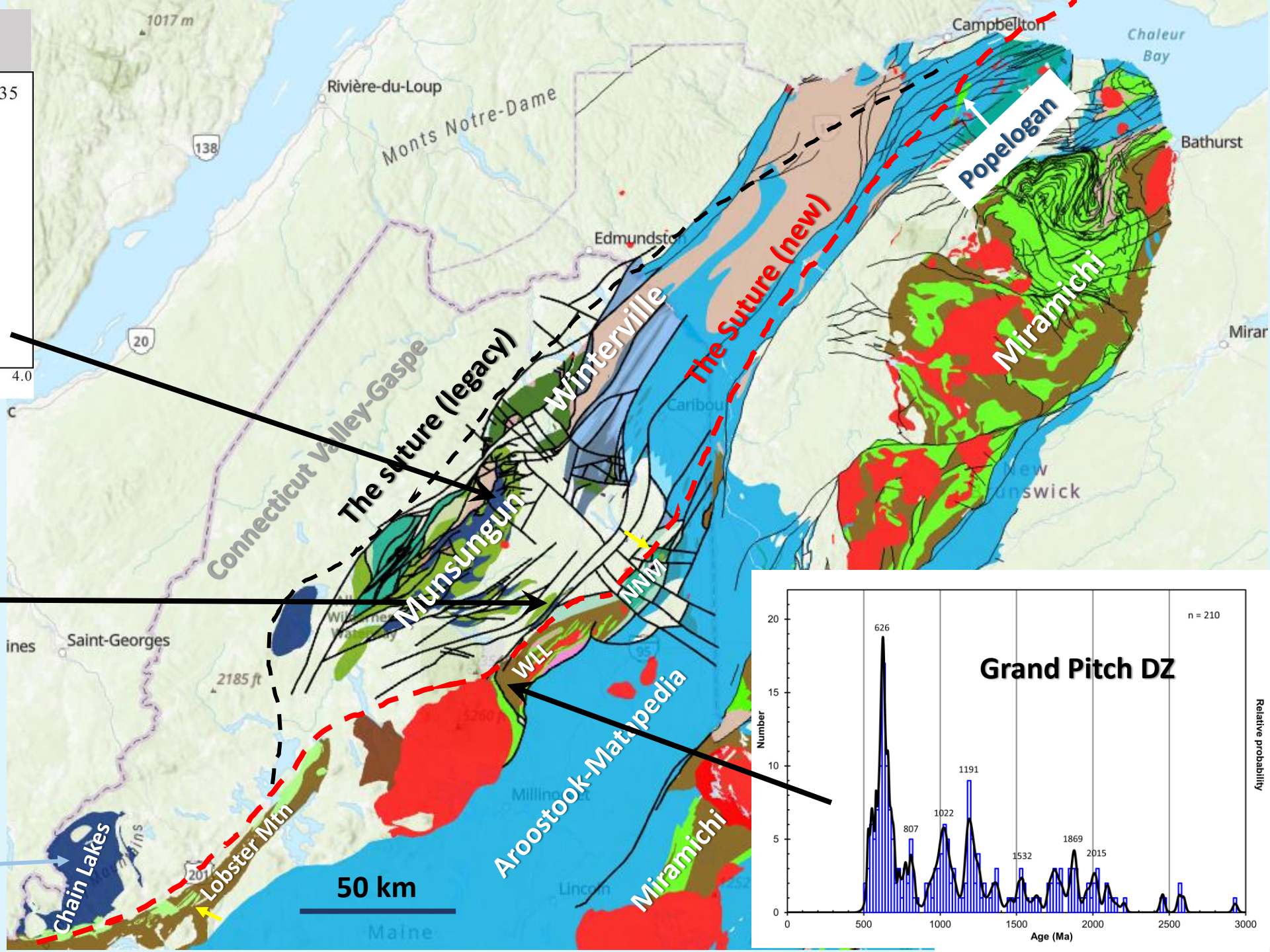
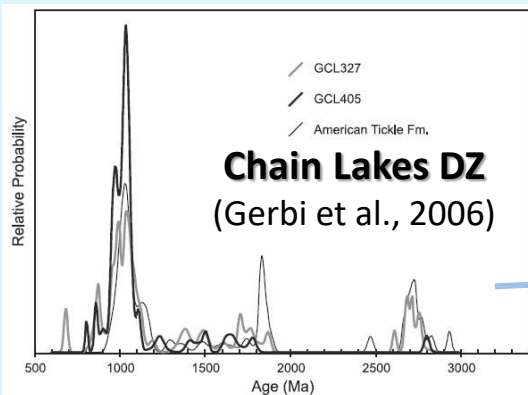
**Munsungun  
DZ Sample 1**



