INTRODUCTION
The Peridotite Nappe obducted in New Caledonia during Late Eocene [1] and outcrops today over more than one third of New Caledonia on scattered masses all over the island (Fig. 1).

FRACTURED PERIDOTITES AND HYDRAULIC CONDUCTIVITY
95 values of hydraulic conductivity deduced from Lefranc tests between packers are available on the 4 boreholes of the Koniambo massif (Fig. 7).

\[
\log K \text{ varies between } -8.5 \text{ and } -2.9. \text{ On one borehole (P4), 60% of joint coating or infilling are hypogene and hydraulic conductivity decreases with depth. It is representative of fresh peridotites.} \\
\]

A correlation between fracture distribution and hydraulic conductivity is not clear but data show that:
- mean hydraulic conductivity of peridotites estimated from Lefranc tests between packers on Koniambo massif is \( K \approx 4 \); 
- most of observed fractures on cores is closed in situ and most probably are impervious (serpentine veins); 
- more permeable zones (\( \log K > -5 \)) correspond to highly weathered peridotites; 
- hydraulic conductivity of totally fresh peridotites decreases with depth.

The cores discontinuities are characterized by their type (typology defined for this study), dip, macrosopic mineralogy of coating or infilling, and stage of weathering grade of the peridotite.

The typology description allows distinguishing hypogene coating (serpentine) from supergene coating, resulting from weathering and water flow, that can include silica, nickel ore.

Here, we use deep boreholes data and cores of the Koniambo massif to characterize the fracture system of these aquifers.

FRACTURE SYSTEM MODELING

- Snow model of discrete fractures (infinite, isotropic, monodisperse, unique shape) applied to observed data (spacing = 0.35 m) and assumed aperture (b=10-4 m), gives a permeability consistent with field data; \( K = 3.2 \times 10^{-6} \text{ m/s} \text{ and } 3.2 \times 10^{-3} \text{ m}^2/s \).
- A numerical model is built [3] using two media:
  - A porous media with \( K=10^{-8} \text{ m/s} \) representative of fresh peridotites;
  - A second more permeable media with \( K=10^{-5} \text{ m/s} \) representative of highly weathered or fractured rock.

Geometry of this second media is (Fig. 8):
- ellipsoidal fractures (dimensions = 20, 20, 5 m),
- oriented N 130° and 45° dip and randomly distributed. Volume of this media is around 16% of total volume (consistent with measured data).

Flow modelling shows that this fracture system does not percolate and equivalent permeability is four times higher than the matrix.

If the modelled geometry is correct, fractures do not percolate so the real hydraulic conductivity is several orders of magnitude lower than the measured one by packer tests.

DISCUSSION AND PERSPECTIVES
- Fracturing is intense and homogenous with depth in peridotites;
- Supergene infilling and coating are observed on vertical dip discontinuities;
- Mean hydraulic conductivity measured on 200 m deep peridotites of the Koniambo massif by Lefranc tests between packers is \( K = 5 \), and probably overestimated;
- Hypogene mineralization is attached to fresh peridotites and shows that hydraulic conductivity decreases with depth;
- Model of peridotite matrix using \( \log K = -8 \), and permeable fractures with single orientation, dip 45° and log \( K > -5 \) does not percolate and hydraulic conductivity is near 10-8 m/s;
- Sensitivity tests must be applied on permeable ellipsoid extension, number and azimut.

References

Acknowledgements
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Fig. 1: The Grande Terre of New Caledonia (SW Pacific) with ultramafic formations pictured in green.

Fig. 2: Regolith profile developed on peridotite in New Caledonia.

Fig. 3: Fresh peridotite discontinuity typology: (a) Broken joint (BJ), here with supergene infilling of garnetite; (b) Closed joint (CJ), here with hypogene mineralogy of serpentinite; (c) Open joint (OJ), here without coating nor infilling; (d) Highly weathered zone (HWZ); (e) Highly fractured zone (HFZ).

Fig. 4: Fracture counting parameters: linear density and percentage of length of weathered or fractured rock.

Fig. 5: Results from the 800 m described cores are:
- Most discontinuities are broken joints;
- Few joints are horizontal (Fig. 5);
- Vertical joints are supergene.

Fig. 6: Fracturing counting of 4 deep cores.

Fig. 7: Distribution of modeled ellipsoidal representative of permeable fractured or weathered rock in a 100 x 100 x 300 m cube.

FRACTURE CHARACTERISATION
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REFERENCES
[4] University of Le Reunion, Saint-Denis, France.

MATERIAL AND METHODS
Four 200 m deep boreholes cores of the Massif du Koniambo (P3 to P6) have been described [2].

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