

**Syn-metamorphic B-bearing fluid infiltrations deduced from tourmaline in the
Main Central Thrust zone, eastern Nepal Himalayas**

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Abstract

Mode of occurrence and chemical composition of tourmaline in pelitic schists from the Main Central Thrust (MCT) zone of the Lesser Himalayan Sequences (LHS) are described in detail with the aim of deducing the chemical characteristics of tourmaline formed through B-bearing fluid infiltration and of estimating the composition of the syn-metamorphic fluids. Metasomatic tourmalines from the tourmalinized wall rocks show significant increases in X_{Ca} [$=Ca/(Ca+Na)$] at almost constant X_{Mg} [$=Mg/(Mg+Fe^{2+})$] from the cores or mantles to the rims. Tourmaline in tourmaline-rich (> 1.0 vol%) pelitic schists from the biotite zone to the kyanite zone also show marked increase in X_{Ca} at almost constant X_{Mg} , and are interpreted as a product of B-bearing fluid infiltration. Abundant margarite and

anorthite formed in the pelitic schists intercalated with the metadolostone layers suggesting that the B-rich fluid became Ca enriched as it interacted with metadolostone layers, and metasomatically introduced Ca into the pelitic schists. Infiltration of such B- and Ca-rich fluids into pelitic schists likely resulted in production of abundant tourmaline with the compositional trend of increasing X_{Ca} at almost constant X_{Mg} . Most of the tourmaline in tourmaline-rich pelitic schists are in equilibrium with plagioclase, suggesting that the fluid composition was buffered by the pelitic schists. Composition of tourmaline in the pelitic schists with less than 1 vol% tourmaline mostly show increase in X_{Ca} and wider range of X_{Mg} values, reflecting its growth during prograde metamorphism. The composition of fluids that coexisted with tourmaline is estimated by applying experimentally-determined fluid/tourmaline chemical relationships to the composition of tourmaline from veins associated with tourmalinization, pelitic schists with less than 1 vol% tourmaline and tourmaline-rich pelitic schists. Assuming coexisting anion to be Cl, the salinity estimated for these rock types was ~0.44-0.59 mol/l NaCl+CaCl₂ that is similar to or slightly lower than the present-day seawater. Veins associated with tourmalinization and tourmaline-rich pelitic schists are sporadically distributed in the MCT zone of the LHS, suggesting that the syn-metamorphic, B-bearing saline fluid infiltrations took place widely in the MCT zone, and the fluid pathways were localized and channeled. Our observation supports the scenario whereby infiltration of fluid into the High Himalayan Crystallines (HHC) caused vapor-saturated partial melting of the HHC to give tourmaline leucogranite melts contemporaneous with

37 inverted metamorphism in the MCT zone.

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39 Keywords: metamorphic fluid; boron; metasomatism; tourmaline leucogranite; inverted
40 metamorphism

41

42 **1 Introduction**

43 Syn-metamorphic fluid movements in the continental collision zone is of great importance especially
44 for mass and heat transfer from the site of their generation. Under a tectonic setting of an inverted
45 metamorphism, low-grade metamorphic rocks have been thrust under high-grade metamorphic rocks.

46 In a study of the Annapurna and Manaslu massifs in the Nepal Himalaya, Le Fort (1981) emphasized
47 the importance of underlying low-grade metamorphic rocks as a source of aqueous fluids that infiltrate
48 into the overlying higher-grade metamorphic rocks to trigger fluid-fluxed partial melting. As the
49 concept of dehydration melting was becoming increasingly accepted, more emphasis was placed on
50 the role of muscovite dehydration melting in forming leucogranites in continental collision settings
51 (e.g., Harrison et al., 1999; Visona and Lombardo, 2002). However, taking into account the relatively
52 low temperature estimates obtained from some areas of the High Himalayan Crystallines (HHC) and
53 most of the Lesser Himalayan Sequences (LHS) compared to the temperature required for the
54 dehydration melting of muscovite, fluid-fluxed melting is potentially an alternative explanation for

the formation of leucogranites in these rocks.

