

## Gem sparkles deep: Preface of the special issue on ‘Jadeite and jadeitite’

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### INTRODUCTION

*‘The gem sparkles deep at the very bottom of the Nuna’*—this is the opening line of a poem (#3247) by the anonymous author of Book 13 of the *Man'yō-shū* in A.D.783 (English translation: Suga, 1991). In this poetry, the sparkling gemstone is jadeitite, a type of jade, that forms where the oceanic lithosphere of one tectonic plate dives beneath another plate. The Nuna refers to the Kotakigawa River, where Kawano (1939) first identified monomineralic jadeitites. We emphasize that the stone should be recognized not only for its beauty, as in poetry, but also for its intellectual challenges, as introduced below.

Jadeite (NaAlSi<sub>2</sub>O<sub>6</sub>) is a high-pressure mineral known to be one of the breakdown products of sodic plagioclase. As proxies of high-pressure metamorphism and metasomatism in ancient convergent plate margins, shock-induced metamorphism in stony meteorites, and sodium-bearing melt generation and physical properties in the deep lower mantle, jadeite and jadeite-bearing rocks (or experimental systems) have been studied from various viewpoints in Earth and planetary sciences. This fascinating mineral has been also recognized to form the precious, tough, semi-translucent gemstone, ‘jadeite jade’ (jadeitite); aqueous fluids that rise from the subducting slab of oceanic crust condense to form the jade (Stern et al., 2013). The importance of jadeitite in Earth’s system has been underscored by journal special issues and review articles devoted to jadeitite (Harlow et al., 2012, 2015). The scientific importance of jadeite as well as the beauty and preciousness of gem-quality jadeitite

led to the designation of ‘jadeite (and jadeitite)’ as the national stone of Japan by Japan Association of Mineralogical Sciences (JAMS) in September of 2016 (Tsuchiyama, 2017).

The special issue of the *Journal of Mineralogical and Petrological Sciences* was planned soon after the designation of jadeitite and jade as the national stone. The JAMS invited two review articles on Japanese jadeitites (Tsuji-mori and Harlow, 2017; Nishiyama et al., 2017) and requested another four review articles (Tsuji-mori, 2017; Miyajima, 2017; Hirajima, 2017; Ohtani et al., 2017) from experts with JAMS membership. In addition, in response to a call for papers to the Japanese geoscience community, five research articles (Kunugiza et al., 2017; Goto et al., 2017; Fukuyama et al., 2017; Takahashi et al., 2017; Sakamaki, 2017) were contributed from the authors and authors’ groups conducting research on jadeite and jadeitite. The eleven papers in this issue cover the fields of mineralogy, petrology, geochemistry, geochronology, mineral physics, and planetary science from different perspectives. Most topics concern Japanese jadeitites and jadeite-rich rocks, but papers also address Californian jadeitite, extra-terrestrial jadeites, and jadeite melts in laboratory.

This is the first-ever Japanese special issue on ‘Jadeite and jadeitite’. We hope that readers will find how jadeite and jadeitites are beautiful and also important to the earth and planetary sciences.

### CONTRIBUTIONS IN THIS ISSUE

The first paper, by Tsujimori and Harlow (2017), is an invited review focusing on historical facts before the first identification by Kawano (1939), and comparisons of

specific features and research problems concerning Japanese jadeitite with those of other occurrences. The paper includes color photos of some gem-quality jadeitites. Based on the authors' experience in jadeitite study, current perspectives on jadeitite are also documented.

Nishiyama et al. (2017) present an invited review of the Nishisonogi jadeitites in the Nagasaki Metamorphic Complex. The authors summarize geochemical and geochronological data of the jadeitites with interpretations on their petrogenesis.

Tsujimori (2017) focuses on new insights in recent studies of Paleozoic jadeitite and jadeite-rich rocks in Japan. The paper includes color photos of the common appearance of non-gem grade jadeitites.

Miyajima (2017) presents a review specializing on the Itoigawa jadeitites. His review includes the lengthy historical story behind the jadeitite studies of the area.

Hirajima (2017) reviews jadeite in Mesozoic high-pressure metamorphic belts in Japan, excluding the Nagasaki Metamorphic Complex. He summarizes jadeite-rich rocks in the Kanto Mountains and also jadeite-bearing metamorphic rocks in the Sambagawa and Kamuikotan belts.

Ohtani et al. (2017) introduce the occurrence of jadeite in shocked ordinary chondrites. They show that the crystallization kinetics of high-pressure polymorphs can facilitate estimates on the size and cooling history of the primary parent-body of chondrites.

Kunugiza et al. (2017) report new in-situ zircon U-Pb dating from the R-type jadeite formed in the Omi area. They confirm the authors' preliminary results of timing of jadeite formation at ~ 520 Ma, as well as constraining a protolith age of ~ 560 Ma.

Goto et al. (2017) propose phase relations of low-temperature hydrothermal jadeitites based on Schreinemakers' rule. They apply these results to explain the hydrothermal precipitations of jadeitite in the Itoigawa jadeite.

Fukuyama et al. (2017) report chemical composition of fluid inclusions within quartz in a jadeite-rich rock in the Kanto Mountains. LA-ICPMS analyses reveal that fluid inclusions are enriched in LILE, Li, B, HFSE and transition metals.

Takahashi et al. (2017) show spectacular optical cathodoluminescence (CL) color images of jadeites from veined jadeitites from California. They characterize the luminescent features, and also emphasize the advantages of CL microscopy for jadeitite study.

The final paper of this special issue by Sakamaki (2017) reports results of in-situ density measurements of jadeite melt under high-pressure and high-temperature, up to 6.5 GPa and 2273 K. Using the result meas-

ured in a beamline of synchrotron radiation facility, he discusses the compression mechanisms of jadeite melts.

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