

# MB 2019-06

Rapport du contrat de géochronologie MERN (2014-2015)

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## **Rapport du contrat de géochronologie MERN (2014-2015)**

Cornelia Roffeis

MB 2019-06

**Avertissement**

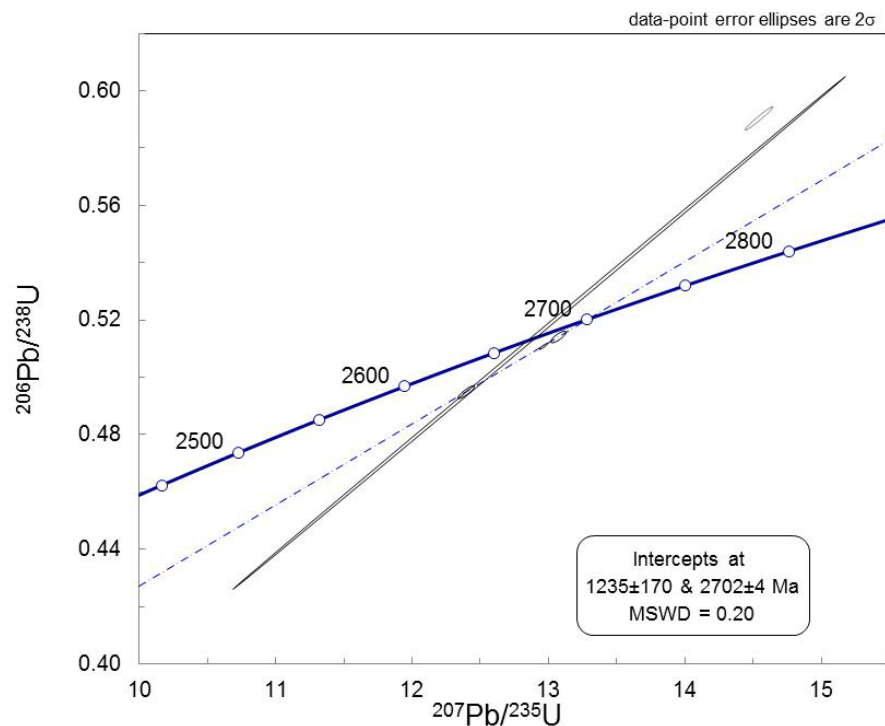
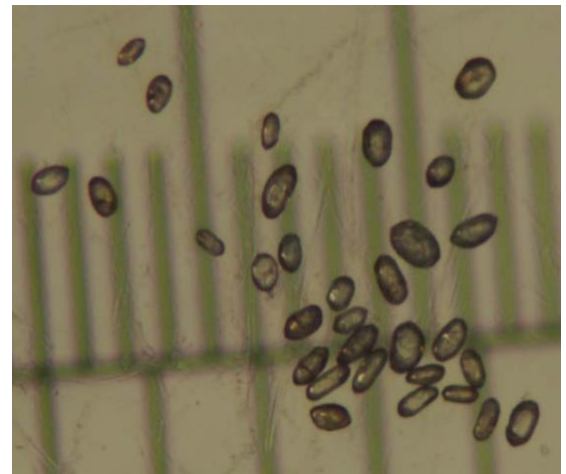
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## Sample 14FT3141 Orthogneissic tonalite

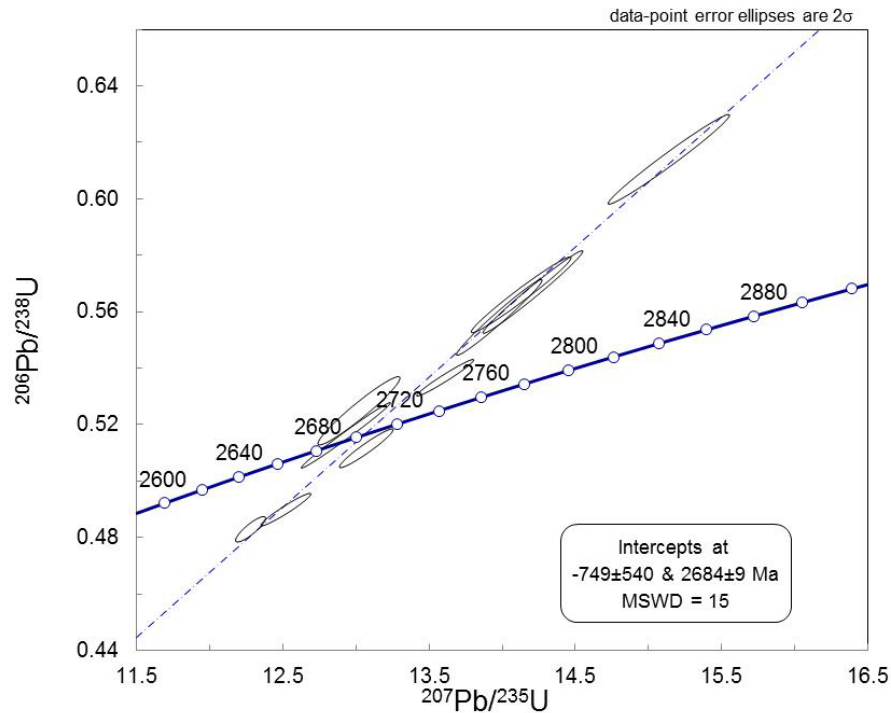
Location: Grenville parautochton

NAD 83 Zone UTM 18N E: 590273 N: 5543734

The rock contains a lot of zircons, with a variety of sizes, shapes and colors. Most grains are prismatic with some degree of rounding; fewer round to ovals shaped grains are observed as well as large prismatic, metamict grains. In some zircons a core-rim structure is observed. The general appearance points towards a metamorphic overprint of magmatic zircons. Single grain analyses of 5 zircons plot discordant, one grain plots reversely discordant and is omitted in the calculations. The remaining 4 data points form a Discordia line with an upper intercept at  $2702 \pm 4$  Ma and a lower intercept at  $1235 \pm 170$  Ma which might correspond to the Grenvillian orogeny, however, the metamorphic overprint is not as pronounced as expected in the isotopic composition of the zircons; the lower intercept is therefore not as well defined as the upper one.



