

What drives the distribution in nature of $3T$ vs. $2M_1$ polytype in muscovites and phengites? A general assessment based on new data from metamorphic and igneous granitoid rocks

**RAFFAELE SASSI,^{1,*} MARIA FRANCA BRIGATTI,² MARIA TERESA GOMEZ-PUGNAIRE,³
LUCA PERUZZO,⁴ FABRIZIO TELLINI,¹ AND FRANCESCO P. SASSI¹**

¹Dipartimento di Geoscienze, Università di Padova, Via Giotto 1, 35137 Padova, Italy

²Dipartimento di Scienze della Terra, Università di Modena e Reggio Emilia, Via S. Eufemia, 19, 41100 Modena, Italy

³Departamento de Mineralogía y Petrología, Universidad de Granada and Instituto Andaluz de Ciencias de la Tierra (CSIC),
Campus de Fuentenueva, 18002 Granada, Spain

⁴Istituto di Geoscienze e Georisorse, CNR, Via Matteotti 30, 35137 Padova, Italy

ABSTRACT

Petrologic, chemical, and polytype data are presented for dioctahedral potassic micas from K-feldspar-bearing metamorphic and igneous rocks of acidic composition unaffected by high-pressure (HP) conditions. The paper aims to demonstrate that: (1) under non-HP conditions, in both metamorphic and igneous plutonic environments, a given bulk-rock compositional constraint imposes a more or less marked phengitic composition to dioctahedral potassic mica; and (2) this muscovite crystallizes as $2M_1$, notwithstanding its phengitic composition. The samples (157 in number) are from widespread provenances. We conclude that the growth of $3T$ polytype of muscovite is not a function of mica composition. This is consistent with the recent crystallographic knowledge on polytypism, cation ordering, elastic properties, and structural deformational mechanisms of muscovite, which address the stabilization of $3T$ with pressure.

Keywords: Muscovite, phengite, celadonitic substitution, polytypism, $2M_1$, $3T$, pressure-polytype relationship, mica chemistry, polytype relationship, petrologic mineralogy