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# Discovery of Neoproterozoic banded iron formation (BIF) in Morocco

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Banded Iron Formations (BIF) have been discovered in the Menhouhou Neoproterozoic inlier (South-Eastern Morocco) during an exploration survey for gold mineralizations. The iron formations are interlayered in a felsic volcano-sedimentary sequence ($f.v.s.$) overlaying a mafic to intermediate volcano-sedimentary sequence ($m.v.s$). The iron formations form thin irregular lenses (up to 10 m) within the rhyolites of the $f.v.s.$ The BIF sequence outcrops as heterogeneous iron-rich banded layers in response to latter non-uniform reworking due to the effects of polyphased tectono-thermal events. Therefore, following the intensity of the hydrothermal and tectonic overprint, one can distinguish three types of BIF: (i) BIF I corresponds to Banded Iron Formation s.s. as it displays fine-grained alternation of quartz and hematite layers ($SiO_2$ = 73 wt % ; $Fe_2O_3$ = 26 wt %); (ii) BIF II shows, as well, the alternation of cm-thick hematite and very thin quartz-monazite layers, but is characterized by a strong iron enrichment due to silica leaching ($Fe_2O_3$ = 90 wt %, $SiO_2 < 2$ wt %, and CaO = 4 wt %); and (iii) BIF III did not present the well-banded alternation of quartz and hematite layers, but rather a disorganized assemblage of specular hematite, quartz, barite and calcite. BIF III is spatially associated with shear-zones developing a strong penetrative schistosity and a pervasive muscovite-argilic alteration. The three types of BIF are crosscut by posterior cm-sized barite and quartz veinlets.

**Geochronology**: The rhyolite host-rocks of BIF I have been dated using the in situ U/Pb method on zircons at CRPG-CNRS (CAMECA IMS 1270 CRPG-CNRS,

Nancy). Analyses of individual zircons from rhyolite define two groups of ages: (i) a Late Cryogenian - early Ediacaran age on seven inherited zircons (cores and rims) with a weighted average age of 630 $\pm$ 9 Ma and, (ii) an Ediacaran age obtained on 8 zircons (cores and rims) with a weighted average age of 571 $\pm$ 7 Ma. Therefore, a late Neoproterozoic age (Ediacaran) is assumed for the felsic volcanism and for the interlayered BIF of the Menhouhou inlier. This age is in agreement with other age determinations of volcanic series in the Pan-African inliers of the Anti-Atlas and High-Atlas chains (Gasquet et al., 2005).

**Geochemistry** : BIF I hematite and quartz exhibit a characteristic REE signature (Eu positive anomaly: Eu/Eu* = 1.66 and 1.52; high $La_{NASC}/Yb_{NASC}$ ratios: 3.93 to 4.62) of pristine BIF derived from hydrothermal solution. BIF II presents a whole-rock content enrichment in As, Cu, Sb, Sn coupled with a decreasing of Ba and Mo relatively to BIF I. The hematite REE signature displays a positive Eu anomaly (Eu/Eu* = 1.48) and a moderate $La_{NASC}/Yb_{NASC}$ ratio (2.03) indicating a possible LREE leaching during alteration. BIF III displays the highest whole-rock concentration in Ba (up to 4260 ppm) and Sr (61 ppm). The BIF III REE hematite signature has very high $La_{NASC}/Yb_{NASC}$ ratios (19.03) and a strong positive Eu anomaly (Eu/Eu* = 3.35) slightly different from BIF I hematite. Therefore, BIF II and III have petrographical and geochemical characteristics related to the late-hydrothermal and tectonic reworking of the Menhouhou pristine BIF I.

**Conclusions :** The newly discovered Banded Iron Formation of the Menhouhou inlier appears to belong to the Algoma-type. They formed in a bimodal volcanic basin and show hematite and quartz REE signatures of hydrothermal vents (Michard et al., 1983 and Lottermoser, 1989). Following Hoffman and Schrag (2000) and Young (2002), this type of BIF is developed during a glaciation event which occurred during the late Neoproterozoic and which is already reported in the Anti-Atlas chain (Dobals et al., 2002). However, the Menhouhou BIF appears as an isolated occurrence outcropping in the Precambrian inliers at the northern boundary of the West African Craton (Gasquet et al., 2005).

Doblas, M., Lopez-Ruiz, J., Cebria, J.-M., Youbi, N.,Degroote, E. (2002). Geology 30, 839-842.

Gasquet, D., Levresse, G., Cheilletz, A., Azizi-Samir, M.R., Mouttaqi, A. (2005). *Precambrian research*, 140, 157-182.

Hoffman, P.F. and Schrag, D.P. (2000). *Sci. Am.* 282, 68-75.

Lottermoser B. G. (1989). *Mineralium. Deposita*, 24, 92-99.

Michard A., Albarede F., Michard G., Minster J.F., and Charlou J.L. (1983). *Nature*,

303, 795-797.

Young G. M. (2002) *Journal of African Earth Science*, 35, 451-466.