A potential tracer of aqueous fluids is B, which can crystallize as tourmaline once the pressure-temperature (P - T) conditions and bulk composition of the rocks are favorable. Tourmaline, with a general chemical formula of $XY_3Z_6(T_6O_{18})(BO_3)_3V_3W$, is a common accessory mineral in the Earth's upper continental crust having a wide stability field (Henry and Dutrow, 1996; van Hinsberg et al, 2011). In metapelites, prograde breakdown of illite and micas locally supply B for tourmaline growth (Henry and Dutrow, 1996; Sperlich et al, 1996; Kawakami and Ikeda, 2003). On the other hand, because tourmaline is the most important sink of B in metapelites (Henry and Dutrow, 1996; Kawakami, 2001a; 2004; Sperlich et al, 1996), B is commonly fixed at the site of fluid/rock interaction as accumulations of tourmaline (e.g., Kawakami, 2001b; Kawakami et al., 2008; Marschall et al., 2006; Marocchi et al., 2011), and thus accumulations of tourmaline are testimony to former presence of B-bearing fluids. Therefore, chemical composition of tourmaline varies as a function of metamorphic grade (e.g., Henry and Dutrow, 1996) and can also serve as a monitor of fluid compositions (von Goerne et al., 2011; Berryman et al., 2016).

Tourmaline is a common mineral in Himalayas, contained in the HHC, LHS, and High Himalayan leucogranites (HHL) and thus has been studied by many researchers (e.g., Benard et al., 1985; Rai and Le Fort, 2002; Visona and Lombardo, 2002). It is clear from its occurrence as a major mafic mineral in the HHL that B played an important role in the formation of the HHL and can

potentially serve as a proxy to constrain its source region. Addition of B can lower the temperature of the granitic solidus and reduce the viscosity of the melt (Johannes and Holtz, 1996). There are several hypotheses for the HHL formation including: (a) fluid-present melting (e.g. Le Fort, 1981; Harris et al., 1993), (b) decompression melting (e.g. Harris and Massey, 1994) and (c) muscovite- and biotite-dehydration melting (e.g., Harrison et al., 1999; Visona and Lombardo, 2002). This study aims to deduce chemical characteristics of tourmaline that may be associated with B-bearing fluid infiltration, unravel the syn-metamorphic fluid activity in the MCT zone by using mode of occurrence and composition of tourmaline, and finally discuss which melting process(es) are likely to form the HHL in the Dhankuta area, Eastern Nepal. Mineral abbreviations are after Whitney and Evans (2010).

2 Geological setting of the MCT zone in the Dhankuta area (Eastern Nepal)

The metamorphic field mapping and sampling were carried out in the Dhankuta area, Eastern Nepal, where the HHC and LHS bounded by the Main Central Thrust (MCT) are widely exposed (Sakai et al., 2013; Fig. 1a). The MCT in this area gently dips north (Fig. 1b). In the footwall side of the MCT, the LHS mainly composed of pelitic schists (Fig. 2a, Table 1) are widely exposed intercalated with subordinate amounts of actinolite schists, quartzites and mafic rocks. The orientation of the foliation appears to be subparallel to the MCT. Mesoscale N-S trending folds with a wavelength of several tens of meters are locally developed and disturb this trend. Actinolite schists (Fig. 2b, Table 1) are locally

boudinaged by the E-W stretching. The detailed metamorphic zone mapping of the footwall rocks of the MCT revealed that the metamorphic grade decreases from the Ky zone through the St and Grt zones to the Bt zone as distance from the MCT increases toward the south (Fig. 1b), representing the inverted metamorphic sequence. These metamorphic zones are apparently affected by the top-to-the-S movement of the MCT as indicated by the asymmetrical structures of deformed quartz lenses (Fig. 2a), and termed the “MCT zone” in the previous studies. In the hanging wall of the MCT, the HHC mainly composed of migmatitic Grt-Bt-Ms gneiss (Fig. 2c, Table 1) is widely distributed. The gneissosity generally dips north, and mesoscale N-S trending upright folds locally disturb this trend. Tourmaline-bearing leucogranite patches either occur concordantly to the gneissosity or cut it discordantly (Fig. 2d).

