Available online at www.sciencedirect.com
SCIENCE DIRECT
Journal of African Earth Sciences 45 (2006) 61–73
Journal of African Earth Sciences
www.elsevier.com/locate/jafrearsci

Talc indices from Boumnyebel (Central Cameroon), physico-chemical characteristics and geochemistry

C. Nkoumbou [a,c,*], D. Njopwouo [b], F. Villiéras [c], A. Njoya [a], C. Yonta Ngouné [a], L. Ngo Ndjock [b], F.M. Tchoua [a], J. Yvon [c]

[a] *Laboratoire de Géologie Economique et Environnementale, Département des Sciences de la Terre Sciences, Faculté des Sciences, Université de Yaoundé I, B.P. 812 Yaoundé, Cameroon*
[b] *Laboratoire de Physico-Chimie des Matériaux Minéraux, Département de Chimie Inorganique, Faculté des Sciences, Université de Yaoundé I, B.P. 812 Yaoundé, Cameroon*
[c] *Laboratoire Environnement et Minéralurgie, UMR 7569, INPL-CNRS, E.N.S.G, 15 Avenue du Charmois, B.P. 40, F-54501 Vandoeuvre-lès-Nancy Cedex, France*

Received 16 July 2005; received in revised form 27 December 2005; accepted 3 January 2006
Available online 3 March 2006

Abstract

Two talc schist occurrences were discovered in the Boumnyebel area, embedded in the Pan-African mica schist, at the junction between Archean, Eburnean and Neoproterozoic formations in Cameroon. They have been analysed by different techniques such as chemical analyses, XRD, DRIFTS, DTA and TG. The talc schist of the northern deposit contains talc (up to 95 wt%) with chlorite, goethite and lepidocrocite as minor minerals. The talc schist of the southern deposit has up to 88% of talc and is speckled with dark green phenoblasts of amphiboles (coexisting prismatic tremolite and magnesio-riebeckite). Due to its high talc content, the amphibole-free talc schist is economically attractive. Chemical analyses show that most of the rocks consist of SiO_2, MgO and Fe_2O_3, except the sample from the southern deposit that displays some amounts of Al_2O_3 and CaO. Among trace elements, Ni, Co and Cr are as high as in serpentinized peridotites, and suggest a protolith of ultrabasic nature. Chromium concentration in tremolite reaches 6178 ppm; most of the trace elements (Cd, Cr, Dy, Er, Eu, Ga, Gd, Ho, Lu, Nd, Pr, Sm, Sn, Sr, Tb, Tm, Y, Yb, Zr) are compatible with a tremolite lattice. The regional metamorphism yielded garnet micaschist nappes and thus belongs to the upper greenschist facies. Based on the high talc contents of the rocks and occasional coexisting tremolite and magnesio-riebeckite, the origin of the talc deposits is assigned to a hydrothermal alteration of ultramafic rocks. During the hydrothermal event, the fluid composition changed from silica-rich to lime-rich, but very few trace element contents were affected. Thus the low Rb, Sr, Th, Nb, K, Ta, Y, Zr, Hf, MREE and HREE and high Ni, Cr, Co contents of the rocks point to depleted peridotites (harzburgite–lherzolite) and pyroxenite as protoliths. The hydrothermal alteration is expressed in the positive cerium anomaly accompanied by little LREE enrichment of talc-rich rocks and hornblendite. The studied talc schist deposits and the neighbouring gabbroic and ultramafic rocks may belong to a dismembered Pan-African ophiolite set.

Keywords: Cameroon; Boumnyebel; Talc schist; Physico-chemical characteristics; Hydrothermal alteration; Protolith

1. Introduction

Physico-chemical and beneficiation studies of clay materials in Cameroon have been carried out on kaolinite, illite, montmorillonite, palygorskite and beidellite (Njopwouo, 1984; Njopwouo et al., 1987, 1988; Elimbi and Njopwouo, 2002) but not on talc. Though talc occurrences are rare in Cameroon, two occurrences of talc-rich rocks are reported

* Corresponding author. Address: Laboratoire de Géologie Economique et Environnementale, Département des Sciences de la Terre Sciences, Faculté des Sciences, Université de Yaoundé I, B.P. 812 Yaoundé, Cameroon. Tel.: +237 954 85 01.
E-mail address: nkoumbouc@yahoo.fr (C. Nkoumbou).

1464-343X/$ - see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jafrearsci.2006.01.007

at Baoina and Mayo Boula in North Cameroon (Laplaine, 1969). Another geological survey of these sites has confirmed their limited volume. They occur as 1-m-thick dykes in amphibolite. X-ray diffraction reveals up to 85% of talc with chlorite, amphiboles, serpentine and diopside as minor minerals and traces of quartz, calcite, dolomite, magnesite and pyrophyllite. At Lomié (Eastern Cameroon), serpentinite resulting from the metasomatic alteration of peridotite displays different types of contacts with the surrounding mica schists and quartzites (e.g. 1: serpentinite–carbonate–mica schist; 2: serpentinite–talc schist–mica schist; 3: serpentinite–carbonate–talc schist–mica schist). At most of these contacts, a few meter-sized talc schists and carbonates are well developed in shear zones and fractures (Ndonguissop et al., 1999), and they may result from the metasomatic alteration of serpentinite during its emplacement; the shear zones acted as pathways for metasomatic fluids. This work presents the first physico-chemical characterisation and geochemical data of large outcrops of talc schist recently discovered in the Boumnyebel area, located 90–100 km west of Yaoundé city.