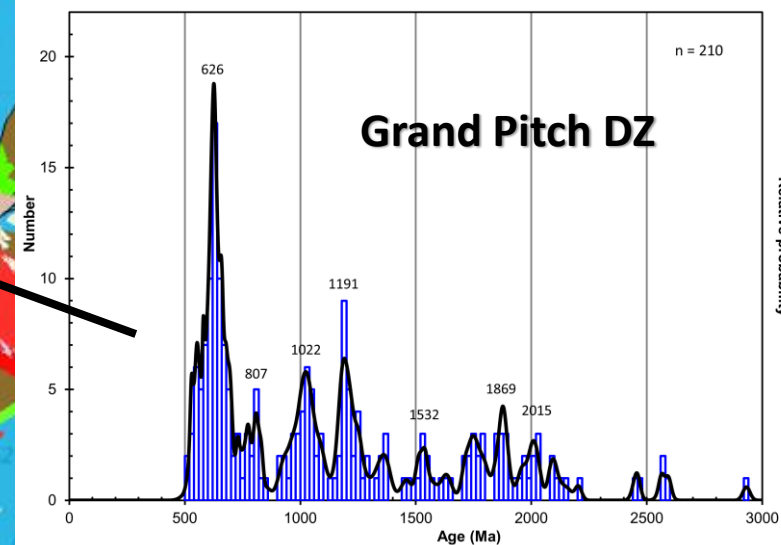
**Munsungun  
DZ Sample 2**



**Chain Lakes DZ**  
(Gerbi et al., 2006)

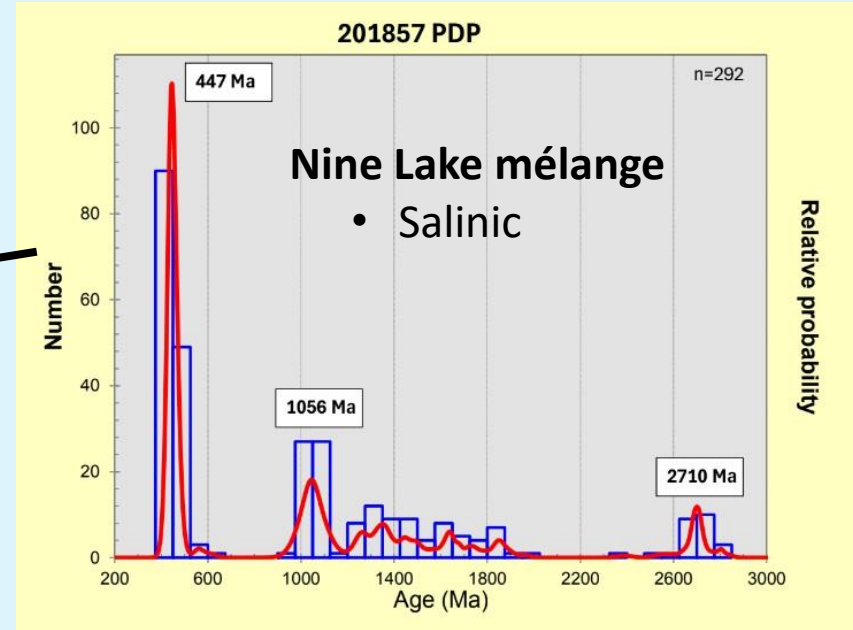
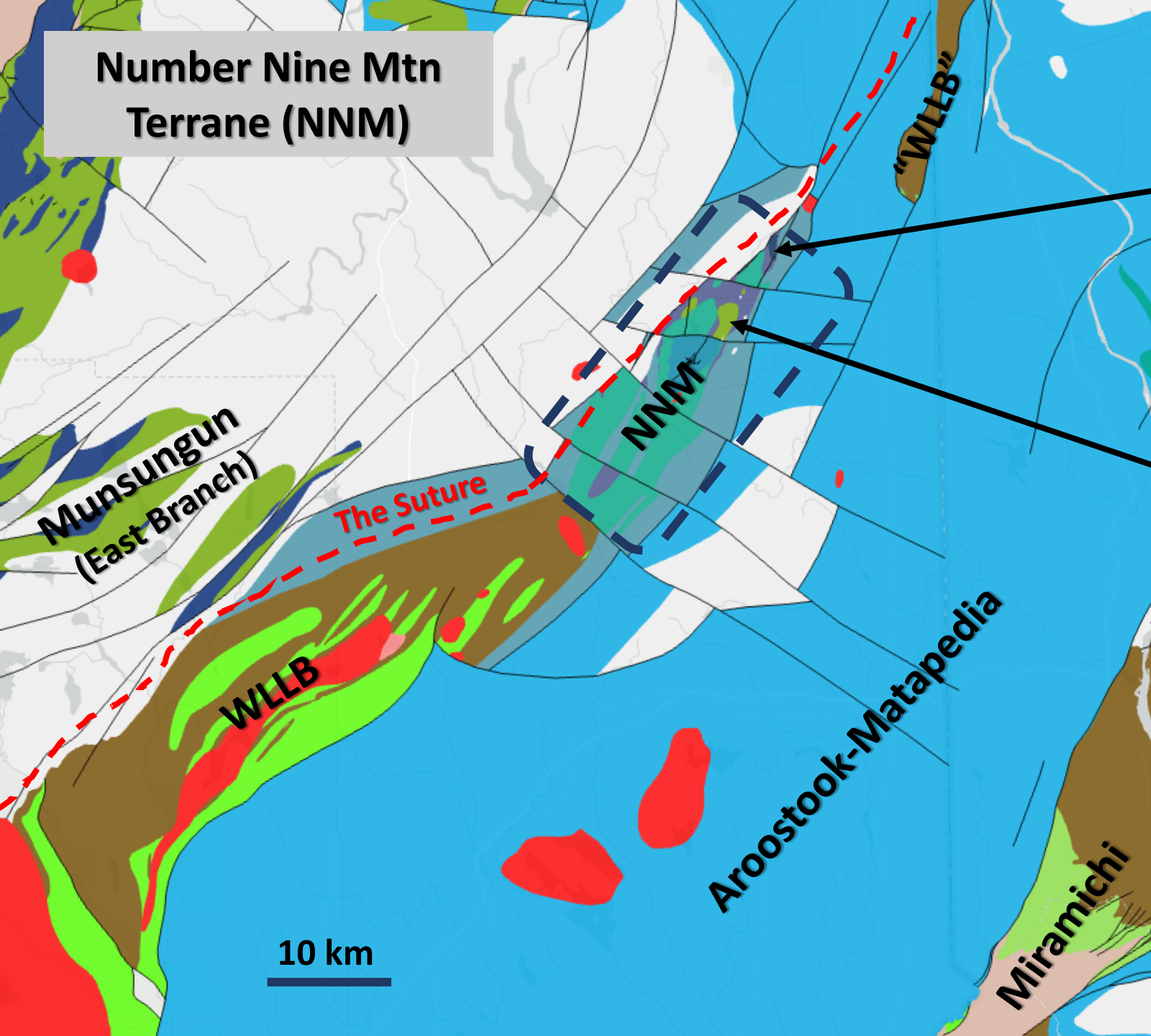


