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1 Sedimentary provenance constraints on the Cretaceous to Cenozoic
2 palaeogeography of the western margin of the Jianhan Basin, South
3 China

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18 **Abstract:** Provenance analysis of sedimentary basins is a direct way to understand the
19 uplift of orogenic belts, basin deposition, and evolution of large rivers. A series of
20 Mesozoic and Cenozoic strata from the western Jiangnan Basin provides key sedimentary
21 archives for investigating the growth of the surrounding orogenic belts and the evolution
22 of the Yangtze drainage. However, the provenance of these sediments remains unclear. In
23 this study, we report U–Pb data for 1098 detrital zircons from the western Jiangnan
24 Basin. We combine these data with published zircon U–Pb ages of potential source areas,
25 paleocurrent data, and paleomagnetic age constraints to reconstruct provenance areas and
26 establish related mountain-building processes. All Cretaceous and Early Cenozoic
27 samples show five major age peaks at 131–210, 432–461, 720–986, 1836–1908, and
28 2470–2552 Ma. We infer that these sediments are primarily derived from recycled
29 sediments associated with the uplift of the western Jiangnan Orogen. The tectonic uplift
30 of the Jiangnan orogenic belt in the Cretaceous and Early Cenozoic was mainly
31 controlled by the subduction of the Pacific and Indian plates underneath Eurasia. The
32 detritus in the current upper reaches of the Yangtze River did not enter the Jiangnan

33 Basin before the Late Eocene (34 Ma). Early Pleistocene strata (1.2–0.7 Ma) show a
34 distinct Cenozoic zircon U–Pb (41 Ma) peak age, which is mainly derived from the
35 detrital sediments of the upper reaches of the Yangtze River. The combination of these
36 data with published provenance tracing results for boreholes in the Jiangnan Basin and
37 Yangtze River Delta indicates that the Yangtze River was completely connected between
38 34 and 1.2 Ma. Such a long time interval may correspond to the tectonic uplift of the
39 Tibetan Plateau and environmental changes during the Late Cenozoic.

40

41 **Keywords:** Detrital zircon U–Pb age, Paleogeography, Jiangnan Basin, Jiangnan Orogen,
42 Yangtze River

43

44 1. Introduction

45 Sedimentary basins and orogenic belts are paired components involved in the mass
46 movement on Earth's surface. Sedimentary basins provide archives of geological records
47 of detrital material that is transported by the rivers from orogenic belts (Liu-Zeng et al.,
48 2008; Jolivet et al., 2010; Allen and Allen, 2013). It is very important to understand the
49 source and sink system of sedimentary basins in geological times to reveal the deposition
50 history of sedimentary basins and the tectonic evolution of adjacent orogenic belts (Tian
51 et al., 2011; Li et al., 2016a; Jolivet et al., 2018; Cheng et al., 2021; Lin et al., 2022) and
52 to construct the evolution of drainages connecting orogenic belts and sedimentary basins
53 (Deng et al., 2018; Li et al., 2018; Wang et al., 2020a; Fu et al., 2021; Zhao et al., 2021a).
54 However, inferring the sediment provenance from the final product, that is, the basin fill,
55 is not straightforward because the detrital spectrum evolves as the sediment is transported
56 along the pathway from the source to the basin (Weltje and von Eynatten, 2004; Clift et
57 al., 2020).

58 The Jiangnan Basin at the northern margin of the South China Block is sandwiched
59 between the Qinling–Dabie and Jiangnan orogenic belts and has a clear basin–mountain
60 boundary (Figure 1A). It is generally accepted that the Mesozoic and Cenozoic
61 sedimentary strata in the Jiangnan Basin recorded the far-field tectonism of the
62 subduction of the Pacific and Indian plates underneath Eurasia (Shi et al., 2013; Dong et
63 al., 2016; Wu et al., 2018). Mesozoic and Cenozoic strata in the western parts of the
64 Jiangnan Basin represent the most complete sedimentary sequence preserved and
65 outcropped in the northern parts of the South China Block (Lei, 1987; Dai, 1997; Yao et
66 al., 2015). Thus, studying Mesozoic and Cenozoic strata in the western Jiangnan Basin
67 provides information on the tectonics and river evolution of the South China Block
68 (Xiang et al., 2007; Li, 2009a; Li et al., 2014; Yao et al., 2015; Dong et al., 2016; Wang
69 et al., 2018; Kang et al., 2021). However, there is no consensus as to whether these
70 sediments originated from the Qinling–Dabie orogenic belt in the north (Wang et al.,
71 2009; She et al., 2012; Wu et al., 2017), Jiangnan orogenic belt in the south (Li, 2009a;
72 Li, 2009b; Wang et al., 2013; Yao et al., 2015; Dong et al., 2016), both the Qinling and

73 Jiangnan orogenic belts (Yu et al., 2018), or the Huangling Anticline in the west (Shen et
74 al., 2012a). This would suggest that for the detrital material, the proximal provenance
75 areas in the Mesozoic and Cenozoic sedimentary strata from the western Jiangnan Basin
76 remain poorly defined.

77 The Yangtze River is the largest river in Asia, and it originates in the interior of the
78 eastern Tibetan Plateau and drains Sichuan Basin, the Three Gorges, the Huangling
79 Anticline and the Jiangnan Basin before flowing into the East China Sea (Figure 1A).
80 Richardson et al. (2010) proposed that the Yangtze River cut through the Three Gorges
81 and entered the Jiangnan Basin between 45–40 Ma based on low-temperature
82 thermochronometric cooling ages of the bedrock of the Huangling Anticline. Based on
83 inverse modelling of the long profile of a river channel and the low-temperature
84 thermochronological data, Jiao et al. (2021) reconstructed the incision history of the
85 Yangtze River near the eastern end of the Three Gorges area and suggested that the onset
86 of the incision occurred in the Early Miocene (21–18 Ma). River terraces, which are well
87 developed along the eastern Sichuan Basin and Three Gorges, formed from the Early
88 to the Late Pleistocene (1.16–0.01 Ma). Therefore, Li et al. (2001) argued that the Three
89 Gorges were cut at the beginning of the Early Pleistocene. This is controversial because
90 the results of other studies suggested that the upper reaches of the Yangtze River were
91 connected to the paleo-Red River system and began to flow eastward at 36 (Chen et al.,
92 2017; He et al., 2021; Zheng et al., 2021; Zhang et al., 2021a), 20–18 Ma (Yan et al.,
93 2012; McPhillips et al., 2016; Shen et al., 2016; Zhang et al., 2022) and 5.5 Ma (Su et al.,
94 2019). In contrast, fission-track dating, U-Pb and trace-element analysis of detrital
95 apatite, combined with U-Pb dating of detrital rutile and zircon, were employed to
96 elucidate the capture of the Upper Yangtze River by the Middle Yangtze River after ca.
97 1.7–1.3 Ma. (Kong et al., 2012; Deng et al., 2021; Zhao et al., 2021b). However, these
98 results have not been verified by Cenozoic sedimentary strata provenance tracing data
99 from the western Jiangnan Basin. Therefore, it remains unclear when the Yangtze River
100 entered the Jiangnan Basin. In other words, the geological information of the proximal
101 and distal provenances recorded in the Mesozoic and Cenozoic strata of the western
102 Jiangnan Basin does not appear to have been well interpreted.

