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山西静乐贺丰三趾马动物群与磁性地层[1)]

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摘要 对 P. Teilhard de Chardin(德日进)和杨钟健发现贺丰动物群的山西静乐贺丰剖面作了磁性地层学测量。结果表明:静乐贺丰地点的静乐红土记录了 Gauss 正极性带,年龄为 2.50—3.00Ma B. P.,时代为晚上新世。因此,贺丰动物群的古地磁年龄当为 2.50—3.00 Ma。

关键词 贺丰动物群,静乐红土,古地磁

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1930 年,P. Teilhard de Chardin(德日进)和杨钟健在考察山西静乐一带时在红色土中发现了丰富的哺乳类化石(Teilhard de Chardin and Young, 1930),并将红色土堆积描述为红色土 A、B、C 三个层,提出了静乐红土概念。1934 年,杨钟健根据上述同样资料,将静乐红土与红色土 A 层视为同期,并命名此期为静乐期,时代定为上新世中期(杨钟健,1934)。

最近,我们在德日进和杨钟健当年将红色土划分为 A、B、C 层,并在红色土 A 层发现贺丰动物群的山西静乐贺丰剖面作了详细的磁性地层测量,将生物地层与磁性地层结合起来研究。这一工作是前辈事业的继续,并以此纪念杨钟健先生。本文将报告这一研究结果。

一、静乐剖面地层划分与古地磁年龄

我们选择了 1930 年德日进和杨钟健提出静乐红土概念,并发现贺丰动物群的建型地点,静乐贺丰为研究剖面。剖面自下而上分为 5 层。

5. 马兰黄土,相当于德、杨氏当年描述的黄土。厚约 2m。

4. 黄土—古土壤序列,不完整,主要为午城黄土,含 18 层红褐色古土壤或钙质结核层。此层相当于德、杨氏当年描述的淡红色土,即红色土 B 带。共厚 40m。

3. 红粘土层及红褐色砂层。红粘土层厚 9m,红褐色砂层厚 1m(红褐色砂层具水平层理,德、杨氏未描述)。此层为 1930 年德、杨氏描述的深红色土,即静乐红土。并在该层采到化石:*Hipparion houfenense*, *Antilospira licenti*, *Gazella blacki*, *Cervus* sp., *Rhinoceros genindet*, *Elephas* sp.等。1934 年杨钟健认为静乐红土相当于红色土 A 层(陈

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晓峰(1994)在此剖面新发现了两种哺乳动物化石，*Nyctereutes sinensis*, *Metailurus* cf. *major*)。

2．硬砾岩。厚度不等，约 1—5m。

1．侏罗纪砂岩。

陈晓峰(1994)在此剖面作了"静乐期"地层及哺乳动物化石研究，为贺丰剖面进一步研究作出了重要贡献。但是，陈在做磁性地层工作中仅取了 13 块样品，样品虽经古地磁学家 Opdyke 测量，但约 50m 厚的地层仅 13 块样品毕竟太少。况且静乐红土仅取了两块样品。陈认为"据古地磁分析结果，产贺丰动物群的砂层、静乐红土及最底部的红色土均落在一个正向时内。……这个正向时应当与高斯正向时一致"。他结合大哺乳动物的研究资料，认为静乐组的年代为 2.5—3.4 Ma B. P.。这次作者在 3—5 层采集了 121 块古地磁标本，其中第 3 层静乐红土采样 43 块。在西北大学古地磁室进行了测量。退磁手段采用分档热退磁。退磁温度为 50℃、100℃、150℃、200℃、250℃、300℃、350℃、400°、450℃、500℃、550℃、600 ℃。退磁仪器为美国 TSD-2型热退磁仪。剩磁测量使用英国 Minisping 旋转磁力仪。