**Grand Pitch DZ**



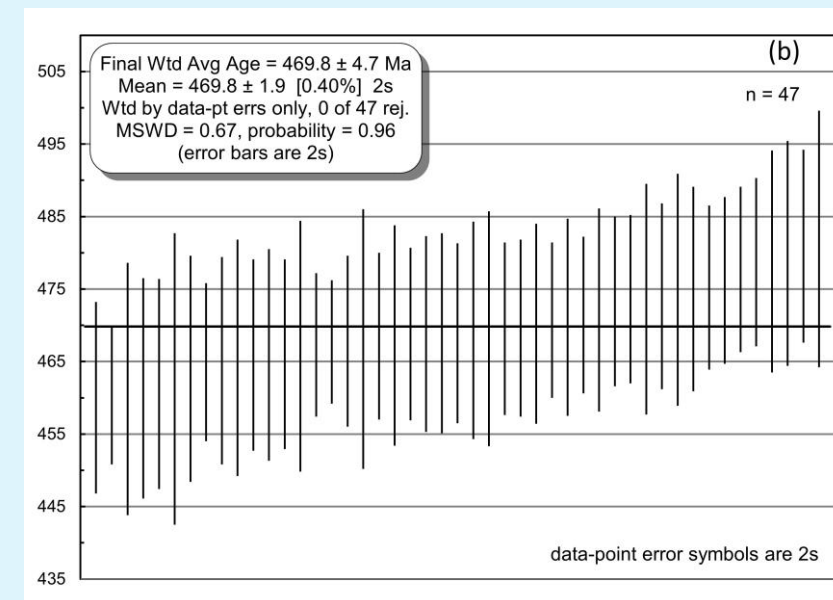


# Number Nine Mtn Terrane (NNM)



## Morehouse Brook volcanic rocks

- Volcanic arc setting
- 470 Ma





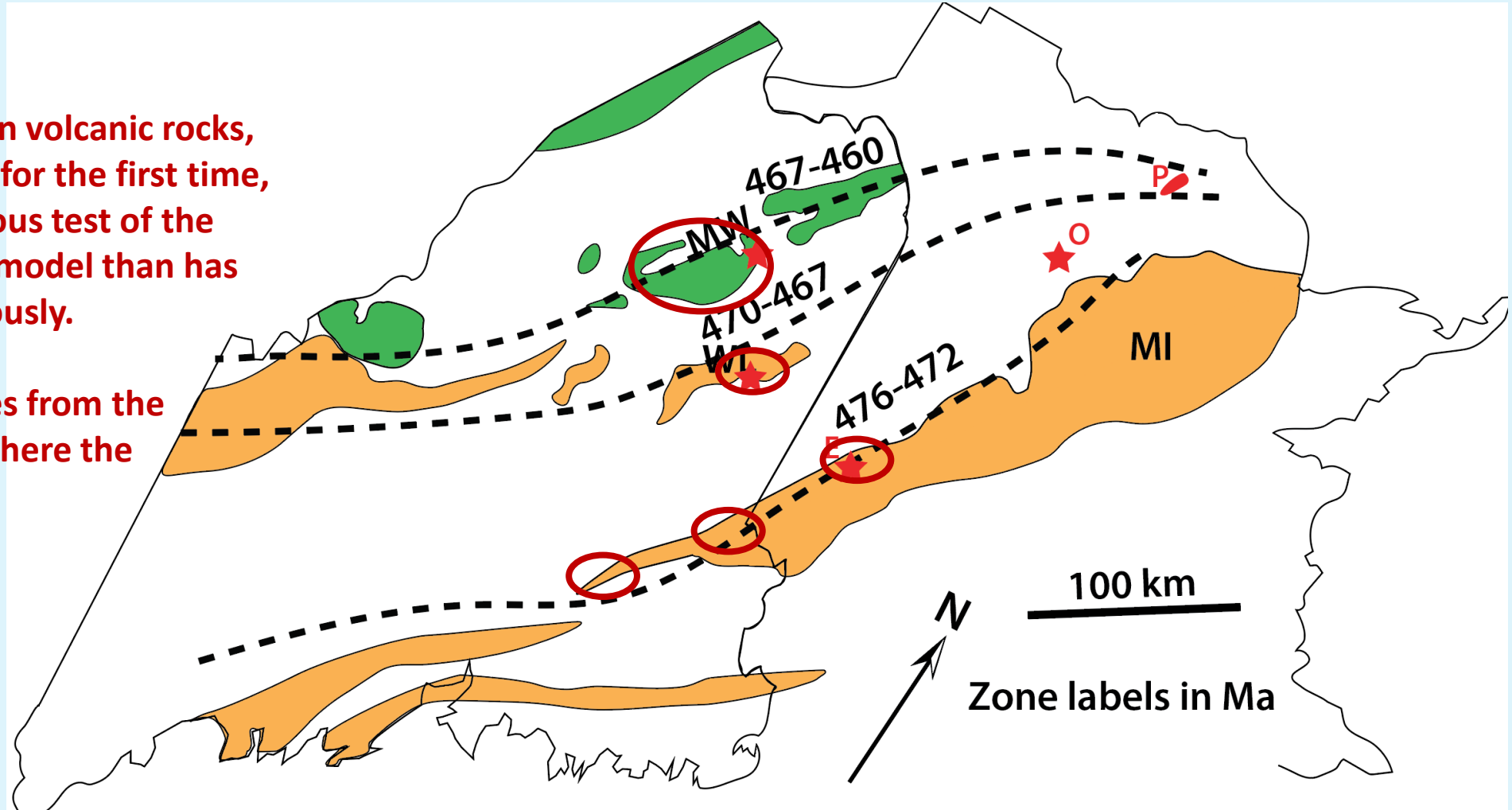
- *Revised Laurentia-Ganderia boundary*
- *A new (Number Nine Mountain) terrane with Silurian mélange*
- ***Extensive dating of Munsungun-Winterville, Weeksboro-Lunksoos Lake, and Miramichi Ordovician volcanic rocks***  
***Partially funded by USGS StateMap grants to the Maine Geological Survey***
- ***Revised tectonic model based on the new ages***