103 The comparative study of zircon U–Pb ages is a powerful tool for provenance
104 tracing in sedimentary basins (Sircombe, 1999; Li et al., 2016a; Deng et al., 2018; Wang
105 et al., 2018; Lin et al., 2021a; Wang et al., 2022a). Zircon U–Pb ages of bedrock and
106 fluvial deposits around the Jiangnan Basin have been widely reported (Lin et al., 2000;
107 Ayers et al., 2002; Xiong et al., 2009; Chu et al., 2012; Zhao et al., 2013; Nie et al., 2016;
108 Huang et al., 2021; Lin et al., 2021b). Detrital zircon data are abundant for the Yangtze
109 River drainage (He et al., 2013; Liang et al., 2018; Lin et al., 2021b). This has laid a solid
110 foundation for comparative studies of detrital zircon U–Pb ages in Meso–Cenozoic strata
111 in the western Jiangnan Basin. In this study, we present 1098 detrital zircon U–Pb ages
112 obtained from 11 Cretaceous to Cenozoic sandstone and sand samples and combine them
113 with the deposition time of the strata to determine the time of the provenance change.
114 Published sandstone petrology and paleocurrent data (Li, 2009b; Yao et al., 2015; Wang
115 et al., 2018) for Meso–Cenozoic strata from the western Jiangnan Basin were used to

116 assist in determining the potential provenance area. The results contribute to the
117 reconstruction of the paleogeographic evolution of the western Jiangnan Basin and
118 improve our understanding of the correlations among the exhumation of the
119 intracontinental orogenic belt, sedimentary basin deposition, and big river evolution of
120 the South China Block.

121

122 2. Geological and geomorphic settings

123 The Qinling–Dabie Orogen stretches across ~2000 km in central China (Figure 1A)
124 and was formed by the collision between the North China Craton and South China Block
125 during the Triassic (Dong et al., 2021). The granitic magmatism in the Qinling Shan can
126 be divided into Neoproterozoic (979–711 Ma), Paleozoic (507–400 Ma), Early Mesozoic
127 (250–185 Ma), and Late Mesozoic (160–100 Ma, Wang et al., 2015) stages. The Dabie
128 Shan is characterised by widespread Triassic high-pressure/ultrahigh-pressure
129 metamorphic rocks, which recorded the deep subduction of continental crust during the
130 collision (Ayers et al., 2002; Dong et al., 2021). The granitic magmatism in the Dabie
131 Shan can be divided into three main stages: Neoproterozoic (787 Ma), Early Mesozoic
132 (235 Ma), and Late Mesozoic (132 Ma).

133 The Jiangnan Orogen (Figure 1A) has a width of ~120 km and extends NEE-SWW
134 for ~1500 km. It is associated with the collision between the Yangtze and Cathaysia
135 blocks along the Shaoxing–Jiangshan suture zone during the Early Neoproterozoic period
136 (1.1–0.9 Ga) in South China Block (Li et al., 2014; Dong et al., 2016). The zircon U–Pb
137 ages of the eastern segment of the Jiangnan Orogen (Mufu Shan) reflect the main
138 magmatic events, which occurred at 987–823, 427, 218, and 154 Ma (He et al., 2013; Li
139 et al., 2016b; Ji et al., 2017; Xin et al., 2017; Lin et al., 2021b). The magmatic zircons
140 from the western parts of the Jiangnan Orogen (Xuefeng Shan, Wuling Shan) yield age
141 clusters of 2700–1800, 900–700, 500–350, 300–150, and 120–100 Ma (Chu et al., 2012;
142 Su et al., 2014; Ma et al., 2019; Lin et al., 2021b). The Huangling Anticline in the
143 northern Yangtze Block was intruded by the 1.85 and 1.0–0.8 Ga granite in the north and
144 south, respectively (Xiong et al., 2009; Zhang et al., 2009).

145 The Jiangnan Basin (Figure 1A), with a total area of 28,000 km², evolved from a
146 Middle Triassic foreland basin into a Cretaceous–Cenozoic rift basin in response to the
147 multistage convergence and subsequent collision of the South China Block (Dai, 1997;
148 Yao et al., 2015; Wu et al., 2018, Figure 1B). Mesozoic strata deposited in the western
149 Jiangnan Basin include the Early Cretaceous Shimen and Wulong formations and Late
150 Cretaceous Luojingtan, Honghutao, and Paomagang formations (Lei, 1987; Li, 2009b;
151 Yao et al., 2015, Figure 2, Figure 3A). The Shimen Formation (paleomagnetic age: 129–
152 121 Ma, Dai, 1997) is dominated by thick brownish grey, massive breccia at the bottom,
153 which is angular unconformable contact with the Ordovician or Permian limestone above.
154 The middle and upper parts of the Shimen Formation consist of a thick grey-purple
155 conglomerate with an imbricated gravel structure (Figure 3B) and the paleocurrent

156 direction is north or northeast (Li, 2009b, Figure 3A). The Wulong Formation (121–97.5
157 Ma, Dai, 1997) is mainly composed of brown-yellow fine- and medium-grained
158 sandstone interbedded with siltstone, silty mudstone, and conglomerate (Figures 3C and
159 D), which is in conformable contact with the Shimen Formation. The restored
160 paleocurrent direction of the Wulong Formation is mainly directed from southwest to
161 northeast (Li, 2009b, Figure 3A). The Luojingtan Formation (97.5–84.3 Ma, Dai, 1997)
162 comprises a thick grey-brown massive conglomerate intercalated sandstone lens (Figures
163 3E and F), which is continuously deposited with the underlying Wulong Formation, and
164 its provenance area is oriented in the southern direction (Yao et al., 2015). The
165 Honghuatao Formation (84.3–72 Ma, Dai, 1997) mainly consists of orange–red massive
166 fine grained sandstone (Figure 3G) and is in conformable contact with the Luojingtan
167 Formation. The Paomagang Formation (72–65 Ma, Dai, 1997), which is in conformable
168 contact with the Honghuatao Formation, is a brownish red and grey-white fine sandstone
169 and siltstone interbedded with purple-red and sandy mudstone (Figure 3H).

