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A novel sulcal taxonomy based on 454 manually labelled sulci

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Objective: To construct an evidence-based taxonomy of sulcal stability to establish the most and least consistent and reliable sulci. Our hierarchy of sulci will enable an order in which to identify and localise sulci for further human brain mapping.

1 Introduction

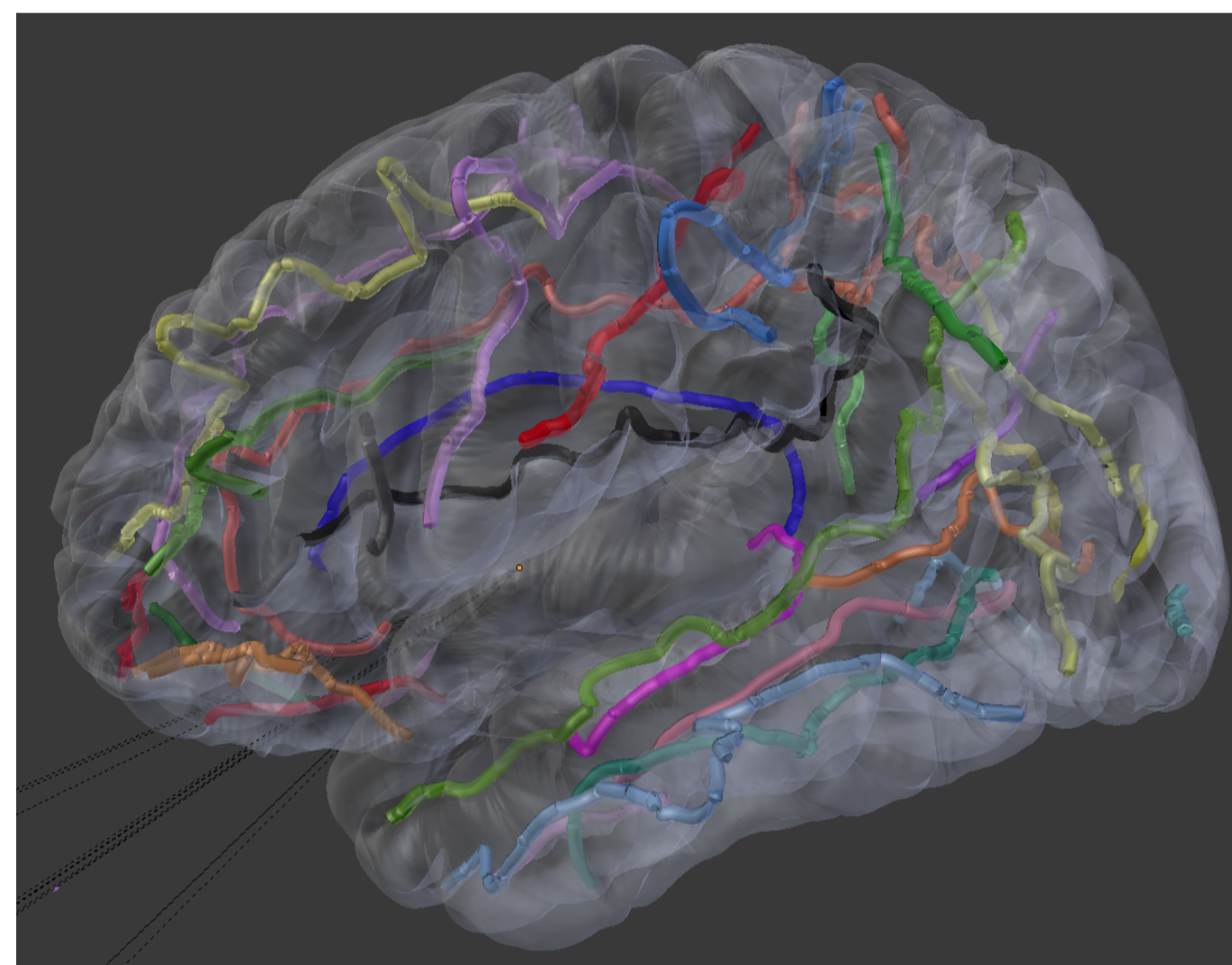
- Differences in sulcal location and morphology contribute to **large inter-individual variability**.
- Some sulci have more homogenous and **reliable development** than others¹.

- In this work we aim to systematise sulcal stability and reliability.

