



Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Comptes Rendus Palevol

www.sciencedirect.com



Human Palaeontology and Prehistory

Magnetic polarity of Masol 1 Locality deposits, Siwalik Frontal Range, northwestern India

Étude des polarités magnétiques des dépôts de la localité de Masol 1, chaîne frontale des Siwaliks, Nord-Ouest de l'Inde

Cécile Chapon Sao^{a,*}, Salah Abdessadok^a, Anne Dambricourt Malassé^a, Mukesh Singh^b, Baldev Karir^b, Vipnesh Bhardwaj^b, Surinder Pal^b, Claire Gaillard^a, Anne-Marie Moigne^c, Julien Gargani^d, Alina Tudryn^d

^a *Histoire naturelle de l'Homme préhistorique (HNHP, UMR 7194 CNRS), Département de préhistoire, Muséum national d'histoire naturelle, 16, place du Trocadéro, 75016 Paris, France*

^b *Society for Archaeological and Anthropological Research, Chandigarh, India*

^c *Histoire naturelle de l'homme préhistorique (HNHP, UMR 7194 CNRS), Centre d'études et de recherches préhistoriques (CERP), 66720 Tautavel, France*

^d *GEOPS, Géosciences Paris-Sud, (UMR 8148 CNRS), Université Paris-Sud, 91405 Orsay, France*

ARTICLE INFO

Article history:

Received 18 February 2015

Accepted after revision 30 September 2015

Available online xxx

Handled by Anne Dambricourt Malassé

Keywords:

Upper Siwalik Subgroup

Siwalik Frontal Range

Masol inlier

Quranwala fossiliferous zone

Geomagnetism

Gauss-Matuyama geomagnetic reversal

Cut marks

ABSTRACT

The Mio-Pleistocene Siwalik formations have been known worldwide since the 19th century for their fossil hominoids. Numerous paleomagnetic studies have contributed to build the chronological framework of the Siwalik Group subdivided into Lower, Middle and Upper Siwalik Subgroups. Our study concerns the Tatrot Formation (Late Pliocene) of the Upper Siwalik Subgroup located at Masol in the Chandigarh Siwalik Frontal Range (India), and is accessible by the Patiali Rao River. At Masol (district Mohali, Punjab), the erosion of the anticline structure has formed an inlier and exposed paleontological assemblages characterizing the Late Pliocene "Quranwala fossiliferous zone". Since 2008, the Indo-French research program, "Siwaliks", has conducted surveys in the Masol inlier and has collected stone tools on the surface of the outcrops among fossilized bones, a few with cut marks. The first cut-marked bone was discovered in 2009 at Masol 1 (M1). The study of the magnetic polarities of some stratigraphic units of M1 revealed that the deposits recorded a normal polarity. According to the paleontology and the previous magnetostratigraphy of the Patiali Rao, it appeared that the deposits of Masol 1 are older than the Gauss-Matuyama reversal, dated to 2.58 Ma.

© 2015 Académie des sciences. Published by Elsevier Masson SAS. All rights reserved.

RÉSUMÉ

Les formations mio-pléistocènes des Siwaliks sont mondialement connues depuis le XIX^e siècle pour leurs hominoïdes fossiles. De nombreuses études paléomagnétiques ont contribué à établir le cadre chronologique du groupe Siwalik (du Miocène au Pléistocène moyen). Notre étude porte sur la formation Tatrot (Pliocène supérieur) du sous-groupe Siwalik supérieur affleurant à Masol, une localité située dans la chaîne frontale des Siwaliks proche de Chandigarh (piémonts himalayens du Nord-Ouest de l'Inde), accessible par la

Mots clés :

Siwalik supérieur

Chaîne Frontale des Siwaliks

Boutonnière de Masol

Zone fossilifère Quranwala

Inversion géomagnétique Gauss-Matuyama

Traces de boucherie

* Corresponding author.

E-mail address: c.chapon.sao@mnhn.fr (C. Chapon Sao).

<http://dx.doi.org/10.1016/j.crpv.2015.09.018>

1631-0683/© 2015 Académie des sciences. Published by Elsevier Masson SAS. All rights reserved.

rivière Patiali Rao. La structure anticlinale et l'érosion ont formé une boutonnière donnant accès à des vertébrés fossiles terrestres et d'eau douce, caractéristiques de la fin du Pliocène supérieur (zone fossilifère Quranwala de la formation de Masol, Tatrot final). Depuis 2008, le programme de recherche franco-indien « Siwaliks » prospecte cette boutonnière et collecte des outils lithiques en surface des affleurements parmi des fossiles dont certains portent des traces de boucherie. Le premier fossile avec des traces de découpes a été découvert à Masol 1 en 2009. L'étude des polarités magnétiques des unités lithostratigraphiques de cette localité (M1) indique une polarité normale et intermédiaire. Compte tenu des nombreuses données biochronologiques de la zone Quranwala dans laquelle s'inscrivent les fossiles aux traces de découpe, d'une part, et des analyses magnétostratigraphiques bien connues du Patiali Rao, d'autre part, les dépôts concernés sont attribués à la magnétozone de Gauss et à la fin du Pliocène.