170 The Gongjiachong Formation (65–54.9 Ma, Dai, 1997), which conforms with
171 Paomagang Formation, is dominated by a brown-red thick massive conglomerate or
172 pebbly sandstone at the bottom and brown-red silty mudstone interbedded with sandstone
173 in the middle and upper parts (Figure 3 I). Its paleocurrent was distributed from south to
174 north (Li, 2009b, Figure 3 A). The Yangxi Formation (54.9–50.5 Ma, Dai, 1997), which
175 is in conformable contact with the Gongjiachong Formation, is composed of a set of
176 greyish brown medium-thick-bedded argillaceous limestone intermixed with purplish-red
177 mudstone and brownish-red sandstone (Figure 3J). The Cheyanghe Formation (50.5–42
178 Ma, Dai, 1997) is a light brown thick-bedded sandstone interbedded with thin
179 reddish-brown mudstone and siltstone (Figure 3 K). It is in conformable contact with the
180 Yangxi Formation. The cross bedding within the sandstone from the Cheyanghe
181 Formation indicates that the paleo-river flowed northeastwards, consistent with the
182 paleo-current direction recovered by the conglomerate (Li, 2009b; Wang et al., 2014a).
183 The Pailoukou Formation (42–34 Ma, Dai, 1997), which is in conformable contact with
184 the Cheyanghe Formation, is a light grey, thick layer of massive sandstone intermixed
185 with grey-green muddy sandstone (Figure 3 L). The direction of the palaeocurrent
186 indicated by the oblique bedding of the sandstone from the Pailoukou Formation is
187 northeastward. The Yunchi Formation is characterised by a thick layer of yellowish
188 gravel, which is well rounded and has a grain size of 2–10 cm (Figure 3 M). The gravel
189 layer is in unconformable contact with underlying Eocene strata and its paleocurrent
190 direction is south or southeast. Although Wang et al. (2018) assigned the Yunchi
191 Formation to the Miocene, other researchers believe that it was formed in the Early
192 Pleistocene based on electron spin resonance dating (ESR: 1.25–0.75 Ma; Xiang et al.,
193 2007; Wei et al., 2020) and stratigraphic correlations (Kang et al., 2021).

194

195 **3. Sampling and method**

196 **3.1 Sampling strategy**

197 Sandstone and sand samples (2–5 kg) were collected from Mesozoic, Early
198 Cenozoic, and Quaternary strata in the western Jiangnan Basin. We collected one sample
199 from the bottom (Y7) and one from the top (LJS-1) of the Wulong Formation. Late
200 Cretaceous samples were obtained from the Luojingtian (Y6), Honghuatao (Y5), and
201 Paomagang (Y4) formations. Samples Y3 and Y2 were obtained from the Gongjiachong
202 and Cheyanghe formations. Samples Y1 and SZK-1 were collected from the bottom and
203 top of the Pailoukou Formation, respectively. We took two samples from the bottom
204 (YC-2) and top (YC-1) of the Yunchi Formation. As there are only a few sand beds in the
205 Shimen and Yangxi formations, we were unable to collect samples from these strata in
206 the field. Consequently, detrital zircon U-Pb age analysis was not performed for the
207 Shimen and Yangxi formations. Specific information about the field sample collection is
208 listed in Table 1.

209

210 3.2 Analytical methods

211 Zircon sorting was completed by the Hebei Langfang Chengxin Geological Service
212 Co., Ltd., China. Under a binocular lens, zircon crystals were randomly selected to be
213 fixed on epoxy resin, irrespective of their size, colour, or crystal form. In this study, ~90–
214 110 grains from each sample were randomly picked for U–Pb dating. Zircon
215 cathodoluminescence (CL) images were recorded and the grains were dated with a laser
216 ablation microprobe (New Wave Research 213) coupled to a quadrupole inductively
217 coupled plasma mass spectrometry (ICP-MS, Agilent 7800) at the Isotope Geology
218 Laboratory of ChronusCamp, Brazil (Figure 4). [Detailed analytical procedures are similar
219 to those described by Shi et al. \(2019\)](#). Concordia ages and diagrams were obtained using
220 Isoplot/Ex (version 3.0, Ludwig, 2003). For frequency histograms and probability plots,
221 only analyses within $100\% \pm 10\%$ of concordance were used. All calculated ages were
222 reported at the 95% confidence level. Grain ages younger than 1000 Ma were determined
223 based on the $^{206}\text{Pb}/^{238}\text{U}$ values, whereas the ages of older grains were calculated based on
224 the $^{207}\text{Pb}/^{206}\text{Pb}$ ratio (Sircombe, 1999).

225 Provenance area directly affects sandstone composition and plate tectonic activity
226 controls the emergence and distribution of sandstone and other sedimentary rocks. Thus,
227 the petrographic study of sedimentary archives is one of many strategies to deciphering
228 geological history. Dickinson (1985) analyzed the composition of sandstones in multiple
229 regions around the world to explore how the clastic composition of sandstones reflects
230 the tectonic background of their source areas. The author performed a quantitative
231 analysis, divided the sandstone debris components, and then compiled a triangular
232 diagram based on the end tuple division, which is mainly divided into the QtFL, QmFLt,
233 and QpLvLs types. Qt is the total number of quartz grains including monocrystalline
234 quartz grains (Qm) and polycrystalline quartz fragments (Qp, including flint). F refers to
235 the total number of feldspar grains including plagioclase (P) and potassium feldspar (K).
236 L is the total number of debris particles composed of pyroclastic particles (Lv) and
237 sedimentary rock debris particles (Ls). Lt represents polycrystalline debris, and is

238 composed of L and Qp. However, these diagrams can be further subdivided according to
239 the needs and particularities of the study area. Over 300 grains were counted in each thin
240 section using the Gazzi-Dickinson method and Ternary diagrams of the compositional
241 trends were created.

242 Multi-dimensional scaling was used to produce a map-like plot in which the
243 Euclidean distance between sample points was as close as possible to another measure of
244 their distance. Furthermore, the detrital zircon U-Pb ages were subjected to
245 Kolmogorov-Smirnov nonparametric tests (K-S test) among target samples and between
246 samples and potential provenances. The K-S test calculates the maximum probability
247 distance and has been previously validated for determining the potential provenance of
248 target samples.

249 4. Results

250 CL images of representative zircons and age spots are shown in Figure 4. These
251 zircon grains show a variety of shapes from prismatic crystals to oval grains, mainly with
252 rounded corners. Note that most grains have Th/U ratios above 0.1 and below 10 and
253 only a few grains have ratios below 0.1 (Figure 5). The CL images of the grains are
254 characterised by oscillatory zoning (Figure 4), reflecting their magmatic origin. U-Pb
255 isotopic ages with errors and relevant [Supplementary Data](#) are provided in Appendix A.
256 The concordia plots for the 11 samples are shown in Figure 6.