## Single, NW-migrating arc model (van Staal et al., 2016; Fyffe et al., 2023)

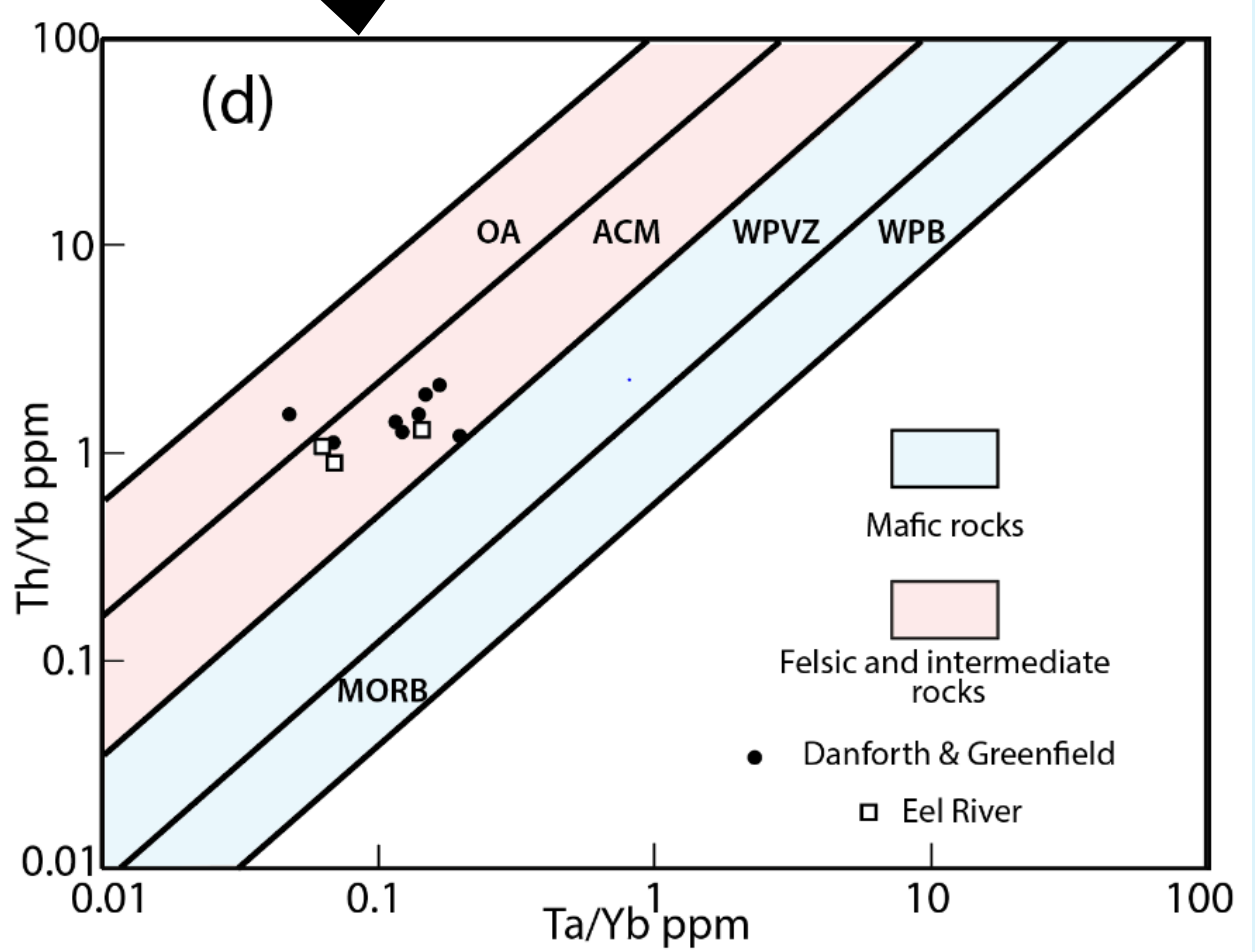
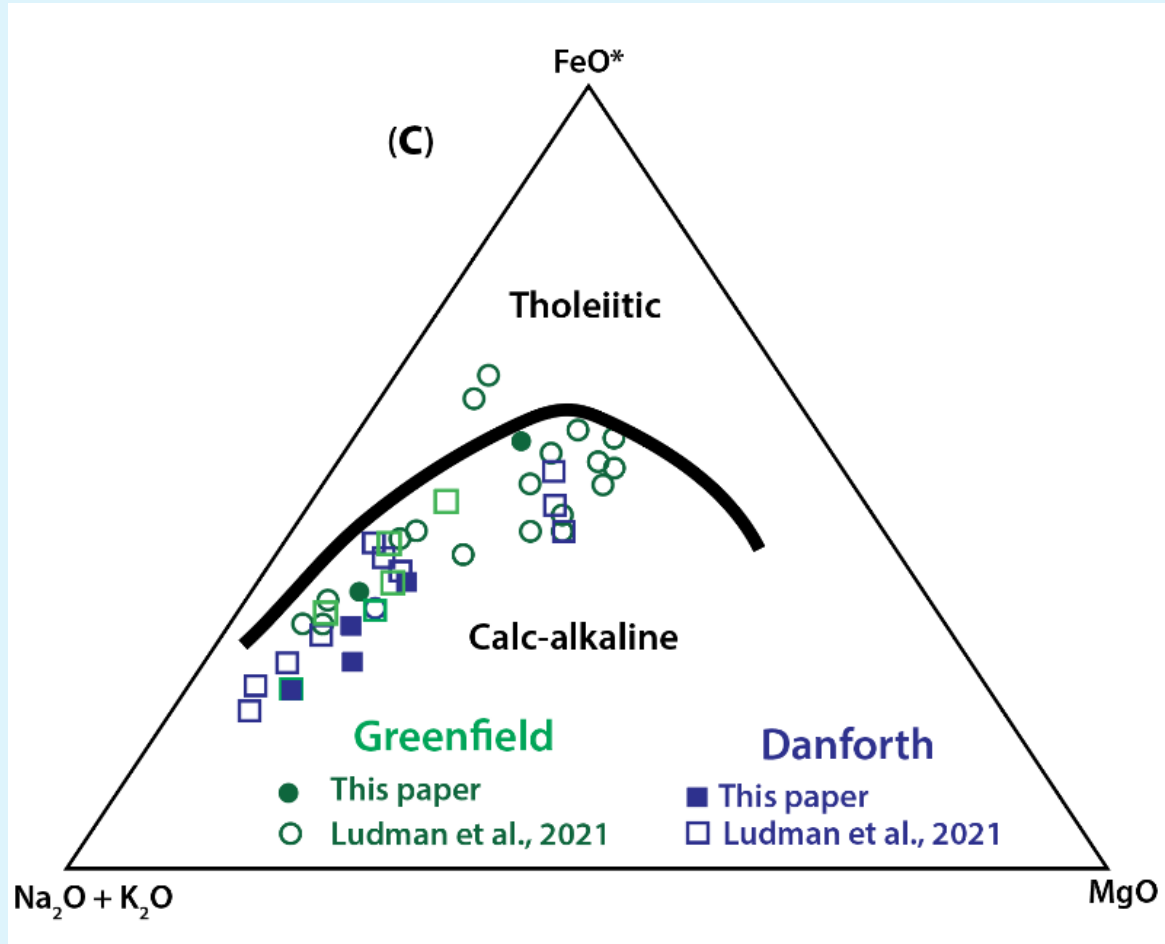
1. Volcanism began ~480 Ma (Meductic Gp) in a Miramichi continental arc
2. Miramichi arc volcanism ended at 470 Ma when Tetagouche rifting began.
3. The locus of volcanism then migrated progressively NW as shown.