Laser data give a younger age of formation than the one obtained with ID-TIMS. There is no clear distinction between core and rim measurements, supporting the observation that the metamorphic overprint is not very pronounced. Most data points are reversely discordant. The upper intercept plots at  $2684 \pm 9$  Ma.



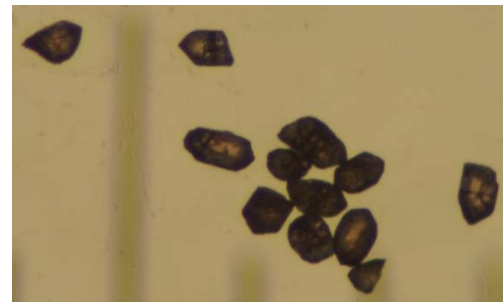
**Conclusion:** The age of formation is  $2702 \pm 4$  Ma, a weak metamorphic overprint happened in the Grenvillian.

### Sample 14FL2127 Orthomylonite

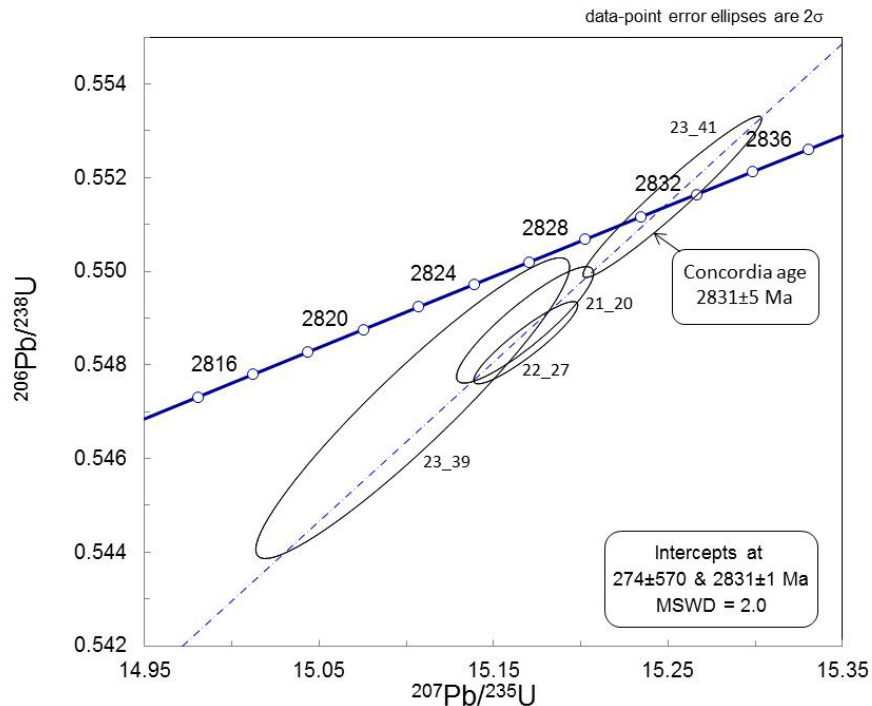
Location: East of Grenville

NAD 83 Zone UTM 18N E: 584778 N: 5562296

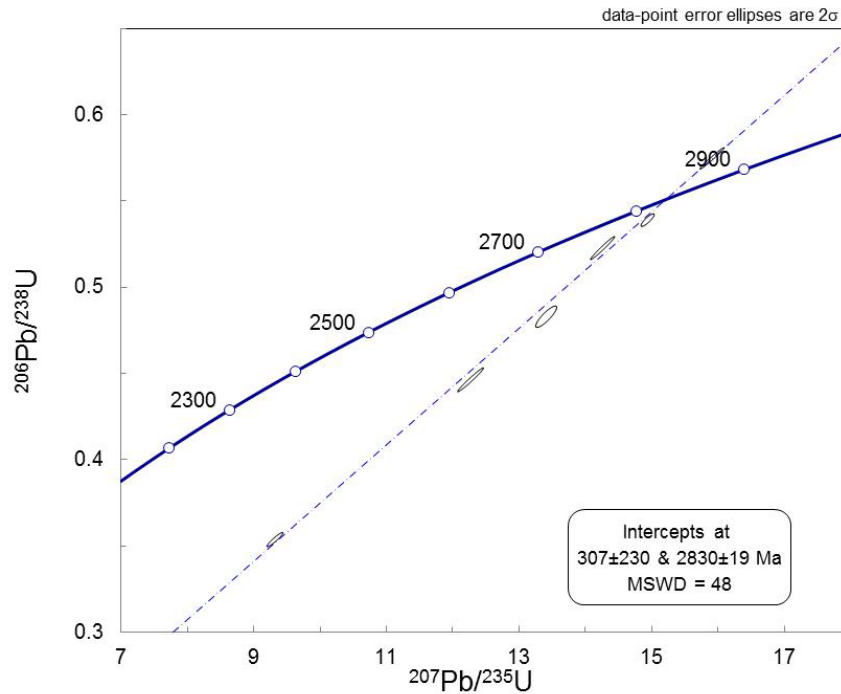
The zircon content in this sample is not very high; in addition grains are small. Most are colored, either pinkish or yellowish, indicating a quite high U content. Cracks and metamictisation are common, but no metamorphic rounding is observed. Most grains are prismatic, some are irregularly shaped.