257 The concordant detrital zircons from two sandstone samples (SZK-1 and Y1) from
258 the Pailoukou Formation (E_{2p}) show broadly similar age patterns, with five major
259 populations of 131–247, 263–321, 600–790, 1852–1910, and 2503–2536 Ma (Figures
260 7a–a' and b–b'). The samples (Y2) from the Cheyanghe Formation (E_{2c}) exhibit U-Pb
261 age spectra with predominant populations centred at 164–247, 428, 765, 1869, and 2536
262 Ma (Figures 7c–c'). The detrital zircons from the Early Cenozoic sample (Y3, E_{1g}) yield
263 four major populations of 141–211, 308–432, 785, and 1861 Ma (Figure 7 d). The zircon
264 U-Pb ages of the Paomagang Formation (K_{2p}) sandstone sample (Y4) show six major
265 peak ages: 172, 238, 296, 461, 769, and 1869 Ma (Figures 7e–e'). Six peak ages were
266 determined based on the detrital zircon U-Pb ages of samples from the Honghuatao
267 Formation (K_{2h} , Y5): 131, 172, 222, 461, 774, and 1836 Ma (Figures 7f–f'). The U-Pb
268 ages of detrital zircon from the Luojiangtan Formation (K_{2l} , Y6) have predominant
269 populations at 113–177, 210–307, 436–760, 1908–2539, and 3122 Ma (Figures 7g–g').
270 The detrital zircon U-Pb age populations of the two sandstone samples from the Wulong
271 Formation (K_{1w} , Y7) of the Early Cretaceous are similar and concentrated at 161–164,
272 216–242, 307–308, 432–436, 720–825, 1844–1873, and 2470–2507 Ma (Figures 7h–h'
273 and i–i'). Zircon U-Pb ages of the two samples from the Yunchi Formation (Q_{1y} , YC1,
274 YC2) have three predominant populations at 172–255, 444–774, and 1869–2495 Ma, a
275 minor peak age at 41 Ma (Figures 7j–j').

276

277 5. Discussion

278 **5.1 Potential source areas of the western Jiangnan Basin**

279 **5.1.1 Provenance area of Cretaceous strata**

280 The majority of detrital zircon ages of Cretaceous samples can be grouped into
281 similar age populations of 131, 161–164, 172–210, 432–461, 720–986, 1836–1908, and
282 2470–2552 Ma during the interval of 121–65 Ma (Figures 8Aa–e). The provenance of
283 sedimentary material can be assessed by comparing detrital zircon U–Pb age
284 compositions with areas or units that may have supplied sediment to the unit and region
285 (Sircombe, 1999; Carter and Moss, 1999; Li et al., 2016a; Wang et al., 2018; Cheng et
286 al., 2019; Lin et al., 2021a; Zheng et al., 2021). Major orogens and terranes around the
287 Jiangnan Basin are potential sources for these zircons, assuming that zircon-bearing rocks
288 were exposed at that time. Four mountain ranges (Qinling Shan, Dabie Shan, Huangling
289 Anticline, and Jiangnan Orogen) surrounding the Jiangnan Basin have been proposed to
290 be potential source areas that can contribute massive detritus to the western Jiangnan
291 Basin.

292 Bedrock and fluvial detrital zircon U–Pb ages of the Qinling Shan (Figure 9) fall
293 into three peak ages of 216, 452, and 751 Ma (Nie et al., 2016; Liao et al., 2017; Lin et al.,
294 2021b; Huang et al., 2021, Figure 8Af). Zircon U–Pb peak ages of Dabie Shan samples
295 dominantly peak at 132, 235, and 787 Ma (Ayers et al., 2002; Zhao et al., 2008; Li et al.,
296 2021; Lin et al., 2021b). Bedrock zircon U–Pb ages from the Huangling Anticline (Figure
297 8Ag) reveal a peak age of 813 Ma, followed by minor peaks at 1863 Ma (Xiong et al.,
298 2009; Jiao et al., 2009; Zhang et al., 2009; Qiu et al., 2011; Zhao et al., 2013). Peak ages
299 of 154, 442, and 823 Ma were obtained for samples from the eastern Jiangnan Orogen
300 based on bedrock and fluvial zircon U–Pb ages (Lin et al., 2000; He et al., 2013; Wang et
301 al., 2014b; Li et al., 2016b, 2016c; Ji et al., 2017; Xin et al., 2017; Lin et al., 2021b).
302 Compared with Cretaceous strata in the western Jiangnan Basin, the peak zircon ages of
303 the Paleoproterozoic and Neoproterozoic from the above-mentioned potential areas are not
304 significant, indicating the lack of a provenance relationship. However, the results of
305 previous detrital zircon U–Pb dating and paleo-flow restoration indicated that Cretaceous
306 sediments from the western parts of the Jiangnan Basin originated from the Huangling
307 Anticline in the west and Qinling Shan in the north (Shen et al., 2012a; Yu et al., 2020).
308 These research sites are closer to the northwestern parts of the Jiangnan Basin. This type
309 of source-to-sink system shows several, rather than a single, source areas and
310 simultaneously attributes sediments to the western Jiangnan Basin (Shen et al., 2012b; Yu
311 et al., 2020). In addition, the gravels of the Shimen, Wulong, and Luojiangtan formations
312 in this study are mainly limestone and dolomite, accounting for 90 %, 40 %, and 67 %,
313 respectively (Li, 2009b; Wang et al., 2013; Yao et al., 2015). The Huangling Anticline
314 and Qinling Shan mainly comprise granite outcrops, whereas metamorphic rocks
315 constitute the main body of the Dabie Shan, which further rules out their non-existing
316 provenance with Cretaceous strata analysed in this study. Zircon U–Pb dating and heavy
317 mineral provenance tracing indicated that rivers in the western Huangling Anticline
318 flowed westward into the Sichuan Basin during the Cretaceous (Li et al., 2018; Deng et
319 al., 2018; Wang et al., 2021a; Zhao et al., 2021a). Therefore, we argue that there was no

320 provenance connection between the Mesozoic strata in the western Jiangnan Basin and
321 the Yangtze River during the Cretaceous.