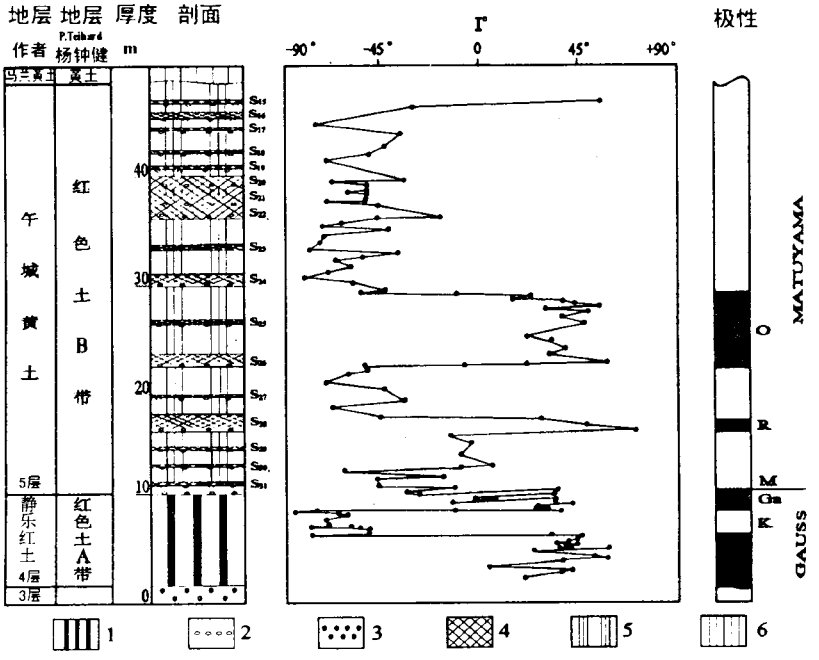

图 1　静乐剖面古地磁测量结果

1. 静乐红土　2. 钙质结核　3. 细砂层　4. 古土壤　5. 午城黄土　6. 马兰黄土

Fig. 1　Paleomagnetic results of Jingle section

1. Jingle red clay　2. concretion　3. fine sandstone　4. paleosol　5. Wucheng loess　6. Malan loess

结果显示(图 1)，第 4 层，黄土—古土壤序列记录了布容正极性带与松山负极性带。23m—29m 处记录了 Olduvai 正极性亚带，17m 处记录的正极性段可能为 Reunion 正极性

亚带。因此，德日进和杨钟健划分的红色土B层包括了O亚带、R亚带。大致相当刘东生(1985)在洛川剖面描述的 W_{s-1}, W_{s-2}, W_{s-3}或 S_{15}–S_{32}地层段。第4层即红色土A带记录了Gauss正极性带，其中包括Keana负极性亚带，而Mammoth负极性亚带未被记录。因此，静乐贺丰地点的红色土A带(或称静乐红土)的年代应当为2.50—3.00 Ma B. P.，时代为上新世晚期。根据磁性地层研究结果，贺丰动物群应是上新世晚期中国北方陆相哺乳动物群代表。由于中新世上限年龄为5.30 Ma，所以静乐贺丰剖面缺失上新世早期地层。陕西省榆林一带出露的红土年龄为2.50—5.30 Ma.，可视为地层较全的静乐红土(另文报道)。

二、几点认识

1．1930年德日进与杨钟健发现贺丰动物群的静乐贺丰地点静乐红土记录了Gauss正极性带，年龄为2.50—3.00 Ma B. P.，时代为晚上新世。

2．贺丰动物群是上新世晚期中国北方陆相哺乳动物群代表，古地磁年龄为2.50—3.00 Ma。

3．静乐剖面红色土B层相当于黄土—古土壤序列 W_{s-1}, W_{s-2}, 或 S_{15}–S_{32}地层段，记录了Olduvai, Reunion正极性亚带，年龄约1.20—2.50 Ma。时代为早更新世早期。

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参 考 文 献

刘东生等，1985．黄土与环境．北京：科学出版社

杨钟健，1934．三门系之历史检讨．地质论评，1(3)：323—330

陈晓峰，1994．山西静乐县"静乐期"地层及大哺乳动物化石．第四纪研究，(4)：339—353

Teilhard de Chardin P, Young C C, 1930. Preliminary Observation on the Pre-Loessic and Post-ponian Formation in western shansi and Northern Shensi. *Men. Geol. Surv. China.* Ser. A, **8**: 1—54

HIPPARION FAUNA AND MAGNETOSTRATIGRAPHY IN HEFENG, JINGLE, SHANXI PROVINCE

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Key words *Hipparion* Fauna in Hefeng, Jingle red clay, Paleomagnetism

Summary

In 1930, P. Teilhard de Chardin and C. C. Young found abundant Mammalian

fossils in reddish clay, when they observed and studied Jingle area in Shanxi Province. They described the red accumulation as layer A, B and C of the reddish clay and also advanced a new term——Jingle laterite. In 1934, based on the same data, Young posed that Jingle laterite and layer A of the reddish clay are of the same age, and named it as Jingle Period aging middle part of Pliocene epoch.