2. Geological setting

Boumnyebel area is a key region of the Precambrian orogens in Cameroon. It is located at the junction between (1) the Archean Ntem unit (3.2–2.9 Ga, Lasserre and Soba, 1976; Tchameni, 1997), (2) the Lower Nyong Unit, a reworked western part of the Archean Ntem Group during the Eburnean orogeny (2.2–2.0 Ga, Feybesse et al., 1987; Toteu et al., 1994) and (3) the Neoproterozoic migmatitic Yaounde gneisses (Pan-African orogeny, 600 Ma) (Nzenti et al., 1988; Mvondo et al., 2003) (Fig. 1a). It is noteworthy

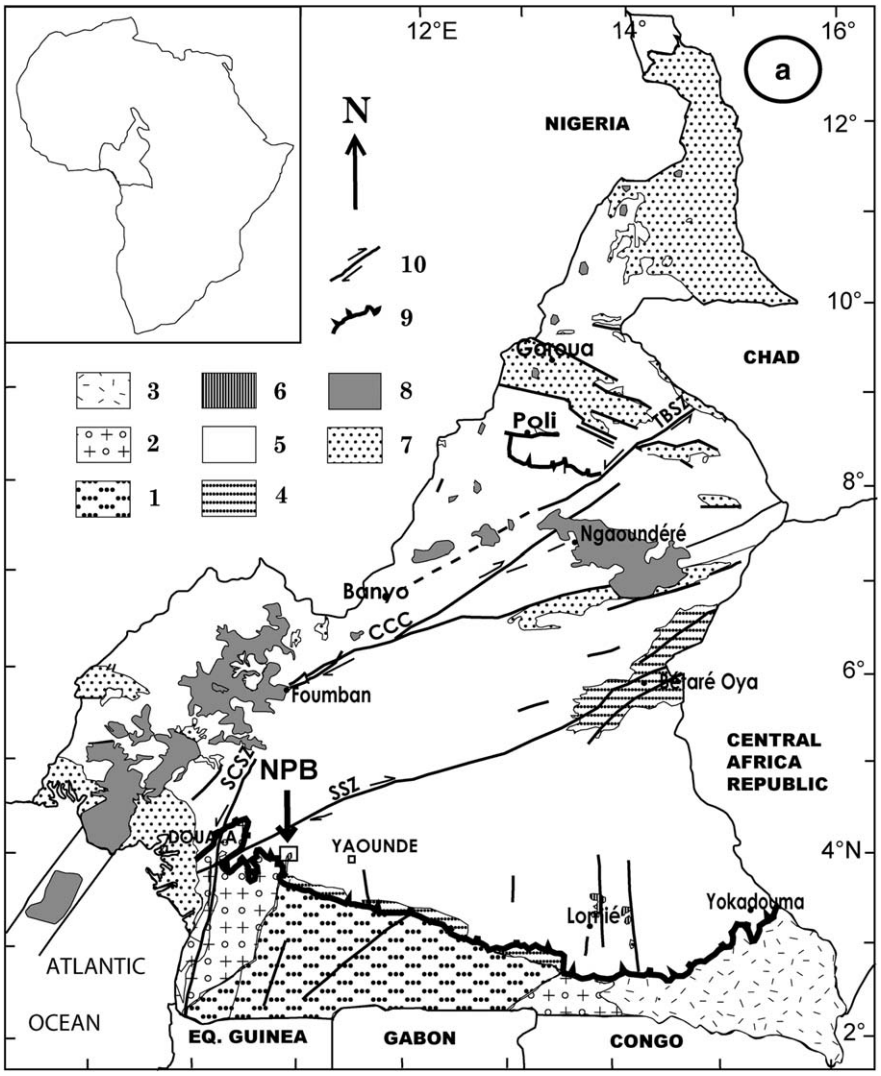

Fig. 1a. Sketch geological map. (1) Archean Ntem unit; (2) Eburnean Ayna and Lower Nyong units, respectively east and west of Ntem unit; (3) Dja series; (4) Neoproterozoic basins; (5) Pan-African belt; (6) Ophiolitic sets; (7) Mesozoic sediments; (8) Cenozoic volcanic rocks of the Cameroon Line and the Adamawa plateau; (9) thrusts; (10) faults: TBSZ, Tcholiré-Banyo shear zone; CCSZ, Central Cameroon shear zone; SSZ, Sanaga shear zone; SCSZ, Southwest Cameroon shear zone. The square NPB indicates the studied area.