24 ages of Ordovician volcanic rocks, some reported here for the first time, permit a more rigorous test of the migrating single arc model than has been possible previously.

Let's look first at ages from the Miramichi terrane where the story began.



# Hypothesis #1: Continental arc setting of Maine and Eel River area Miramichi volcanics



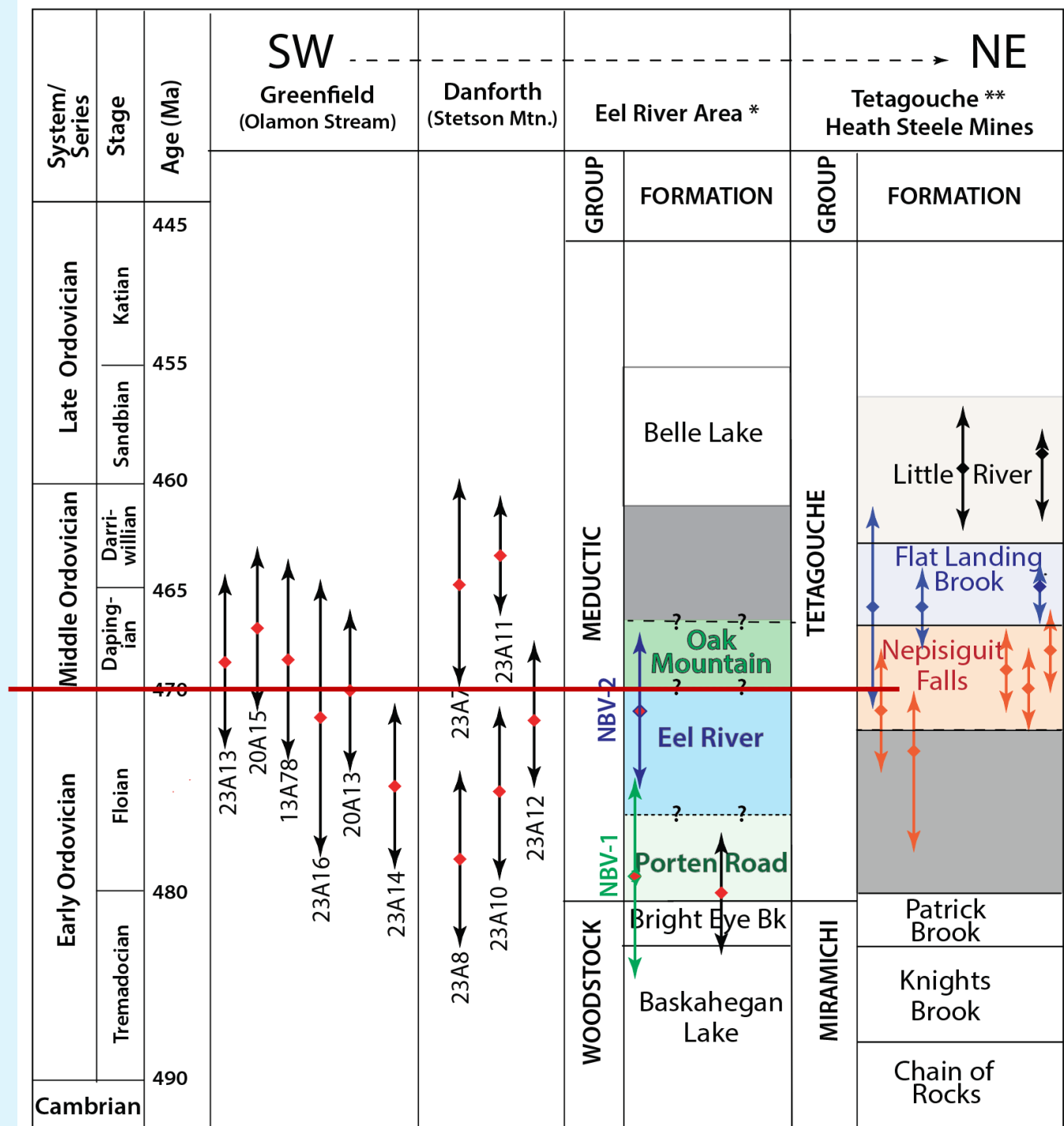
ME Miramichi volcanics are a calc-alkaline suite – same as Meductic Group in the Eel River area of west-central NB (McClenaghan et al. (2006))