© 2015 Académie des sciences. Publié par Elsevier Masson SAS. Tous droits réservés.

1. Introduction

The Masol inlier (district Mohali, Punjab) is known for its fossiliferous deposits belonging to the "Quranwala zone", which is rich in vertebrate species characterizing the Late Pliocene of the Siwaliks (Sahni and Khan, 1964, 1968). The Indo-French program, "Siwaliks", was conducting pre-historic research in this sector since 2008 (Dambricourt Malassé, 2016; Dambricourt Malassé et al., 2016a), collecting stone tools (Gaillard et al., 2016) and numerous fossils (Moigne et al., 2016) among which a few bovid bones show cut marks made by sharp edges of artefacts in quartzite (Dambricourt Malassé et al., 2016b). Considering the geological map of Sahni and Khan (1964, 1968), the magnetostratigraphy (Ranga Rao et al., 1995), the fossils collected in the Quranwala fossiliferous zone (Moigne et al., 2016) and the long field experience of the Indian team in this area, it clearly appears that the deposits belong to the Tatrot Formation (Pliocene). Its uppermost part coincides with the Gauss/Matuyama magnetic reversal (Ranga Rao, 1993; Ranga Rao et al., 1995) dated to 2.58 Ma (Cande and Kent, 1995). The cut marks on the bones reveal anthropic activities on the Asian continent slightly older than the earliest ones known so far in Africa at Kada Gona in Ethiopia (Coppens, 2016; Dambricourt Malassé, 2016; Semaw, 2010) and in Asia at Longgupo Cave (South China) dated to the very beginning of the Pleistocene (Han et al., 2015). The paleomagnetic study presented in this article is integrated into the pluridisciplinary Indo-French program 2008–2014 (Abdessadok et al., 2016; Chapon Sao et al., 2016; Dambricourt Malassé et al., 2016a, b; Gaillard et al., 2016; Gargani et al., 2016; Moigne et al., 2016; Tudryn et al., 2016), and was undertaken to confirm that the deposits of Masol 1 are below the Matuyama/Gauss geomagnetic reversal.

2. Geological context of the Siwalik Group

The Siwaliks are continental molasse deposits that extend from the North of Pakistan to Assam in North-east India along the Himalayan Range. The Siwalik Series have been known worldwide since the 1830s for their Neogene and Quaternary fossil vertebrates, especially in the Upper Indus Basin, with special attention paid to the human origins in this area of the Indian sub-continent (e.g.,

Dennell, 2010, see review of the history in Dambricourt Malassé et al., 2016a). The 6000 meter thick Siwalik Series is divided into three subgroups: Lower, Middle and Upper Siwalik (see Patnaik, 2013 for a review; Stidham et al., 2014) and further into zones or formations based on Mammalian fauna, called faunal zones (Pilgrim, 1913). These biostratigraphic subdivisions are named Kamliyal and Chinji for the Lower Siwalik, Nagri and Dhok Pathan for the Middle Siwalik, Tatrot, Pinjor and Boulder Conglomerate for the Upper Siwalik. Unfortunately, the paleontological record is spatially unequally distributed, and the deposits are characterized by lateral facies variations complicating the regional correlations (Nanda, 2002). To ease this difficulty, a well-developed chronostratigraphic framework was established based on studies of magnetic polarity (Barry et al., 1982, 2012; Keller et al., 1977; Opdyke et al., 1979), coupled with fission track dating of volcanic tuffs (Johnson et al., 1982).

The type locality of the Tatrot Formation is described in the Potwar Plateau, Pakistan, and the type locality of the Pinjor Formation in a northeastern area of the Chandigarh anticline, near the Pinjaur Township (Fig. 1). Numerous fossil species were exhumed from several localities of the Tatrot and Pinjor Formations (Badam, 1973; Barry et al., 1982, 2012; Gaur and Chopra, 1984; Nanda, 1973; Patnaik, 2003, 2013; Raghavan, 1990; Sahni and Khan, 1964, 1968; Sahni and Mitra, 1980; Stidham et al., 2014). Four tuffaceous mudstones have been discovered in the Pinjor Formation near the Ghaggar River (Tandon and Kumar, 1984), but only one was dated by fission tracks, providing an age of 2.14 ± 0.5 Ma (Mehta et al., 1993). Thus, this tuffaceous layer became a chronological benchmark to correlate the magnetostratigraphy of the Pinjor Formation with the geomagnetic polarity time scale (GPTS) (Gradstein et al., 2004; Kumaravel et al., 2005; Tandon et al., 1984).

In other Upper Siwalik localities in Pakistan and India, the chronostratigraphic and paleontological results showed that the uppermost part of the Tatrot Formation provides a paleontological assemblage with new species, especially *Equus sivalensis*, emerging during the very Late Pliocene (Upper Tatrot Formation) and developing over the Pleistocene (Pinjor Formation) (Nanda, 1994, 2002). This paleontological assemblage is called "transitional fauna" (Sahni and Khan, 1968; Sahni and Mitra, 1980). At Masol, the top of this transition coincides with the

Download English Version:

<https://daneshyari.com/en/article/6448076>

Download Persian Version:

<https://daneshyari.com/article/6448076>

[Daneshyari.com](https://daneshyari.com)