All grains were treated with chemical abrasion. Due to the very small size of the grains for some analyses fractions of 2 or 3 grains were used. In total seven fractions were analyzed; they all plot close to Concordia, one data point, 23\_41, plots concordant. It reveals a Concordia age of  $2831 \pm 5$  Ma. Three analyses have large errors stemming from analytical problems and are omitted. The remaining analyses form a Discordia line with an upper intercept at  $2831 \pm 1$  Ma which is considered the age of formation.



Laser ablation data scatters and gives too low ages for the  $^{206}\text{Pb}/^{238}\text{U}$  ratio, however, reveals nearly the same upper intercept age on a Concordia diagram as with TIMS, but with a higher error.



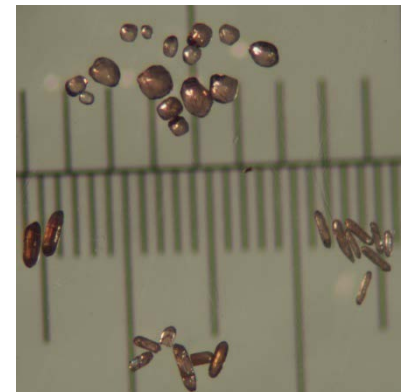
**Conclusion:** Age of formation is  $2831 \pm 1$  Ma, no strong metamorphic overprint is detected.

### Sample 14YD5004 Migmatite

Location: Opatica Subprovince

NAD 83 Zone UTM 18N E: 547162 N: 5576854

Zircons are quite abundant within this sample. One can clearly differentiate between magmatic and metamorphic grains. The magmatic ones are prismatic with different lengths and aspect ratios and are metamict (brown to slightly pinkish). Most magmatic grains show metamorphic rounding at the tip. The metamorphic zircons are clear, nearly colorless and round. Irregularly shaped but clear zircons appear to be related to the round grains and have probably also formed metamorphically. All zircon types occur in different sizes. Nine single grain zircons and 2 titanite fractions were analysed. Titanite was used to obtain the metamorphic age, and can be grouped into pinkish and yellowish grains. Both types are very clear and don't have visible on-growths. They were therefore not abraded.



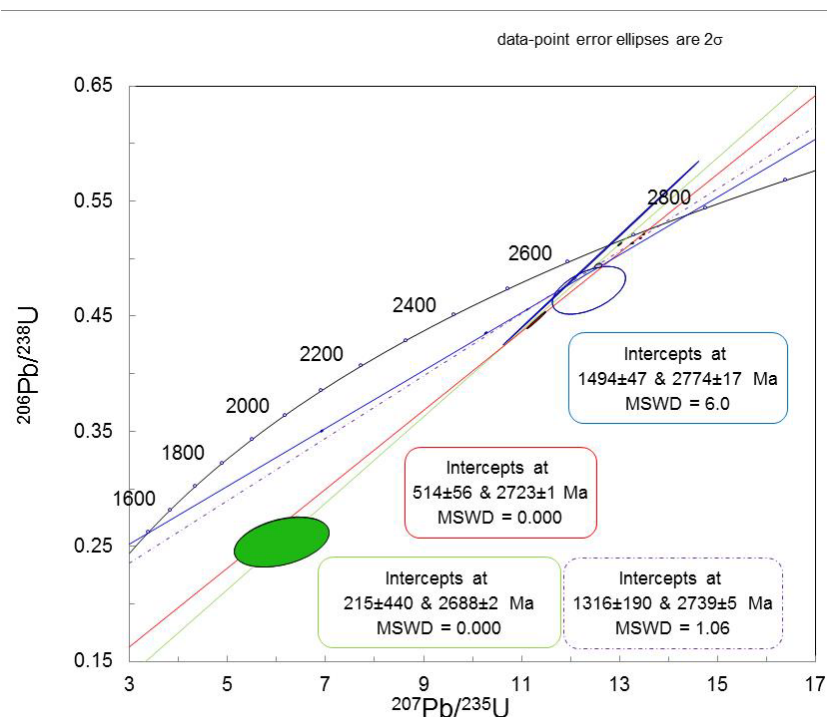
Analyses 18\_39, 18\_41 and 21\_30 represent prismatic grains with only slight metamorphic rounding, 18\_38 and 18\_40 represent tips of magmatic grains and 18\_35 and 18\_36 represent metamorphic grains. There is a

chemical distinction between magmatic and metamorphic grains. The magmatic grains are higher in U and Pb and have a lower U/Th ration compared to the metamorphic grains.

On a Concordia diagram the data points scatter. Grouped based on appearance 4 Discordia lines emerge. The oldest age,  $2774 \pm 17$  Ma, is an upper intercept formed by air abraded (except 21\_30), magmatic looking grains (18\_38, 18\_39, 18\_40, 18\_41, 21\_30). (blue line on the diagram). The metamorphic grains, also air abraded (18\_35, 18\_36), form a Discordia line with an upper intercept at  $2723 \pm 1$  Ma. This age very well defined with one grain, 18\_36, plotting very close to Concordia and is considered the metamorphic age (red line on diagram). Some chemically abraded metamorphic grains (21\_21, 21\_28, 21\_30, 21\_32) form an upper intercept between the intrusive and the metamorphic age,  $2739 \pm 5$  Ma. It is the question if that represents an earlier metamorphic event or if it is the result of mixing ages due to inheritance. (purple dashed line on the diagram). Two fractions of differently colored titanite grains form a Discordia line with an upper intercept at  $2688 \pm 2$  Ma, well constrained by an analysis of yellowish grains close to Concordia.

