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Comments on "Detrital zircon geochronology and Nd isotope geochemistry of the basal succession of the Taebaeksan Basin, South Korea: Implications for the Gondwana linkage of the Sino-Korean (North China) Block during the Neoproterozoic–early Cambrian" by Lee et al. [Palaeogeography, Palaeoclimatology, Palaeoecology 441 (2016) 770–786]

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ABSTRACT

Lee et al. [Palaeogeography, Palaeoclimatology, Palaeoecology 441 (2016) 770–786] reported significant contrasts in detrital zircon age distributions and Nd isotopic compositions of Cambrian sandstones in the Taebaeksan Basin, Korea. Zircon populations at ~500 Ma, defined by concordant or nearly concordant ages, were also documented in four samples, but wrongly discarded. As a consequence, some discussions on the provenance, Nd isotope geochemistry and paleogeography remain equivocal. We suggest an alternative interpretation that ~500 Ma detrital zircon populations and juvenile whole-rock Nd signatures are well accounted for by the influx of active- or retro-arc materials into Middle Cambrian Taebaeksan Basin. In addition, the "Neoproterozoic–early Cambrian" in the title is misleading because the lowermost strata overlying the Precambrian basement are generally known to be Lower Cambrian in the Sino-Korean Block.

A recent paper by Lee et al. (2016) reported in-situ laser ablation (LA-ICP-MS) U–Pb ages of detrital zircon in two Cambrian formations, Myeonsan and Myobong, from the Taebaeksan Basin, Korea, and suggested that the latter only contains Gondwana-derived detrital zircons. The contrasts in detrital zircon geochronology and depleted mantle Nd model ages (T_{DM}) of these formations have led Lee et al. (2016) to conclude that the Sino-Korean Block is contiguous with the northern margin of East Gondwana. This result is of utmost importance because of their implications on the Cambrian paleogeography of not only the Korean Peninsula but also the Sino-Korean Block. Hence, this paper is a welcome addition to the existing database on the assembly and dispersal of Gondwanan crustal fragments. The dataset of Lee et al. (2016) is generally compatible with our own U–Pb zircon ages estimated using a sensitive high-resolution ion microprobe (SHRIMP) from Early Paleozoic strata of the Taebaeksan Basin (Cho et al., 2014). For a comparison, we have carefully examined detrital zircon data of Lee et al. (2016), and found major disagreement with their interpretations on zircon U–Pb and whole-rock T_{DM} ages as described below.

In their paper, Lee et al. (2016) presented the LA-ICP-MS U–Pb ages of detrital zircons separated from five sandstones of the Myeonsan and Myobong formations. Using this dataset, we were able to reproduce the Wetherill concordia diagram of each sample given in the Supplementary Fig. B of Lee et al. (2016), and newly constructed the Tera–Wasserburg concordia diagram of Fig. 1. Two formations obviously differ in their age distribution patterns, and many Archean to Paleoproterozoic zircons yield discordant dates affected by subsequent Pb loss and/or radiogenic Pb mixing event(s). Nineteen concordant or nearly concordant dates range from the Cambrian to the Jurassic, apparently forming distinctive populations in the majority of analyzed samples (Fig. 1). Lee et al. (2016) simply attributed the occurrence of these Phanerozoic dates to the Pb loss effect because they are younger than the biostratigraphic age, and excluded the zircon dates younger than ~520 Ma from the discussion. This interpretation, however, is not warranted because the Pb loss alone cannot account for the repetitive occurrence of concordant dates clustering at ~500 Ma (Fig. 1b–e). We suggest that these Cambrian populations