Recently, detailed magnetostrtigraphic measurement has been made at Hefeng Section, in Jingle, Shanxi Province, where Teilhard de Chardin and Young divided the reddish clay into layer A——in which Hefeng fauna was discovered——layer B and layer C. This study was continued to be in honor of C. C. Young. And we will report the results in the article.

1. Stratigraphic division and paleomagnetic age in Jingle Section

We selected Hefeng Section in Jingle where Teilhard de Chardin and Young discovered Hefeng fauna and advanced the term of Jingle laterite. From the bottom to the top the sequence can be divided into five units.

Layer 5, Malan loess, about 2m thick, corresponds to loess described by Teilhard de Chardin and Young.

Layer 4, The partly-developed loess-paleosol sequence, about 40m thick, consists mainly of Wucheng loess, containing 18 red brown paleosols and calcareous concretion. The sequence is equal to light reddish clay——layer B of the reddish clay, described by Teilhard de Chardin and Young.

Layer 3, Reddish clay layer, which is about 9m thick, and red brown sand, which is about 1m thick (red brown sand is of horizontal bedding, which was not described by Teilhard de Chardin and Young), are Jingle laterite described as the dark reddish clay by Teilhard de Chardin and Young in 1930. Fossils were taken from this layer: *Hipparion houfenense*, *Antilospira licenti*, *Gazella blacki*, *Cervus* sp., *Rhinoceros genindet*, *Elephas* sp. etc. In 1934, Young thought of this Jingle laterite as layer A of the reddish clay (In 1994, Chen Xiaofeng found the two new mammalian fossils, *Nyctereutes sinensis* and *Metailurus* cf. *major* at this section).

Layer 2, Conglomerites ranges from 1 to 5m in thickness.

Layer 1, Sandstone in Jurassic period.

In 1994, Chen studied strtigraphy and mammalian fossils of "Jingle Peroid". Even though the thirteen samples were measured by Opdyke, a famous paleomagnetist, they were not sufficient for the 50m-thick section. In addition, only two samples were collected from Jingle laterite. In this study, 121 paloemagnetic samples were collected from layer 3-5 among which 43 samples were taken from layer 3 of Jingle laterite. All measurements were carried out in the Paleomagnetic Laboratory of Northwest University. Each sample was stepwisely thermally demagnetized in Thermal

Demagnetizer TSD2(made in America) at 50℃, 100℃, 150℃, 200℃, 250℃, 300℃, 350℃, 400℃, 450℃, 500℃, 550℃ and 600℃. And remanences were measured using Monisping Spinner Magnetometer.

Fig. 1 shows: Layer 4 of loess-paleosol sequence recorded Brunhes normal polarity zone. The 23-29m and 17m of the sequence recorded Olduvai Reunion normal polarity subzone, respectively. As a result, layer B of the reddish clay divided by Teilhard de Chardin and Young, which included O and R polarity subzone, may coincide with WS1, WS2 and WS3 or soil S_{15}-S_{32} at Luochuan Section described by Liu (1985). Layer 4, namely layer A of the reddish clay recorded Gauss normal polarity zone including Keana reversed polarity subzone while excluding Mammoth reversed polarity subzone. Therefor, layer A of the reddish clay at Hefeng in Jingle (or Jingle laterite) aged 2.50—3.00 Ma B. P.

2. Conclusions

1. Jingle laterite at Hefeng section in Jingle area described by Teilhard de Chardin and Young in 1930, is layer A of the reddish clay which recorded Gauss normal polarity zone aging 2.50—3.00 Ma B. P. in late Pliocene epoch.

2. *Hipparion* Fauna in Hefeng is the representive of late Pliocene mammalian fauna in North China. The age is 2.50—3.00 Ma.

3. Layer B of the reddish clay, which recorded Olduvai and Reunion normal polarity subzone aging 1.20— 2.50 Ma B. P. in early Early Pleistocene epoch, corresponds to WS1, WS2 or soil S_{15}-S_{32} of loess-paleosol sequence.