### Conclusion

The most clearly metamorphic looking grain (18\_36) lies close to Concordia and strongly supports the Discordia line with an upper intercept at 2723 Ma. This event is considered the first metamorphic event. The titanite upper intercept age of 2688 Ma, well constrained by an analysis close to Concordia, is considered either a second metamorphic event or a part of the protracted metamorphic path. The oldest age of 2774 Ma is regarded as the intrusive age. The lower intercepts are not well constrained, most likely due to several metamorphic overprints.





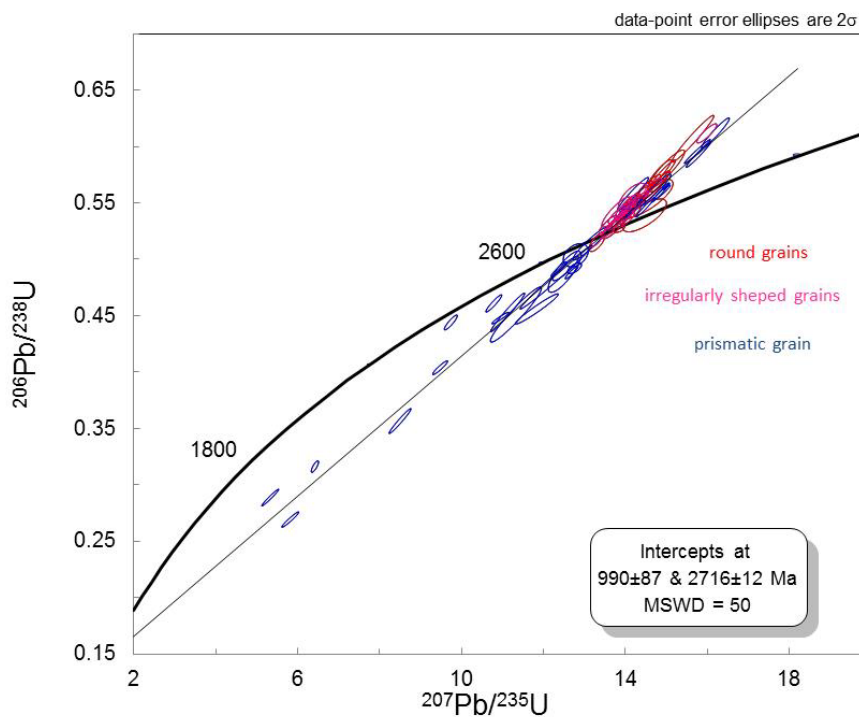
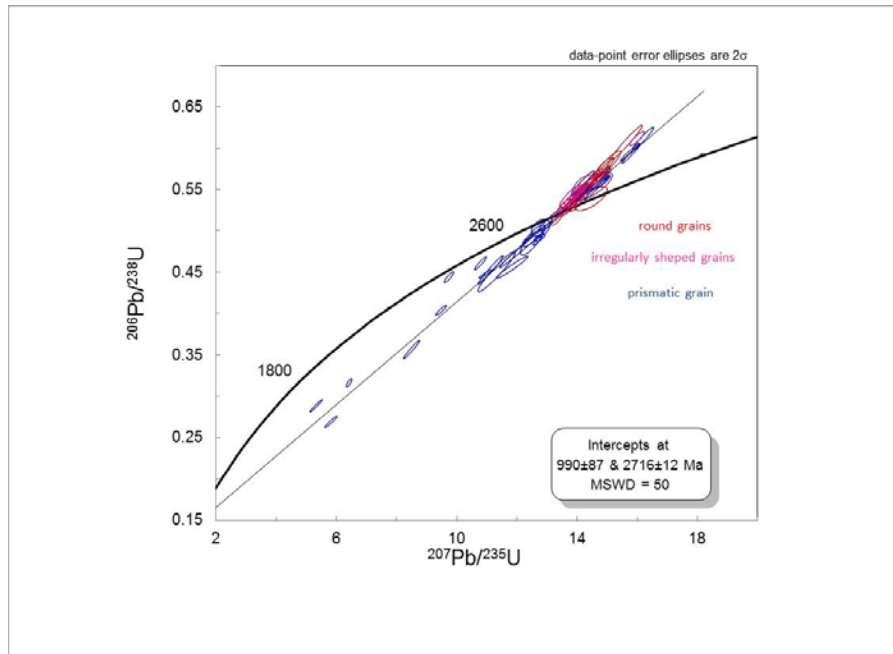
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Volet post-doctorant : Cornelia Roffeis