322 The following pieces of evidence show that the western Jiangnan Orogen is a major
323 potential source region for the Cretaceous strata of the western Jiangnan Basin. First,
324 compared with the peak ages of detrital zircon from Cretaceous strata of the western
325 Jiangnan Basin in this study (Figures 8Aa–e), the above-mentioned potential source areas
326 (except for the Yangtze River Basin) lack significant Paleoproterozoic and Neoproterozoic
327 peak ages. In contrast, bedrock and detrital zircon age signatures of the western Jiangnan
328 Orogen show pronounced similarities with Cretaceous strata of the western Jiangnan
329 Basin because they share age populations of 129–131, 172–176, 210–223, 432–458, 720–
330 924, 1811–1908, and 2470–2494 Ma (Chu et al., 2012; Ma et al., 2018; Su et al., 2018;
331 Lin et al., 2021b). Second, Yao et al. (2015) analysed the carbon and oxygen isotopic
332 compositions of the limestone gravel from the Wulong and Luojingtang formations and
333 showed that they are derived from the western Jiangnan Orogen. Third, the paleocurrent
334 direction of Cretaceous strata in the western Jiangnan Basin is mainly directed northward
335 or northeastward (Li, 2009b; Wang et al., 2013; Yao et al., 2015). The sedimentary
336 environment is important for interpreting provenance and comparing source areas from a
337 macroscopic perspective (Allen and Allen, 2013). Alluvial conglomerates in the Shimen
338 and Luojingtang formations indicate a proximal source (Li, 2009b; Yao et al., 2015). On
339 the MDS plots (Figures 10a–d), the four Cretaceous sandstone samples from the western
340 Jiangnan Basin show distinct affinities with the western Jiangnan Orogen. Therefore, as
341 mentioned above, we can conclude that the detrital zircon grains in sandstone of
342 Cretaceous strata in the southwestern parts of the Jiangnan Basin are mainly derived from
343 the western Jiangnan Orogen in the south.

344

345 5.1.2 Provenance area of Cenozoic strata

346 The zircon U–Pb age patterns of four sandstone samples from the Early Paleocene to
347 Late Eocene (Figure 3) are similar to those of Cretaceous samples from the western
348 Jiangnan Basin (Figures 8Ba–d). By comparing the above-mentioned potential source
349 areas with Paleogene sandstone samples in this study, the provenance areas of the
350 western Jiangnan Basin in the Paleogene period (65–34 Ma) were identified. The peak
351 ages of the main populations in the Paleogene samples overlap with the age distributions
352 recorded by detrital and bedrock zircon populations from the western Jiangnan Orogen.
353 Several lines of evidence lead us to exclude the remaining potential source areas (Qinling
354 Shan, Dabie Shan, Huangling Anticline, and eastern Jiangnan Orogen). First, the peak
355 ages of 1852–1910 and 2503–2567 Ma are significant in the Paleogene strata in the
356 western Jiangnan Basin (Figures 8Ba–d) but absent or weak in the Qinling Shan (Figure
357 8Af), Dabie Shan (Figure 8Be), Huangling Anticline (Figure 8Bf), and eastern Jiangnan
358 Orogen (Figure 8Bg). Furthermore, the prominent age populations of 428–469 Ma is
359 significant in the western Jiangnan Basin but absent in the Dabie Shan and Huangling
360 Anticline. Second, the palaeocurrent directions of the Gongjiachong and Cheyanghe

361 formations are north and northeast, respectively, indicating that the provenance area was
362 the southern part of the Jiangnan Basin. Third, the closest provenance neighbour of the
363 Gongjiachong, Cheyanghe, and Pailoukou formations in the MDS plots (Figures 10e–h)
364 is the western Jiangnan Orogen, implying a potential source–sink relationship.

365 Four major peaks at 257, 782, 1852, and 2408 Ma and one minor peak at 41 Ma
366 (Figure 8Ai) were identified in samples from the Yangtze River Basin at the western
367 Jiangnan Basin (Figure 9). Because the Yangtze River flows from Shigu Town to the
368 Huangling Anticline (Figure 1A), mainly within the South China Block, its detrital zircon
369 U–Pb peak ages are similar to those of the South China Block (He et al., 2013; Liang et
370 al., 2018). However, because the Yangtze River passes through the Cenozoic magmatic
371 body in the southeastern Tibetan Plateau (Zhang et al., 2019a), predominant age
372 populations of zircons of 40–55 Ma are common in its fluvial sediments (He et al., 2013;
373 Liang et al., 2018). By contrast, this Cenozoic peak age was not observed in Cenozoic
374 strata in the western Jiangnan Basin, indicating that there is no provenance link between
375 the two areas. K-feldspar sand grains from the Cretaceous–Paleogene sequences in the
376 western Jiangnan Basin suggest that there was no large river like the Yangtze connecting
377 the Tibetan Plateau to the Jiangnan Basin at that time (Zhang et al., 2021b).

378 Because the zircon U–Pb age results obtained for samples YC1 and YC2 from the
379 Yunchi Formation (Figure 8Bi) are similar, we combined the 180 age spectra into a
380 single one for the discussion. Compared with the zircon U–Pb age compositions of
381 samples from the Qinling Shan, Dabie Shan, Huangling Anticline, and eastern Jiangnan
382 Orogen, zircons from the Yunchi Formation present distinct peak ages in the
383 Paleoproterozoic and Neoproterozoic. The zircon U–Pb peak ages match those of samples
384 from the upper reaches of the Yangtze River (Figure 8Bj). During the sedimentary period
385 of the Yunchi Formation (1.2–0.75 Ma), the palaeocurrent direction changed from
386 northward/northeastward into southeastward (Xiang et al., 2007), coinciding with the
387 current mainstream of the Yangtze River. Based on the combination of the dating and
388 MDS results, detrital zircons from the Yunchi Formation are not associated with the
389 provenance of the above-mentioned potential source areas but originate from the upper
390 reaches of the Yangtze River.

391 In summary, the samples from the Cretaceous and Paleocene succession in the study
392 area generally have similar age patterns, which indicates that these strata belong to a
393 continuous sedimentary system and share a common provenance area in the western
394 Jiangnan Orogen. In contrast, the provenance of the western Jiangnan Basin changed to
395 the upper reaches of the Yangtze River during the Early Pleistocene, indicating the
396 establishment of a provenance link between the Jiangnan Basin and Tibetan Plateau
397 during this period.

398

399 **5.2 Tectonic implications and paleogeographic constraints for the South China** 400 **Block**

401 Detrital sediments within peripheral basins derived from adjacent orogenic belts
402 accurately record the composition of their source regions and provide evidence of the
403 evolution of orogenic belts and big rivers. Our results indicate that the western Jiangnan
404 Basin contains sediments that were derived from the western Jiangnan Orogen and upper
405 reaches of the Yangtze River during the Meso–Cenozoic and Early Pleistocene,
406 respectively. Therefore, we established a source–sink model for the western Jiangnan
407 Basin, revealing the provenance evolution from the Early Cretaceous (121 Ma) to the
408 Early Pleistocene (1.2 Ma).

