Seven sandstone samples were collected from five major stratigraphic horizons in the northern and southern Qamdo basin, including the lower Upper Triassic Jiapila Formation, the upper Upper Triassic Bagong Group, the Jurassic lower and upper Chaya groups, and the Lower Cretaceous Xiangdui Formation. Detrital zircon U-Pb isotopic analyses were conducted at the Arizona LaserChron Center using a laser ablation-inductively coupled plasma-mass spectrometer (LA-ICP-MS). The results were used to generate an age distribution curve for each detrital sandstone sample, and then the age distributions are compared with published zircon ages of the surrounding geological units.

Detrital zircon provenance analysis suggests that the Qamdo basin received sediments mainly from the northeastern and central depocenters of Songpan-Ganzi Complex (SPC), the Yidun arc, and the Azhong arc. One significance of this study is that it reveals the Qiangtang terrane (QT) and the Jianshajiang suture mélange (JSSM) were not contributing sediments into the Qamdo depocenter, as indicated by the presence of a significant zircon age population at 500-1000 Ma in the QT and the JSSM that is missing in the Qamdo basin. The result indicates that the Mesozoic continental-continental collisions associated with the accretion of terranes (e.g. Qiangtang and Lhasa terranes) against the Eurasian Plate did not lead to significant deformation and exhumation of QT and adjacent suture zones, as might be excepted for the early stage of a peripheral foreland basin. Our data also show that the Qamdo basin received sediments primarily from the far-field sources rather than by recycling of older sediments in the basin, indicating limited amount of deformation of the Qamdo basin during Mesozoic.

Detrital zircon signature of the Upper Triassic Jiapila Formation is characterized by abundant Precambrian zircon ages forming two major populations at 1.8-2.0 and 2.4-2.5 Ga, along with three minor Mesozoic-Paleozoic zircon age groups: Permian-Triassic (260-235 Ma), Carboniferous (310-330 Ma), and Middle Ordovician to Silurian (460-420 Ma), suggesting that the Jiapila Formation was sourced primarily from the northeastern depocenter of the Songpan-Ganzi Complex (SPC).

Detrital zircon signature of the lower Chaya Group indicates the evolution of at least three depocenters in the Qamdo basin during Early Jurassic. The northern depocenter is largely dominated by Paleozoic ages (500-250 Ma), along with few proterozoic ages at 800-1000, 1200-1400, and 1800-2400 Ma. In contrast, the central depocenter is characterized by a significant population of Paleoproterozoic zircon ages at 1800-1900 Ma, with smaller populations of Paleozoic (250-330 M, and 430-500 Ma). The southern depocenter is distinguished from the northern and central depocenters by the presence of a significant Triassic zircon age population at 220-250 Ma. Here, we interpreted that the northern Qamdo depocenter received sediment mainly derived from the central depocenter of the SPC. The central depocenter, however, was sourced primarily by sediment shed from the Paleoproterozoic gneissic basement of the Azhong arc exposed to the north of the Qamdo basin, along with smaller input from the central depocenter of the SPC. For the southern depocenter, the presence of a significant Triassic age population (220-250 Ma) indicates that the southern depocenter was filled mainly by sediment derived from the Yidun arc system, with potential input from the basement of the Azhong arc and the SPC.

Detrital zircon signature of the upper Chaya Group is dominated by an Early-Middle Jurassic age population at 170-195 Ma, along with several smaller Mesozoic, Paleozoic, and Proterozoic age populations: Permian-Triassic (290-215 Ma), Carboniferous (310-350 Ma), Middle Ordovician-Silurian (480-420 Ma), Neoproterozoic (800-1000 Ma), and Paleoproterozoic (1800-2400 Ma). The Jurassic age group (170-195 Ma) is
consistent with the zircon U-Pb ages of an extensive granitoid emplacement (170-185 Ma) found within the Amdo crystalline basement which are thought to represent a ‘missing’ continental arc developed in the Meso-Tethys realm that paralleled the length of the Bangong-Nujiang suture during Early-Middle Jurassic, and later been subducted beneath the Qiangtang terrane as the result of the closure of the Meso-Tethys ocean basin (Guynn et al., 2011).
Although no volcanic arc-type rocks that have ages between 170 and 185 Ma have been found near the Qamdo basin, detrital zircon age signature of the upper Chaya Group provides important evidence for existence of the Jurassic continental arc in eastern Tibet. We interpreted that the upper Chaya Group received sediment derived primarily from the Jurassic arc system existed in the Meso-Tethys ocean, along with minor clastic input from the central SPC and Azhong arc basement.

The Lower Cretaceous Xiangdui Formation contains abundant Middle-Late Triassic (240-225 Ma) zircons, along with a few zircon grains at 250-510 and 1800-1900 Ma. The dominant age cluster at 240-225 Ma is consistent with the zircon U-Pb ages of the Yidun arc system reported by Reid et al. (2007), indicating that the Xiangdui Formation was sourced primarily from the exhumed Yidun arc system. Since no zircon grains exhibit ages younger than 210 Ma the Xiangdui Formation received little sediment derived from the recycled Jurassic strata. Thus, the Paleoproterozoic zircon grains of the Xiangdui Formation were probably derived from the Paleoproterozoic basement of the Azhong arc.

Key words: Qamdo basin, sedimentary provenance, detrital zircon geochronology

References