Juin 2015



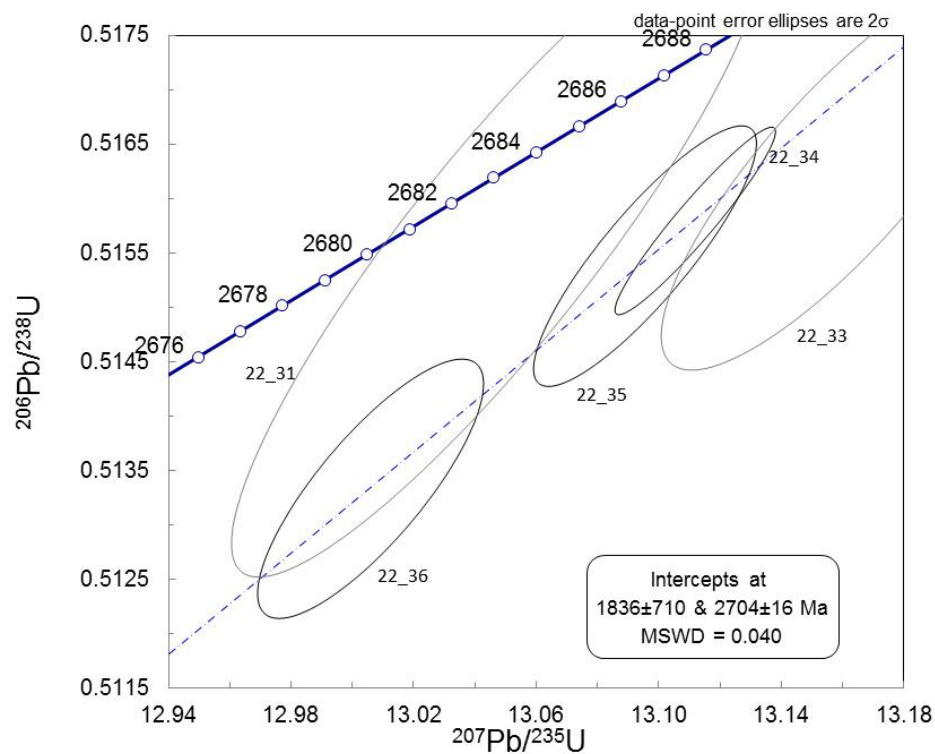
Laser ICPMS didn't detect the difference between magmatic and metamorphic grains. The ages are in general younger than the age of formation obtained with ID-TIMS, and scatter around the older metamorphic age. The upper intercept lies at  $2716 \pm 12$  Ma (MSWD = 50).



## Sample 14FT3008 Granite

Location: Dubergergranite, East of Grenville  
NAD 83 Zone UTM 18N E: 582147 N: 5543089

The zircons in this sample appear magmatic, no metamorphic rounding is observed. The grains are clear to slightly yellowish but no strong metamictisation is observed. They are all prismatic with different aspect ratios. Five single grains were analysed, they are chemically comparable in terms of U and Pb content, and Th/U ratio. All analyses plot slightly discordant. **Analysis 22\_31 is omitted in the calculation since the measurement was faulty.** Analyses 22\_36, 22\_35, 22\_34 and 22\_33 form a Discordia line with an upper intercept at  $2713 \pm 33$  Ma. Without the poor measurement 22\_33 the upper intercept lies at  $2704 \pm 16$  Ma, which is considered the age of formation.



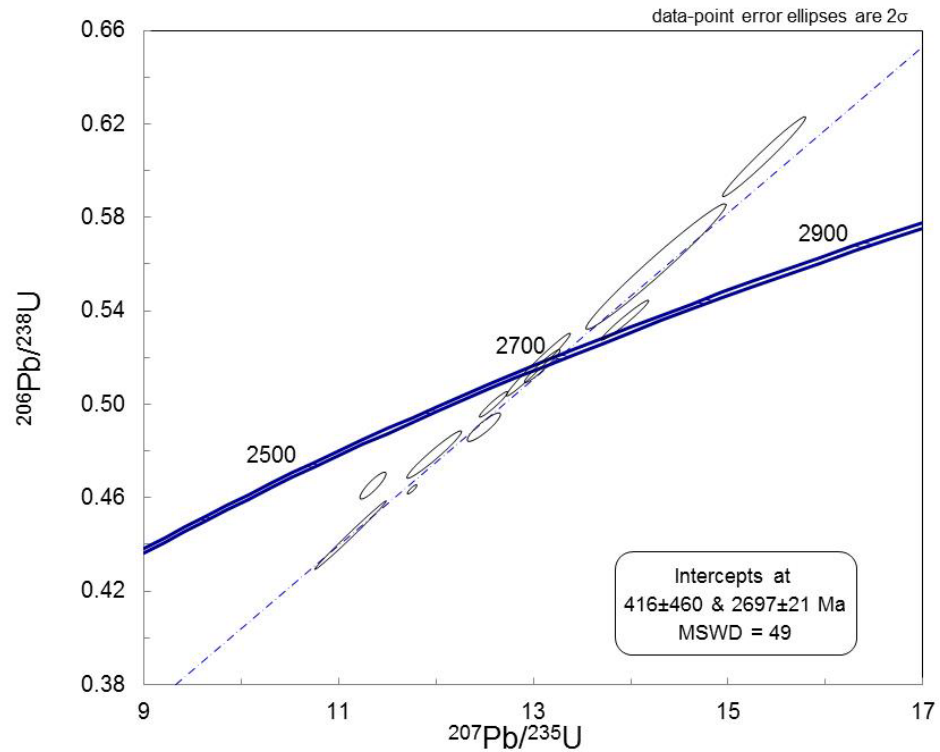
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Laser data confirms that there is no core-rim structure in the zircons. An upper intercept reveals  $2697 \pm 21$  Ma, which supports the TIMS age.