409

410 **5.2.1 Cretaceous**

411 Detrital zircon U–Pb dating (Deng et al., 2018; Li et al., 2018; Wang et al., 2021a)
412 and the provenance of heavy mineral assemblages (Deng et al., 2018) indicate that the
413 rivers derived from the western parts of the Huangling Anticline flowed into the Sichuan
414 Basin from east to west during the Cretaceous (Figure 1B). This means that no large
415 rivers flowed through the Sichuan and Jiangnan basins at that time. The results of
416 low-temperature thermochronological studies showed that extensive uplift and
417 exhumation events (142–70 Ma) occurred in the western Jiangnan Orogen during the
418 Cretaceous (Mei et al., 2010; Tang et al., 2014; Ge et al., 2016; Zheng et al., 2019; Chu et
419 al., 2020). We thus attribute the zircon age distributions in Cretaceous clastic sediments
420 within the western Jiangnan Basin to the nearly synchronous denudation of the western
421 Jiangnan Orogen. Correspondingly, the components of these sandstone samples suggest a
422 sedimentary derivation from recycled and collision orogenic source areas according to
423 the discriminant results of the QmFLt, QtFL, and QpLvLs plots (Li, 2019b; Yao et al.,
424 2015; Wang et al., 2018, Figure 11). This is in line with high-energy alluvial- to
425 fluvial-dominated coarse clastic deposits (Dai, 1997; Li, 2009a; Wang et al., 2013; Dong
426 et al., 2016) that formed in the western Jiangnan Basin during the same period. Such
427 Cretaceous accumulations of coarse clastic deposits can also be observed in the Changtao
428 Basin (Wu et al., 1979) and Yuanma Basin (Li et al., 2014) along the western Jiangnan
429 Orogen. Hence, the above-mentioned evidence implies that the western Jiangnan Orogen
430 had already been uplifted in the Cretaceous and provided the detrital sediments for the
431 western Jiangnan Basin. During the Cretaceous period, red bed deposits were widely
432 distributed in South China Block (Li et al., 2014), mud cracks developed at the top of thin
433 mudstone layers, and desert was extensively deposited in the Jiangnan Basin (Yu et al.,
434 2020), indicating that the paleoclimate was hot and dry. The arid climate is also
435 evidenced by sporomorph fossils from most parts of the South China Block (Wang et al.,
436 2022b). The oblique subduction of the Pacific Plate underneath the South China Block
437 triggered the rifting of the Jiangnan Basin during the Cretaceous (Dong et al., 2016; Wu
438 et al., 2018). Therefore, tectonic activities have played the dominant role in the
439 establishment of the basin–mountain coupling relationship between the western Jiangnan
440 Basin and western Jiangnan Orogen since the Cretaceous.

441 From a larger perspective, the results of previous thermochronological studies on

442 Mesozoic sedimentary rocks from the Eastern Sichuan Basin (Mei et al., 2010; Deng et
443 al., 2013; Shi et al., 2016), Eastern Jiangnan Orogen (Shen et al., 2020; Wang et al.,
444 2021b), and eastern parts of South China Block (Wang et al., 2020b; Suo et al., 2020)
445 revealed that rapid exhumation took place during the Cretaceous. The formation of
446 widespread coarse clastics from the Hengyang, Ganzhou, Ji'an, and Poyang basins
447 (Figure 9) indicates that the basement rocks of eastern South China Block underwent
448 rapid uplift and erosion during the Cretaceous (Luo et al., 1991; Li et al., 2014, Figure
449 12). These findings also coincide with the tectonic activity and low-angle subduction of
450 the Pacific slab (Li et al., 2014). Overall, we infer that not only the entire Jiangnan
451 orogenic belt but also other areas of the South China Block have suffered strong tectonic
452 deformation, corresponding to the subduction of the Pacific Plate underneath the South
453 China Block during the Cretaceous (Figure 1B).

454

455

456 **5.2.2 Cenozoic**

457 Integrated with detrital zircon U–Pb (Chen et al., 2017; Feng et al., 2021; Zheng et
458 al., 2021; Wang et al., 2021a), heavy mineral (He et al., 2021), and K-feldspar Pb isotope
459 (Zhang et al., 2021a) data, previous studies suggest that the upper reaches of the Yangtze
460 River were separated from the Red River system at ~36–35 Ma. Furthermore, based on
461 apatite fission-track and (U–Th)/He low-temperature thermochronology data from the
462 Huangling Anticline, an enhanced cooling event occurred at 40 Ma. Richardson et al.
463 (2010) proposed that the upper and middle reaches of the Yangtze River were connected
464 in the Late Eocene. These studies imply that the provenance relationship between the
465 southeastern margin of the Tibetan Plateau and the Jiangnan Basin has been established
466 during the Late Eocene. However, as mentioned above, the provenance tracing results of
467 Paleogene sandstone samples from the western Jiangnan Basin indicate that the source
468 area was mainly derived from the western Jiangnan Orogen at 65–34 Ma (Figure 13A). In
469 addition, the research results obtained for the Three Gorges of the Yangtze River (Jiao et
470 al., 2021) and from cores of the Jiangnan Basin (Yang et al., 2019; Zhang et al., 2021b)
471 and lower Yangtze River delta (Jia et al., 2010; Zheng et al., 2013; Zhang et al., 2019b;
472 Fu et al., 2021) reveal that the Yangtze River appeared in the Miocene or Pliocene.

473 There are pieces of evidences to indicate that the detrital materials in the western
474 Jiangnan Basin were mainly derived from the western Jiangnan Orogen corresponding to
475 the far-field effects of the subduction of the Indian and Pacific plates underneath Eurasia.
476 Firstly, the Pacific Plate began to subduct underneath Eastern Eurasia in the Early
477 Paleocene, the direction changed from NNW to WNW at a reduced convergence rate of
478 ~6.5 cm/yr (Maruyama et al., 1997; Müller et al., 2016). The Indian Plate collided with
479 the Asian continent, with an increased convergent rate of ~16–17 cm/yr in the Early
480 Paleocene (Müller et al., 2016; Suo et al., 2020). These two plate kinematics should have
481 jointly affected South China Block, which experienced a compressional regime during

482 this period (Yin, 2010; Li et al., 2012; Dong et al., 2016; Tian et al., 2018; Wu et al.,
483 2018). Secondly, low-temperature thermochronology data obtained on apatite and zircon
484 indicate that the western Jiangnan Orogen experienced strong uplift from 60–40 Ma (Ge
485 et al., 2016; Qiu et al., 2020). Coarse-grained alluvial fans and fluvial sediments in the
486 western Jiangnan Basin accumulated during this period. Thirdly, the QmFLt, QtFL, and
487 QpLvLs plots show that the Early Paleogene sandstone deposited in the western Jiangnan
488 Basin belongs to recycled and collisional orogen materials (Li, 2009b; Yao et al., 2015;
489 Wang et al., 2018, Figure 11). Moreover, the Jiangnan Basin was not governed by a
490 typical East Asian monsoon climate (Teng et al., 2019) but characterised by a dry and hot
491 climate during the early Cenozoic (Dai, 1997; Zheng et al., 2011). Considering that the
492 depocenter of the Jiangnan Basin were accompanied by salt lake deposits in the
493 Paleogene (Zheng et al., 2011; Wu et al., 2017; Teng et al., 2019), we conclude that the
494 Jiangnan Basin had not developed an outflow drainage system flowing through the basin
495 at this time.