Last summer's samples from Maine and the Eel River area (Porten Road and Eel River formations) confirm continental arc setting.

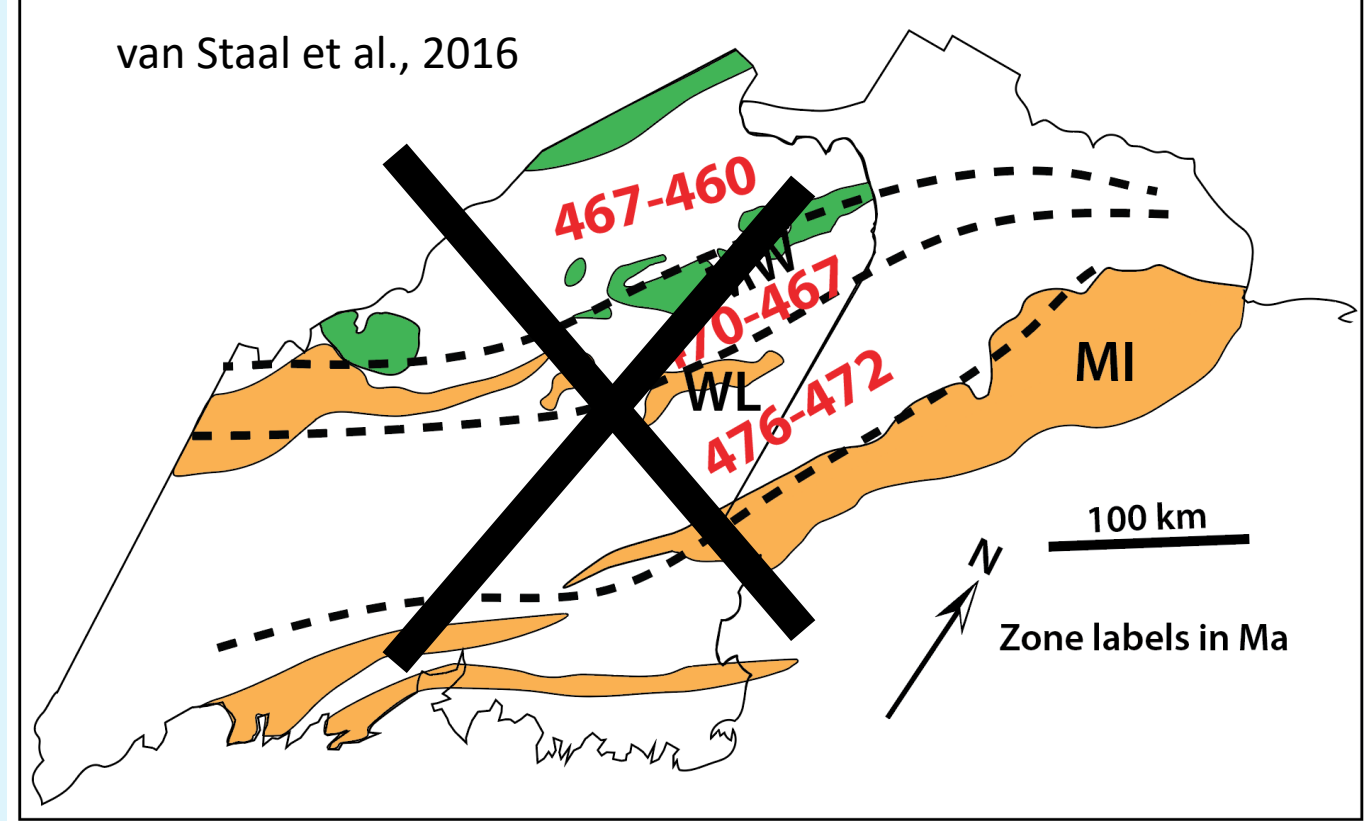
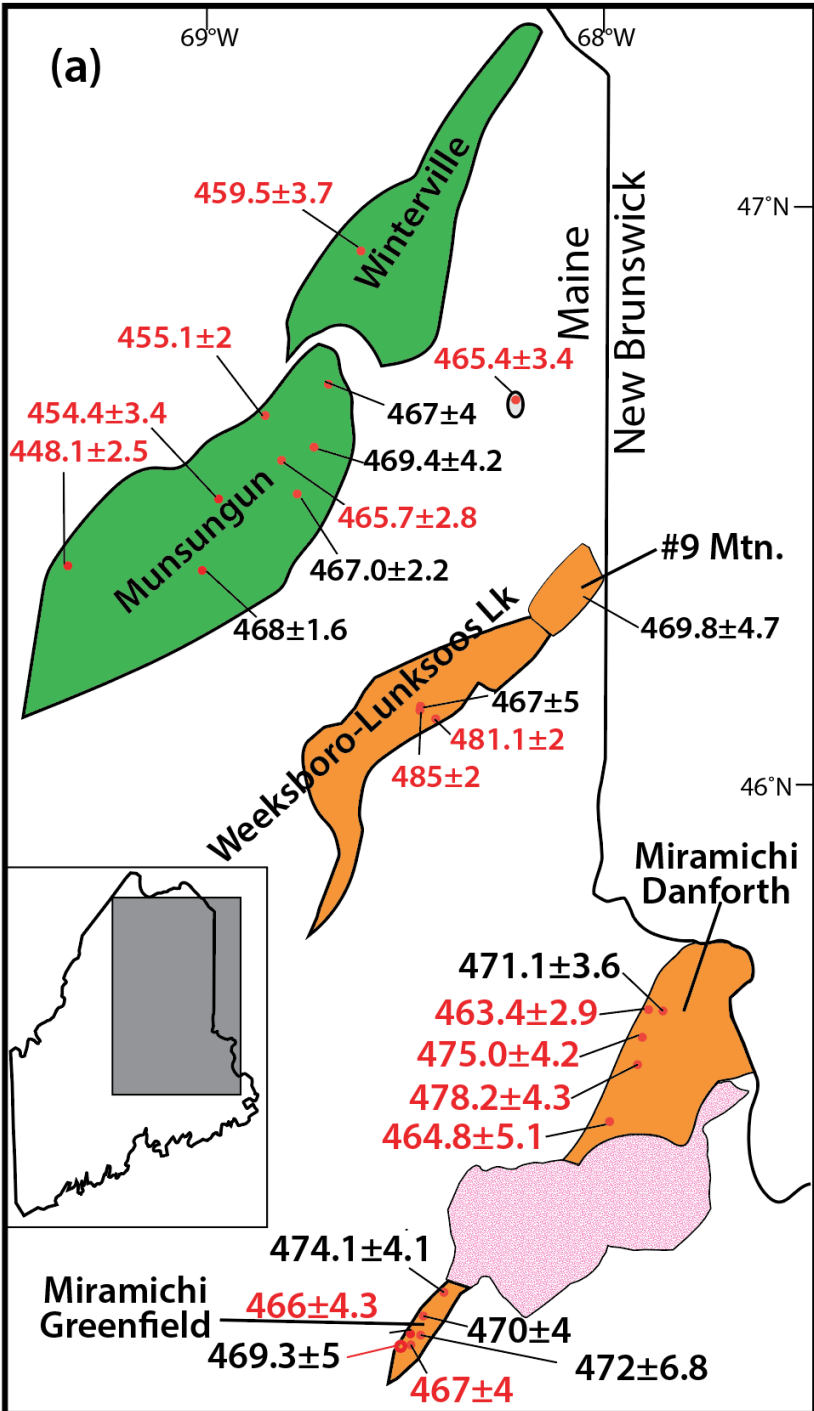
11 of the new ages are in the Miramichi terrane in Maine and two are in the Meductic Group in New Brunswick. These provide much more detail and permit correlation along the length of the terrane.