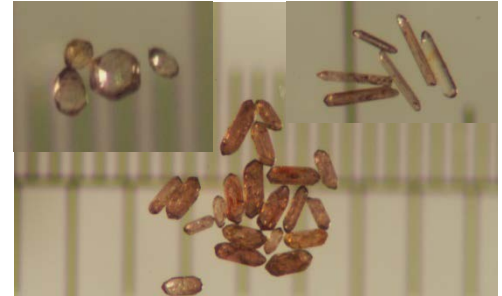


**Conclusion:** age of formation is  $2704 \pm 16$  Ma.

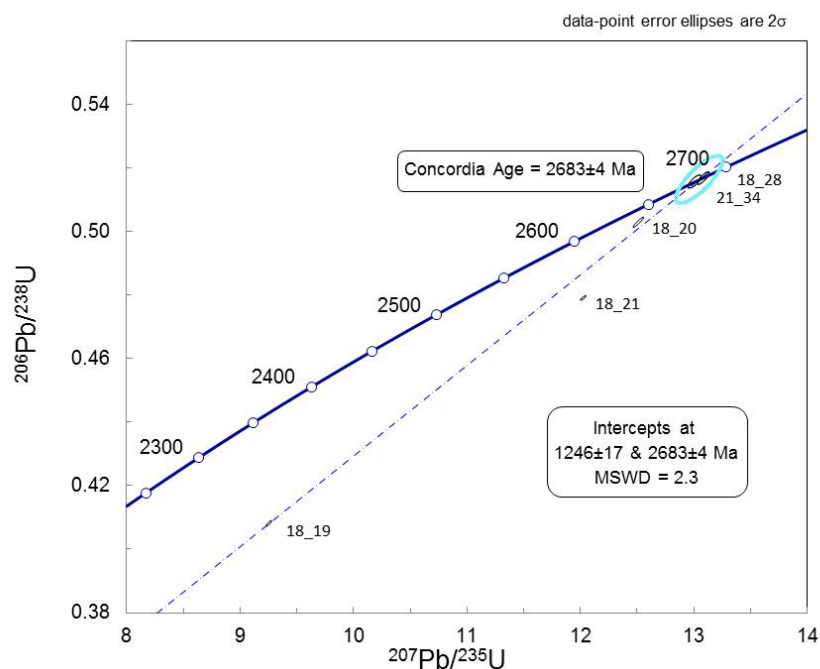
## Sample 14JM5021 Tonnancourt granite

UTM Nad 83 E 358591 N: 5416936

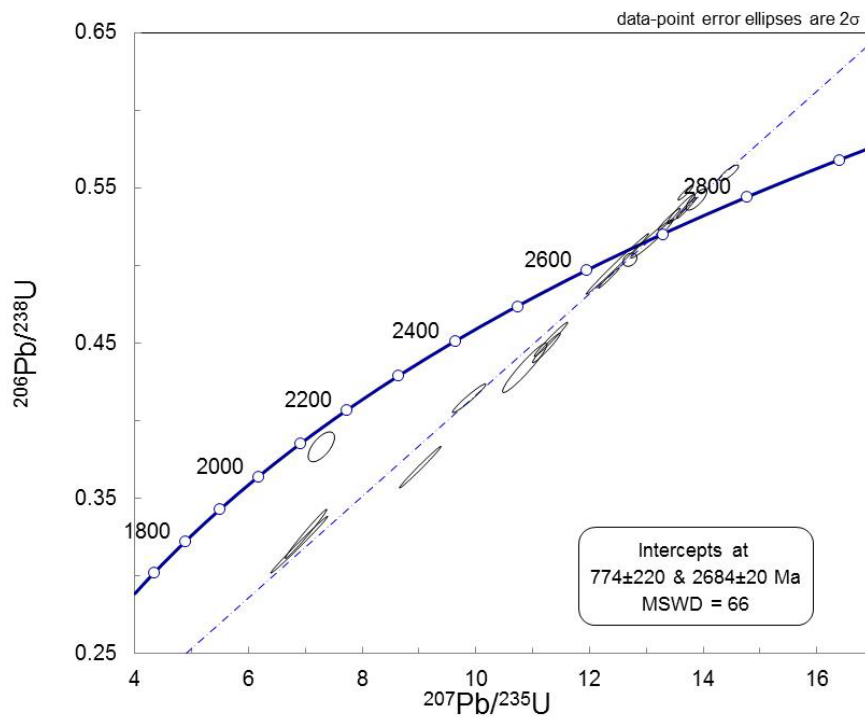
The sample reveals a lot of zircons which all appear to be of magmatic origin; no metamorphic rounding is observed. The grains are prismatic with varying aspect ratios, ranging from short prismatic to long, thin needles. Many grains show signs of metamictisation (yellow to brown in color), but also clear grains occur.



Five single grains were analysed, three metamict grains were treated with air abrasion (18\_19, 18\_20, 18\_21) and two clear grains were treated with chemical abrasion (18\_28, 21\_34). The air abraded grains plot discordant whereas the chemically abraded grains plot concordant. It seems like chemical abrasion managed to remove the areas affected by Pb loss better. Grains treated with chemical abrasion are distinctively lower in U and Pb compared to the air abraded grains. The chemically abraded grains form a Concordia age at  $2683 \pm 4$  Ma, the assumed age of formation. The discordant grains don't fall on a single Discordia line, but scatter. This might indicate several events causing Pb loss. The most meaningful Discordia line in terms of regional geology would be one formed by the concordant data points and grain nr 18\_19, a needle shaped grain, high in U and low in common Pb. It gives a lower intercept age of  $1246 \pm 17$  Ma, which might be related to the Grenvillian event.



Laser data suggests that there is no difference between core and rim analyses. A combined age from all laser data points reveals nearly the same age as ID-TIMS analyses,  $2684 \pm 20$  Ma.



**Conclusion:** The intrusive age of the rock is  $2683 \pm 4$  Ma a slight metamorphic overprint is detected in the Grenvillian.