496 The detrital material of the Yunchi Formation is not related to the near-source
497 orogenic belt of the Jiangnan Basin but originated from the upper reaches of the Yangtze
498 River between 1.2–0.7 Ma (Figure 13B). This indicates that the Yangtze River appeared
499 in the Jiangnan Basin during the Early Pleistocene, which agrees with previous
500 provenance tracing results obtained for boreholes in the Jiangnan Basin (Zhang et al.,
501 2008; Wang et al., 2010; Shao et al., 2012; Sun et al., 2018) and Yangtze River Delta
502 (Yang et al., 2009; Yue et al., 2018). In the Quaternary, large-scale orogenic movements
503 around the Jiangnan Basin ceased and the basin entered the stage of shrinkage and
504 decline (Dai, 1997; Li, 2009b; Yao et al., 2015). The East Asian summer monsoon was in
505 a phase of significant intensification between 1.2 and 0.7 Ma (Kissel et al., 2003; Wan et
506 al., 2006). Therefore, the gravel layer of the Yunchi Formation deposited in the western
507 Jiangnan Basin reflects the transport of the Yangtze River affected by the East Asian
508 summer monsoon during the Early Pleistocene.

509

510 6. Conclusions

511 The combination of the analysis of U–Pb ages of detrital zircon collected from
512 Cretaceous–Cenozoic sedimentary rocks and available sandstone petrography,
513 paleocurrent data, and paleomagnetic ages provides new information that can be used to
514 constrain the source regions and tectonic evolution of the western Jiangnan Basin in
515 South China. In summary, the following main conclusions can be drawn:

516 (1) Due to the far-field effects of the subduction of the Pacific and Indian plates
517 underneath Eurasia, the western Jiangnan Orogen was strongly uplifted during the
518 Cretaceous and Early Cenozoic, contributing a large amount of clastic materials to the
519 western Jiangnan Basin. The provenance area of the western Jiangnan Basin at this time
520 mainly originated from the western Jiangnan Orogen. In the Early Pleistocene, the
521 provenance area of the western Jiangnan Basin changed to the Yangtze River, responding

522 to the strengthening of the East Asian summer monsoon.

523 (2) The upper reaches of the Yangtze River did not enter the western part of the Jiangnan
524 Basin during the Late Eocene (34 Ma). The provenance link between the Jiangnan Basin
525 and Tibetan Plateau was established through the Yangtze River in the Early Pleistocene
526 (1.2 Ma). Combined with the published provenance tracing results obtained for boreholes
527 in the Jiangnan Basin and Yangtze River Delta, the connection of the whole Yangtze
528 River Basin occurred between 34 and 1.2 Ma.

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954

955 Figure 1. (A) Map showing the major tectonic blocks and location of the study area
956 (modified from Li et al., 2014; Dong et al., 2016). Abbreviations: SXJS: Shaoxing –
957 Jiangshan suture zone; DY: Dayong fault; TLF: Tanlu fault. (B) Cartoon figure showing
958 the formation mechanism of the Cretaceous – Early Cenozoic in the Jiangnan Basin
959 (modified from Li et al., 2014). The backarc extension was associated with the rollback
960 or retreat of the subducted paleo-Pacific slab.

961

962 Figure 2. Geological map delineating the distribution of Cretaceous to Cenozoic strata
963 and sample locations (modified from a 1:1500000 geological map; Zhao et al., 2019).

964

965 Figure 3. (A) Cretaceous and Cenozoic stratigraphic units and typical photographs
966 showing the sampling horizons at the western Jiangnan Basin. The magnetostratigraphic
967 and ESR ages were obtained from Dai (1997), Xiang et al. (2007), and Wei et al. (2020).
968 Paleocurrent data are cited from Li (2009b), Yao et al. (2015), and Wang et al. (2013).
969 (B) Massive breccia and thick conglomerate with a clast size ranging from 5 to 30 cm in
970 an alluvial fan deposit in the Shimen Formation. (C – D) Thick coarse sandstone with
971 siltstone, silty mudstone, and conglomerate and cross-bedding developed in sandstone
972 strata in braided fluvial deposits of the Wulong Formation. (E – F) Thick conglomerate
973 with sizes ranging from 2 to 20 cm intercalated sandstone is alluvial fan deposits of the
974 Luojingtian Formation. (G – H) Honghuatao and Paomagang formations composed of
975 massive fine sandstone, siltstone, and mudstone in a shallow lacustrine deposit. (I)
976 Gongjiachong Formation mainly containing thick conglomerate, pebbly sandstone, and
977 mudstone in alluvial fan facies. (J) Carbonate lacustrine facies strata developed in the
978 Yangxi Formation with argillaceous bands. (K – L) Massive sandstones, mudstones, and
979 siltstones developed in the Cheyanghe and Pailoukou formations and planar
980 cross-stratification used to determine the paleocurrent directions, indicating a meandering
981 river delta facies. (M) Yunchi Formation consisting of alluvial fan sedimentary facies
982 with thick gravel and sandy lens deposits. The size of the gravel is well rounded and
983 sorted, ranging from 2 – 10 cm.

984

985 Figure 4. Representative CL images of detrital zircon from the western Jiangnan Basin
986 showing the internal structure and morphology. Yellow circles indicate the U – Pb
987 analysis spots.

988

989 Figure 5. Plot of Th versus U of concordant detrital zircons used in this study. Th/U
990 values above 0.4 indicate zircons with an igneous origin, whereas values below 0.1
991 represent metamorphic zircons (Wu and Zheng, 2004).

992

993 Figure 6. U - Pb concordia diagrams of detrital zircon collected from the Jiangnan Basin
994 constructed using ISOPLOT (Ludwig, 2003).

995

996 Figure 7. Distribution of detrital zircon U - Pb ages of Cretaceous - Cenozoic sediments
997 (a - j) from the western Jiangnan Basin. Detrital zircon ages ranging from 0 - 500 Ma are
998 shown on the right (a' - j').

999

1000 Figure 8. Zircon U - Pb age probability density plots of (A) Cretaceous (a - e) and (B)
1001 Cenozoic (a - d, i) sediments in the western Jiangnan Basin compared with age spectra
1002 from potential source regions (Af: Qinling Shan; Ag: Huangling Anticline; Ah: eastern
1003 Jiangnan Orogen; Ai: western Jiangnan Orogen; Aj: Yangtze River; Be: Dabie Shan).
1004 Note that the Cenozoic zircon peak age (41 Ma) only appears in Yangtze River (Aj) and
1005 Quaternary samples (Bi).