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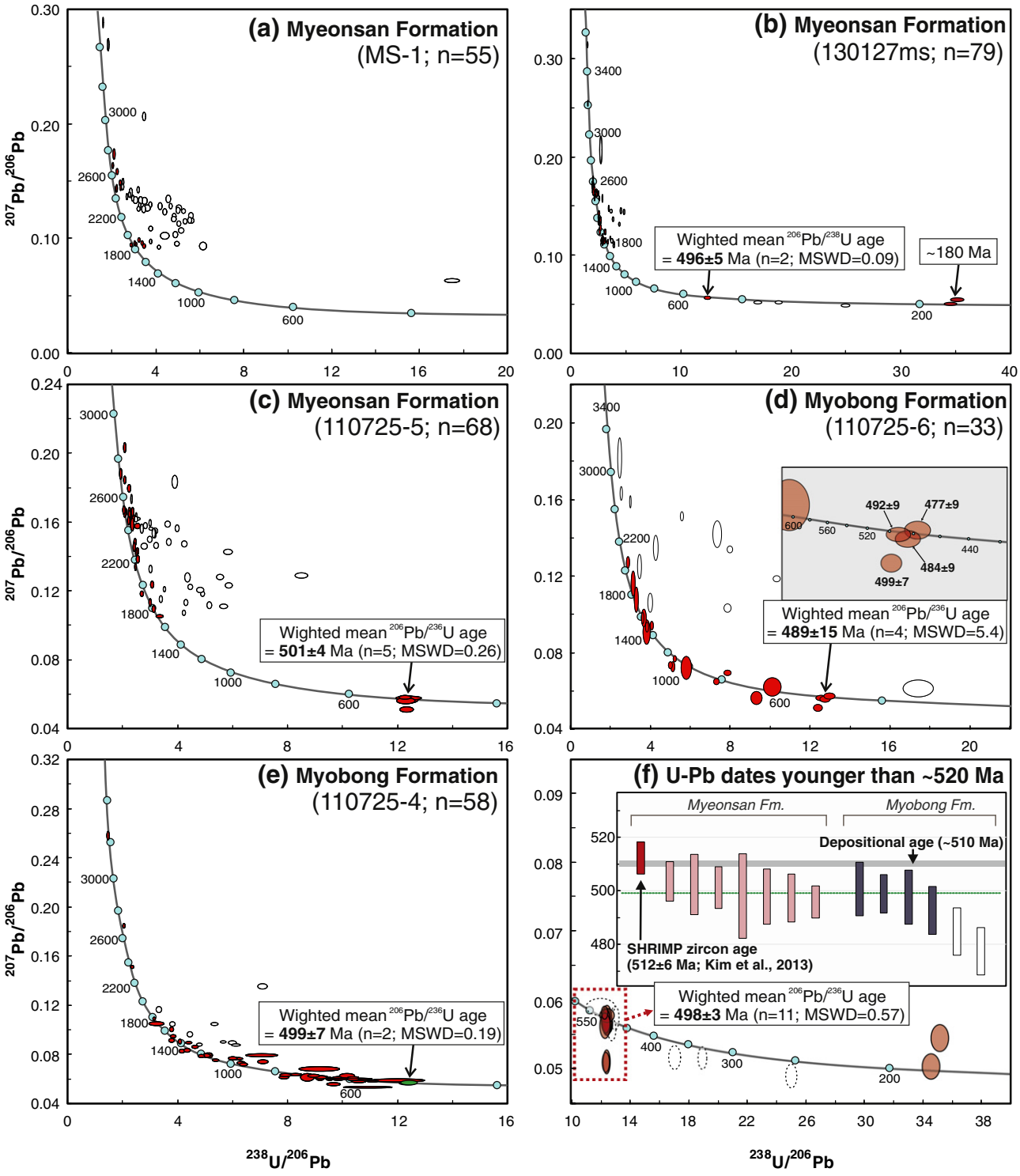

Fig. 1. (a–e) Tera–Wasserburg concordia diagrams showing the U–Pb dates of detrital zircons from five samples of Lee et al. (2016); and (f) enlarged concordia diagram showing nineteen U–Pb dates younger than ~520 Ma from four samples. Also shown for reference in the inset of Fig. 1f are two age constraints for the Myeonsan and Myobong Formations, respectively; single SHRIMP zircon age of 512 ± 6 (1σ) Ma for the former and depositional age of ~510 Ma for the latter (Kim et al., 2013). Open ellipses denote the spot analyses that are discordant and excluded for further discussion. Error ellipses of data points are at 95% confidence level. MSWD, mean square of weighted deviates.

should be geologically meaningful and taken into account in any discussion on provenances.

The prevalence of discordant dates in ancient zircons of the Taebaeksan area has been well known by previous workers and attributed to the Pb loss event(s) variably associated with Silurian to Cretaceous magmatism (Kim et al., 2012, 2013; Cheong et al., 2015). It is thus tempting to discard ~500 Ma zircon dates, slightly younger than the Middle Cambrian biostratigraphic age, as Lee et al. (2016) have adopted. However, many spot dates are not only concordant but also clustered to define distinct age populations broadly coeval with ~510 Ma arc materials (Kim et al., 2013) and ~180 Ma Daebo granites in the Taebaeksan Basin (Fig. 1b, f). It is thus likely that repetitive occurrences of ~500 Ma zircon age populations in four sandstones (Fig. 1b–e) are best interpreted to reflect more or less syn-depositional, Cambrian arc magmatism followed by an Early Jurassic thermal event.