## Sample 14FT3038, Tonalite

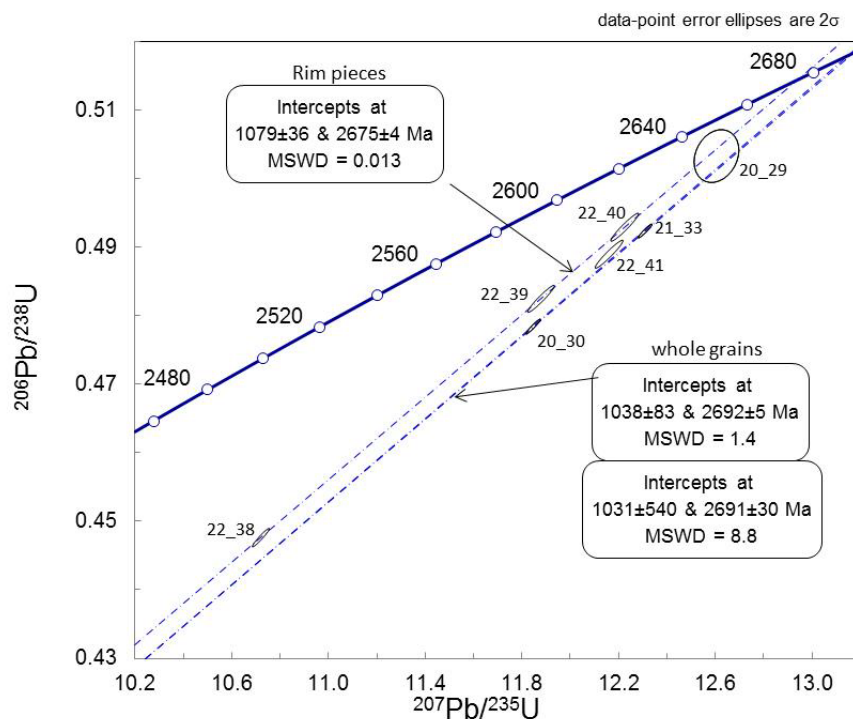
Location: Laganiere Complex

NAD 83 Zone UTM 18N E: 602523 N: 5561729

Zircon is very abundant in this sample; most grains are prismatic with different aspect ratios. Slight rounding is common, metamictisation is not pronounced. In many grains a core-rim structure is visible. Prismatic whole grains and pieces of the outermost rim – broken off from the core after chemical abrasion - were analyzed separately. Analyses 22\_38, 22\_39 and 22\_40 stem from rim pieces most likely not containing any core. Analyses 20\_29, 21\_33, 22\_41 and 20\_30 stem from prismatic whole grains.



Two Discordia lines can be plotted, one formed by rim pieces, one by whole grains. Data points 22\_39, 22\_40 and 22\_41 were calculated with default fractionation values, since the measured values seemed to have been disturbed. The rim analyses Discordia gives an upper intercept age at  $2675 \pm 4$  Ma, the upper intercept for prismatic grains lies at  $2691 \pm 30$  Ma. This age is the presumed age of formation. The high error stems from the poor fit of analysis 22\_41, a grain which shows magnificently lower values in U and Pb content compared to the other prismatic grains. Without this data point the age of formation is  $2692 \pm 5$  Ma.



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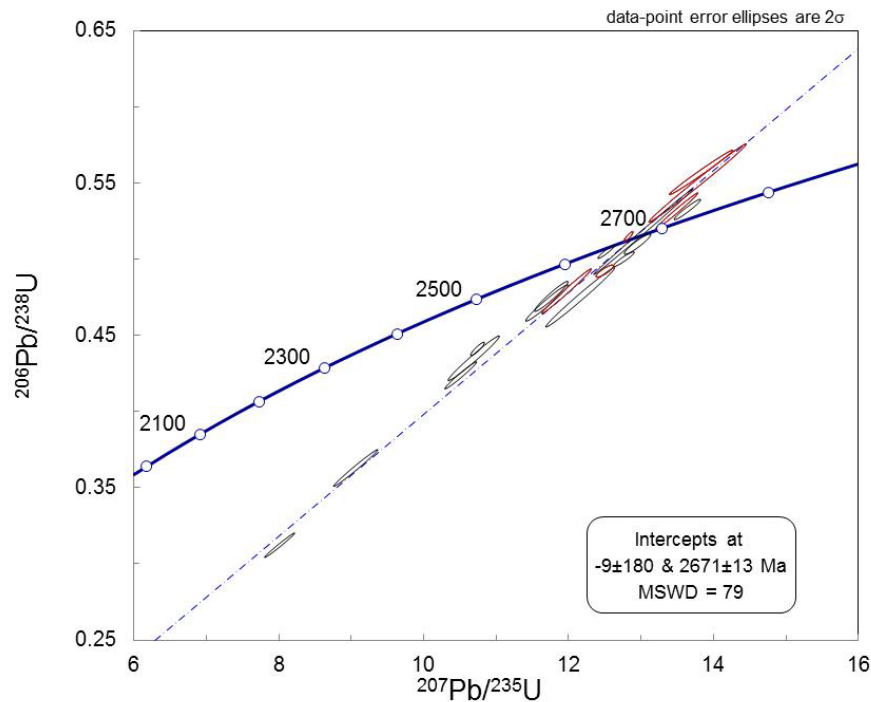
Volet post-doctorant : Cornelia Roffeis

Juin 2015



The metamorphic event responsible for the formation of the rim occurred at  $2675 \pm 4$  Ma. The lower intercept varies between 1079 and 1031 Ma and is not well established. However, it indicates later Pb loss at a Grenvillian time.

Laser data reveals younger ages for both, core and rim analyses. The data scatters and doesn't reveal two clearly different Discordia lines but rather shows that the core data (red) plots less discordant compared to the rim data. The upper intercept lies at  $2671 \pm 13$  Ma.



### Conclusion:

The rock was formed at  $2692 \pm 5$  Ma and experienced a first metamorphic event at  $2675 \pm 4$  Ma. A later event, probably Grenvillian, caused further Pb loss.