Tetagouche rocks are tholeiitic, from an arc-rifting setting. All others are calc-alkaline, erupted in a continental arc.

~~Hypothesis #2: Miramichi calc-alkaline arc volcanism DID NOT END at 470 Ma, but was coeval with arc-rift volcanism for at least 7 million years~~





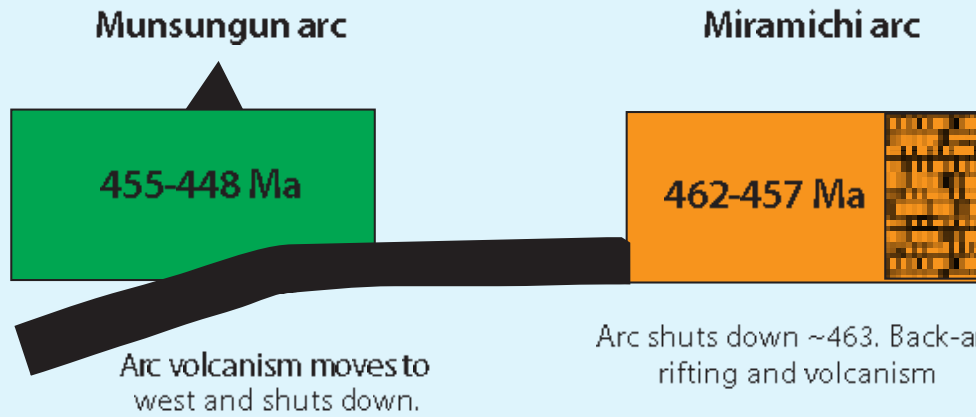


Hypothesis # 3: 463-469 Ma volcanism *in all three tracts* disproves arc migration hypothesis.