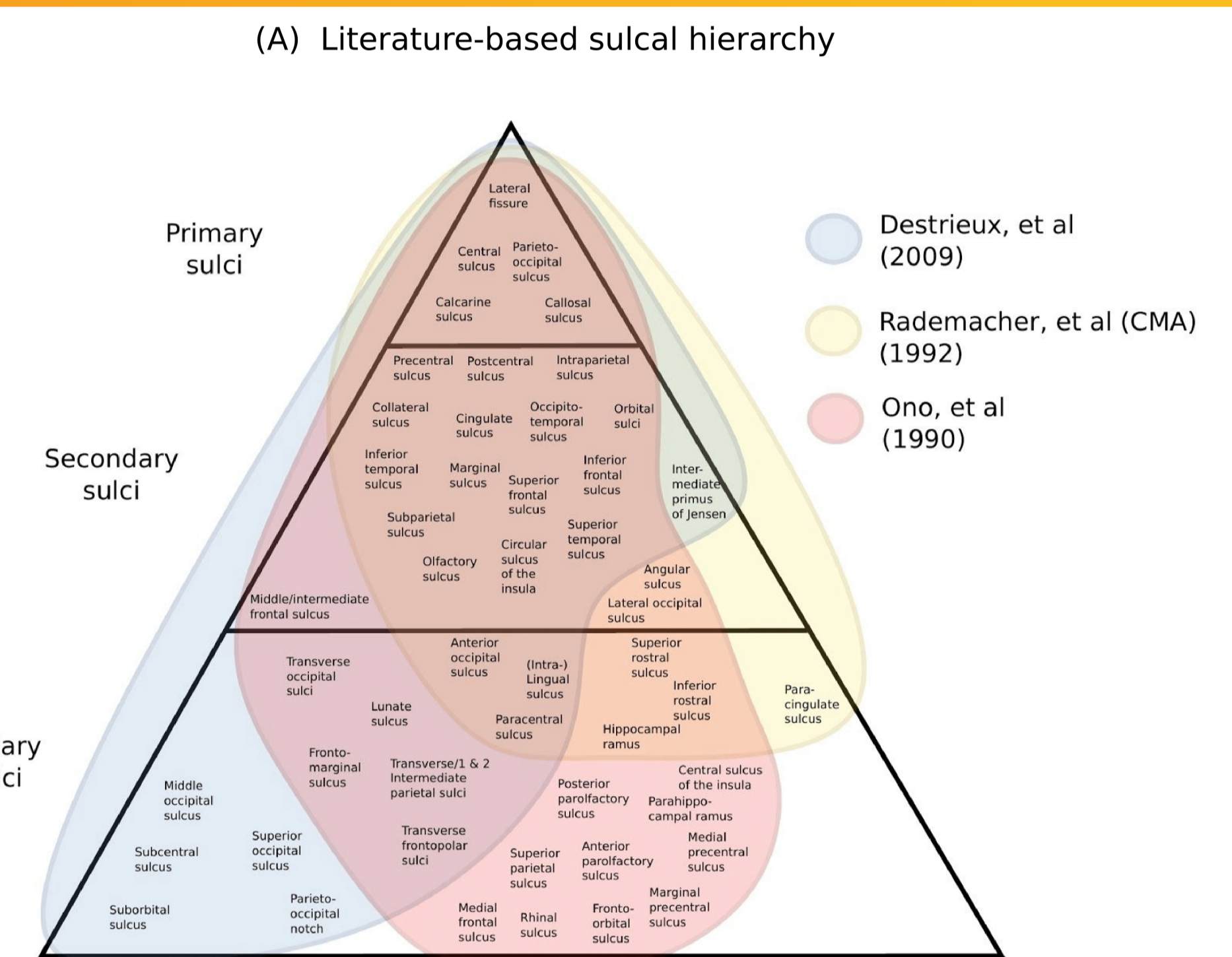
- **Origin landmarks** are considered as 'primary sulci'. Secondary sulci are typically reliably identified in most brains, and tertiary sulci exhibit the largest variability.