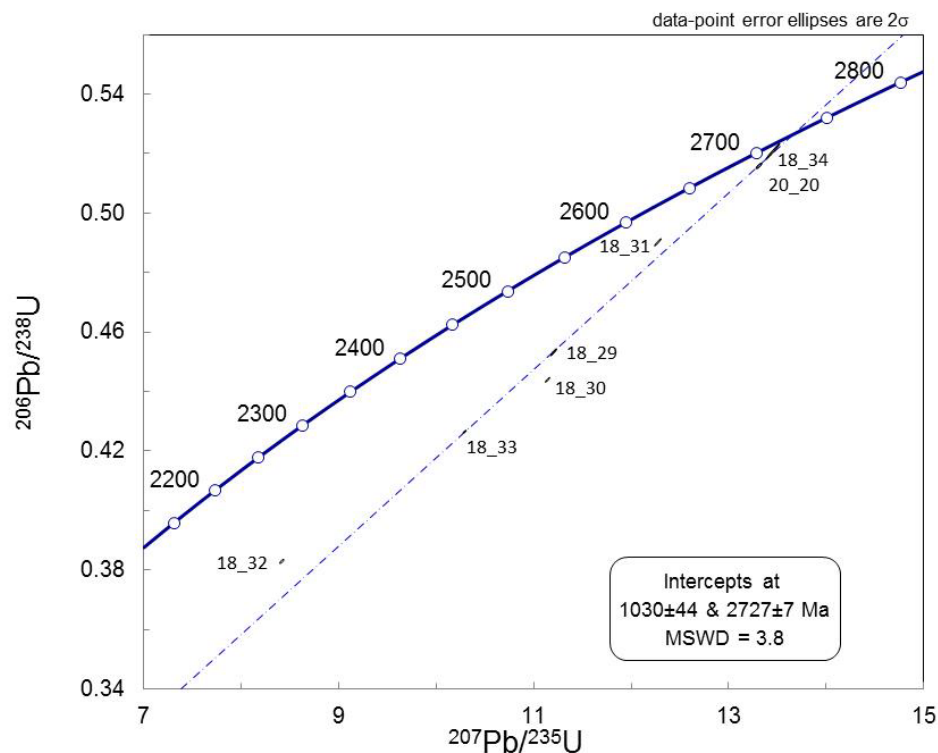
## Sample 14HH1206 Holmes tonalite

Location: UTM Nad 83 E: 374793 N: 5425352

The sample reveals many zircons which are generally prismatic with variable aspect ratios. The most common shape is short prismatic (1:2 – 1:3) but also long and narrow needles occur. Metamictisation ranges from slightly yellowish to brown. No rounding is visible.

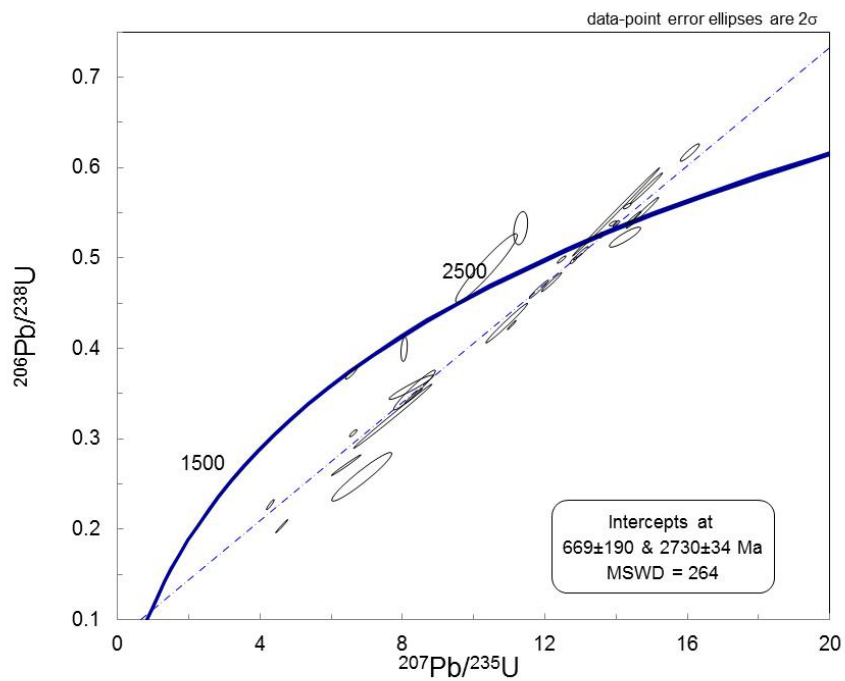


All analyses are discordant. However, they don't plot on the same Discordia line but scatter. The best analyses are 18\_34 and 20\_20, which represent long prismatic grains, treated with chemical abrasion. They plot just slightly underneath Concordia and therefore constrain the upper intercept very well. A Discordia line can be formed with these grains plus two short prismatic grains (18\_29 and 18\_33). The upper intercept lies at  $2727 \pm 7$  Ma, the presumed age of formation. The lower intercept lies at  $1030 \pm 44$  Ma which could indicate a Grenvillian influence. Grains 18\_31, 18\_32, 18\_30 don't plot on the same Discordia line but scatter. That might indicate several events that caused Pb loss.



Laser ICPMS measurements show no difference between the different zircon shapes or core and rim analyses. In general the data is more scattered. An upper intercept age gives  $2730 \pm 34$  Ma.





## Conclusion

The age of formation is best revealed but an upper intercept age from 4 ID-TIMS analyses and lies at 2727 Ma.