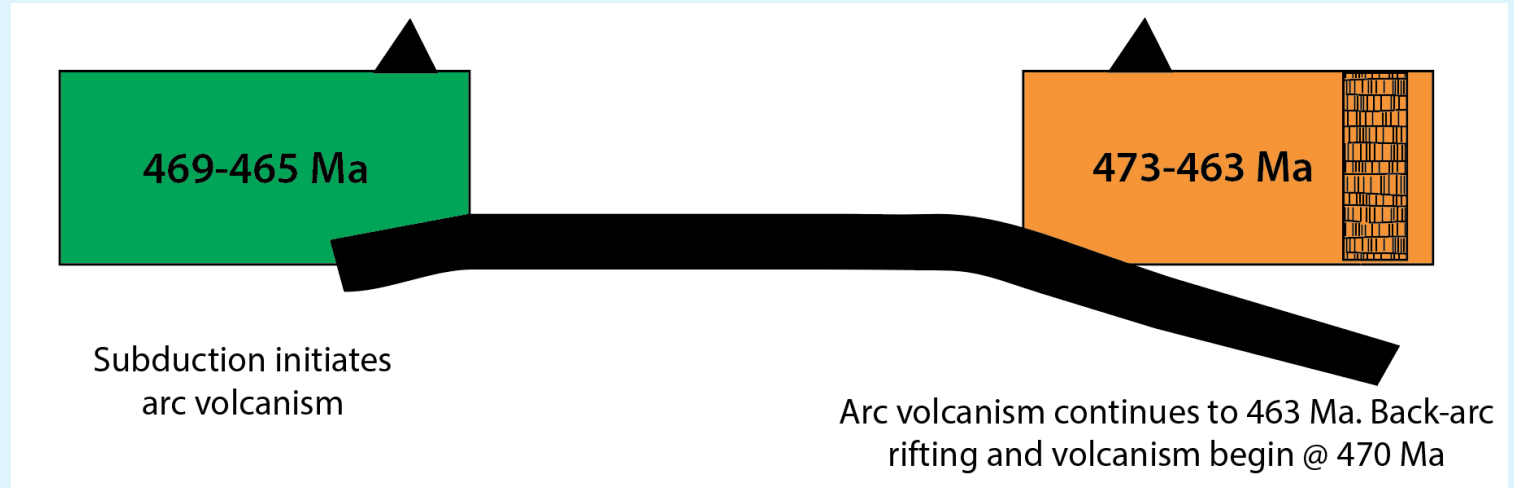
Black=ages consistent with arc migration model  
 Red = ages inconsistent with arc migration

Arc volcanism in the MW belt began 10-15 m.y. later than in MI and WLL – but clearly not because the arc migrated. **THIS SUGGESTS EXISTENCE OF A SECOND, “MUNSUNGUN” arc**

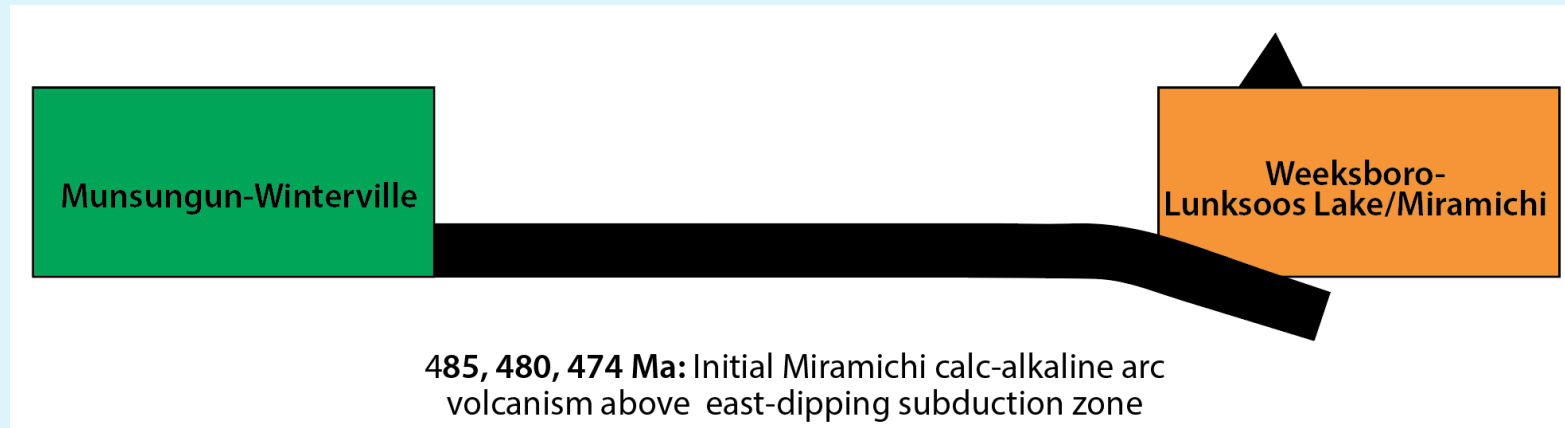
Arc volcanism only in Munsungun arc



Coeval arc volcanism in Munsungun and Miramichi arcs



Arc volcanism only in Miramichi arc



## ADDITIONAL DATING NEEDED

- ❖ Winterville inlier
- ❖ Weeksboro-Lunksoos Lake: Shin Pond felsic tuffs
- ❖ Miramichi arc rocks
  - Eel River segment: Meductic Group Eel River and Oak Mountain formations. *Duration of volcanism*
  - Danforth segment: fragmental lithologies
  - Greenfield segment: VERY recalcitrant mafic rocks.