2 Materials & Method

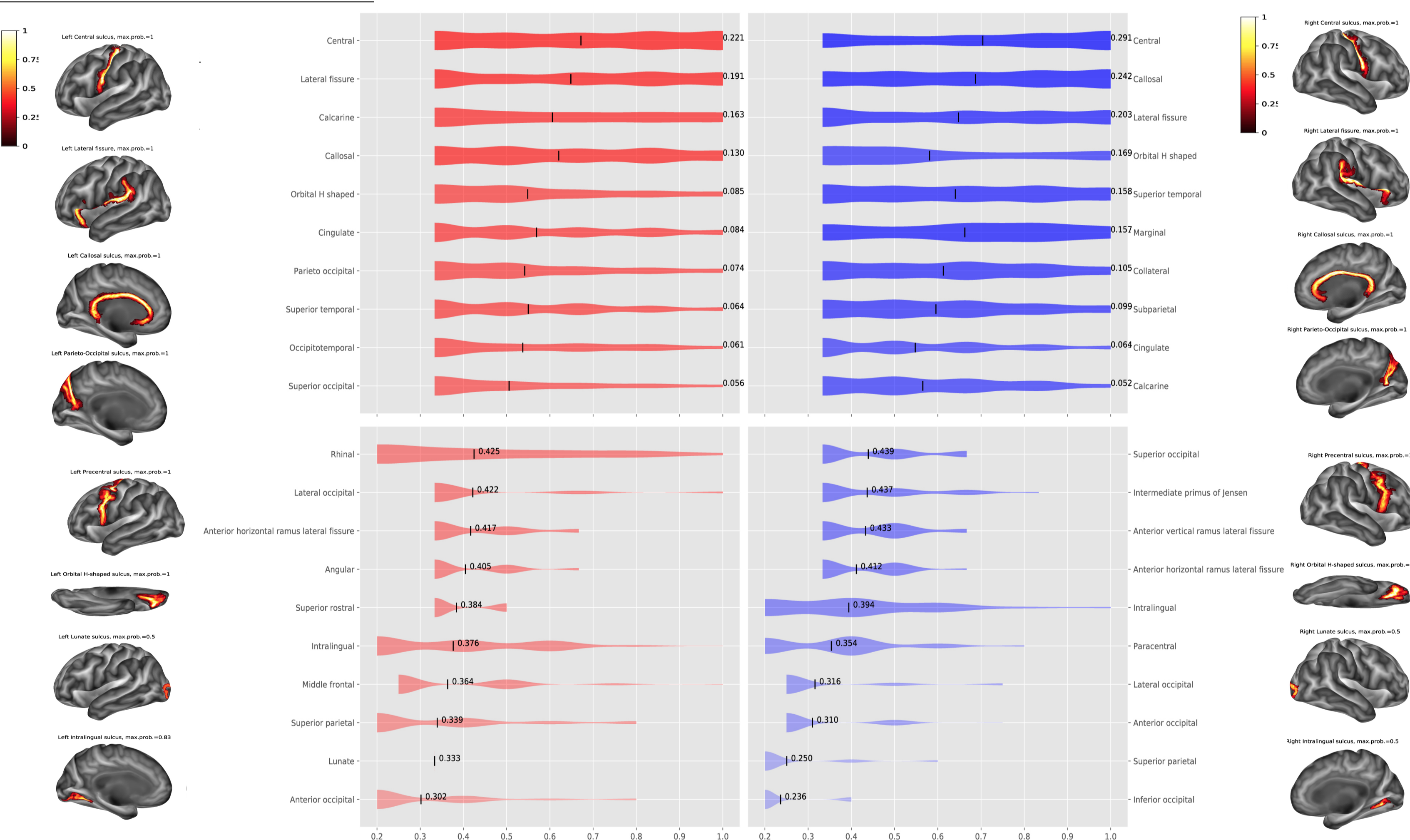
Manual segmentation of sulci in **6 HCP subjects** (3F, 22-30yo, right-handed) using **Blender**.



- **Mean** and **mass probability** calculated per sulcus.
- Sulcal location reliability was evaluated by measuring **largest common sulcus surface area**.