1006

1007 Figure 9. Map showing the marked positions of cited zircon age data in potential source
1008 areas. Abbreviations: HJR = Hanjiang River, QJR = Qingjiang River, LSR = Lishui
1009 River, YJR = Yuangjiang River, ZJR = Zijiang River, XJR = Xiangjiang River, GJR =
1010 Ganjiang River; HL = Huangling Anticline, WLS = Wuling Shan; WJN = West Jiangnan
1011 Orogen, EJN = East Jiangnan Orogen. Data sources: Yangtze River (He et al., 2013;
1012 Liang et al., 2018), Qinling Shan (Wang et al., 2015; Nie et al., 2016; Liao et al., 2017;
1013 Lin et al., 2021b; Huang et al., 2021), Dabie Shan (Ayers et al., 2002; Zhao et al., 2008;
1014 Li et al., 2021; Lin et al., 2021b), Huangling Anticline (Xiong et al., 2009; Jiao et al.,
1015 2009; Zhang et al., 2009; Qiu et al., 2011; Cen et al., 2012; Zhao et al., 2013), eastern
1016 Jiangnan Orogen (Lin et al., 2000; He et al., 2013; Wang et al., 2014b; Li et al., 2016b; Li
1017 et al., 2016c; Ji et al., 2017; Xin et al., 2017; Lin et al., 2021b), western Jiangnan Orogen
1018 (Chu et al., 2012; Ma et al., 2018; Su et al., 2018; Lin et al., 2021b). Yellow squares,
1019 white diamonds, and white circles represent river samples cited from He et al.(2013), Li
1020 et al.(2016), and Lin et al. (2021b), respectively.

1021

1022

1023 Figure 10. Multidimensional scaling (MDS) plot for Cretaceous (a – d) and Cenozoic
 1024 (e – i) detrital zircon data generated following methods outlined by Vermeesch et al.
 1025 (2016). The solid and dashed lines mark the nearest and second nearest neighbours,
 1026 respectively. Abbreviations: DB: Dabie Shan, EJM: eastern Jiangnan Orogen, WJM:
 1027 western Jiangnan Orogen, QL: Qinling Shan, YR: Yangtze River, HL: Huangling
 1028 Anticline.

1029 Figure 11. Triangular plots of detrital components for the studied sandstones (Dickinson,
 1030 1985). (A) QmFLt plot; (B) QtFL plot; (C) QpLvLs plot. Qm: monocrystalline quartz;
 1031 Qp: polycrystalline quartz; Qt: total quartz (Qm+Qp); F: total feldspar; Ls: sedimentary
 1032 lithic grains; Lv: volcanic lithic grains; L: total nonquartzose lithic grains (Ls+Lv); Lt:
 1033 total lithic grains (L+Qp). Data sources: Wulong and Luojiang Formation: Li (2009b),
 1034 Yao et al. (2015); Honghuatao and Cheyanghe Formation: Wang et al. (2018).

1035

1036 Figure 12. Correlation section showing the characteristics of sedimentary facies of
 1037 Cretaceous and Cenozoic strata surrounding the Jiangnan orogenic belt. Numbers 1 – 7
 1038 represent the corresponding positions in Figure 9. Data for the Changtao (1) and Poyang
 1039 (7) basins were obtained from Li et al. (1966) and Luo et al. (1991), respectively. Data
 1040 for the Yuanma (3), Hengyang (4), Ganzhou (5), and Ji'an (6) basins were taken from Li
 1041 et al. (2014).

1042

1043 Figure 13. Reconstruction of the basin – mountain and river distribution maps from the
 1044 Late Cretaceous to Early Cenozoic (A) and Early Pleistocene (B) in the Yangtze River
 1045 Basin.

1046

1047 Table 1. Collected sampling point information

1048

1049 Table 1. Collected sampling point information

| Sample No. | Strata (Fm.) | GPS | | Nature of sample |
|------------|--------------|------------|-----------------|------------------|
| Y7 | Wulong | 30°38'17"N | 111°19'55" E | sandstone |
| LJS-1 | Wulong | 30°41'02"N | 111°16'55" | sandstone |

| | | | E | |
|-------|--------------|------------|-----------------|-----------|
| Y6 | Luojingtan | 30°33'18"N | 111°23'21" E | sandstone |
| Y5 | Honghuatao | 30°31'27"N | 111°23'17" E | sandstone |
| Y4 | Paomagang | 30°16'29"N | 111°31'08" E | sandstone |
| Y3 | Gongjiachong | 30°16'48"N | 111°31'14" E | sandstone |
| Y2 | Cheyanghe | 30°15'12"N | 111°34'37" E | sandstone |
| Y1 | Pailoukou | 30°17'09"N | 111°36'39" E | sandstone |
| SZK-1 | Pailoukou | 30°18'33"N | 111°37'32"E | sandstone |
| YC-2 | Yunchi | 30°33'10"N | 111°27'39"E | sand |
| YC-1 | Yunchi | 30°31'50"N | 111°26'04"E | sand |

1050

1051

1052 Tectonic activities control the sedimentary processes in the western Jiangnan Basin.

1053

1054 The Jiangnan orogenic belt is the main provenance area of western Jiangnan Basin.

1055

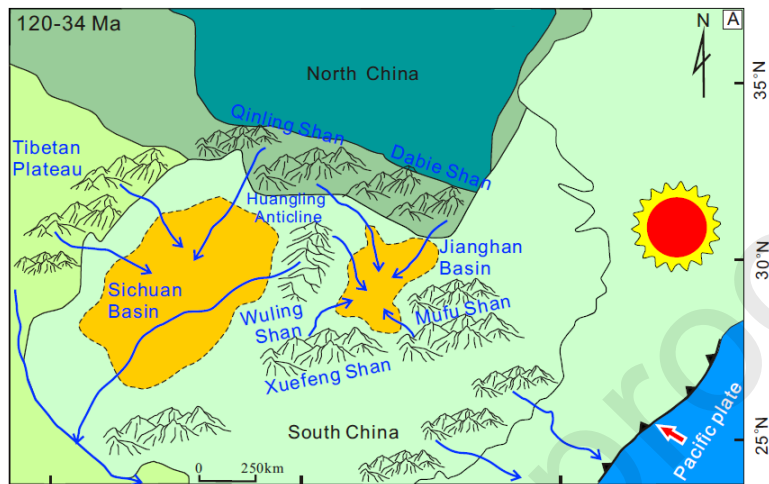
1056 The Yangtze River enters the Jiangnan Basin between 34 Ma and 1.2 Ma.

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1058

1059 We declare that the data in this article are true and reliable.

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