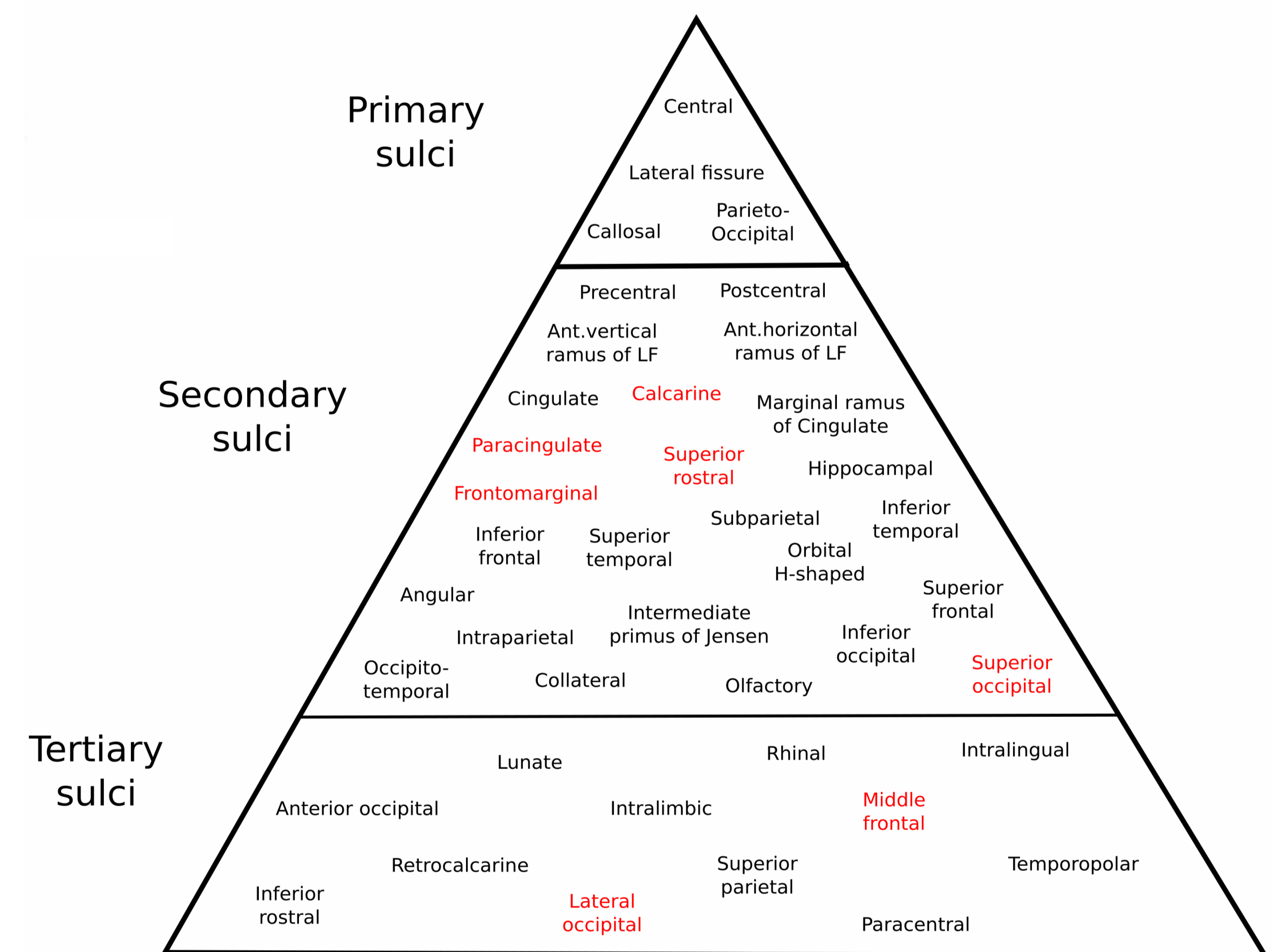
3 Results



The **top** and **bottom 10 stable sulci** in each hemisphere and some of their probability maps.

The most stable sulci were the **Central sulcus, Lateral fissure** and **Callosal sulcus** in both hemispheres.

(B) Evidence-based sulcal hierarchy



'**Primary sulci**' are the most stable & interlobular. '**Secondary sulci**' were identified in all hemispheres. '**Tertiary sulci**' were not identified in all hemispheres. Sulci in red have changed tiers from the literature-based hierarchy.

4 Discussion & Conclusions

- Stability of sulci in each tier are in general agreement with literature from classical neuroanatomy.
- A notable unexpected result is the lack of Parieto-Occipital sulcus stability, perhaps because of its common Y-bifurcation.

- Neuroimaging atlases are grounded in the use of **stable sulci as reference landmarks**².

- We provide an **evidence-based hierarchical atlas for cortical mapping** with additional inter-individual variability.

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