3 Analytical methods

Quantitative analyses of rock-forming minerals and X-ray elemental mapping of thin section samples were performed by a JEOL JXA-8105 superprobe. Analytical conditions for quantitative analyses were 15.0 kV acceleration voltage, 10 nA beam current, and 3 µm beam diameter. The counting time for the peak and backgrounds were 30 s and 15 s for Cl, 60 s and 30 s for F, and 10 s and 5 s for other elements. Natural and synthetic minerals were used as standards and the ZAF correction was applied. Representative mineral analyses are given in Table 2 for tourmaline and Table 3 for other rock-forming

minerals. Analytical conditions for the Zr-in-rutile thermometry followed that of Zack et al. (2004). Analytical conditions for X-ray elemental mapping were an acceleration voltage of 15.0 kV, probe current of 50 nA, with a focused beam or a beam diameter of 3 μm . Fine-grained Al_2SiO_5 minerals were identified with laser Raman spectroscopy (JASCO NRS 3100). All of these analyses were done at Department of Geology and Mineralogy, Kyoto University, Japan. Tourmaline composition was normalized based on 15 T+Z+Y cations (Henry and Dutrow, 1996; Henry et al., 2011), assuming three B atoms per formula unit (apfu). The most common constituents of each site are: $^{[9]}\text{X} = \text{Na}^+, \text{Ca}^{2+}, \text{K}^+$ and $\square$ (vacancy); $^{[6]}\text{Y} = \text{Fe}^{2+}, \text{Mg}^{2+}, \text{Al}^{3+}$ and Li^+ ; $^{[6]}\text{Z} = \text{Al}^{3+}, \text{Fe}^{3+}$ and Mg^{2+} ; $^{[4]}\text{T} = \text{Si}^{4+}$ and Al^{3+} ; $^{[3]}\text{B} = \text{B}^{3+}$; $\text{V} = \text{OH}^-$ and O^{2-} ; and $\text{W} = \text{OH}^-, \text{F}^-$ and O^{2-} (Henry et al., 2011). Although $\text{Fe}_{\text{total}} = \text{Fe}^{2+}$ in most of the tourmaline analyses, Fe^{3+} and Fe^{2+} were estimated by $\text{Fe}^{3+} = 6 - \text{Al}(\text{Z})$ and $\text{Fe}^{2+} = \text{Fe}_{\text{total}} - \text{Fe}^{3+}$, respectively in some analyses. Small amounts of Ba^{2+} are assumed to enter the X site in this study (Table 2). Full dataset of tourmaline analyses is available as a supplementary material (Table S1).

4 Sample description

4.1 Metapelites in the Lesser Himalayan Sequences

Four metamorphic zones are defined in the MCT zone based on mineral assemblages in pelitic schists (Fig. 1b; Table 1). Abundant quartz veins are found as sheared lenses concordant to the penetrative schistosity in the MCT zone (termed “quartz lenses” hereafter). Their asymmetric shapes indicate the

shear sense of ductile deformation to be top-to-the-S (Fig. 2a), which is identical with the movement of the MCT.

Pelitic schists in the Ky zone are characterized by the presence of kyanite (Fig. 1b; Table 1). Representative mineral assemblage is Ky + Grt + Bt ± St + Ms + Pl + Qtz. Some of the kyanite-bearing rocks have appearance similar to black slates in the outcrop due to accessory graphite. In such samples (e.g., sample 402-3; Table 1), fine-grained, lath-shaped kyanite is arranged along the schistosity with muscovite, biotite and staurolite. Kyanite, garnet and minor plagioclase are found as mm- to cm-sized crystals near or within the quartz lenses, and are significantly coarser-grained than other matrix-constituting minerals (Fig. 2e). Some garnet and kyanite grains show sheared and elongated grain shape in the vicinity of the quartz lenses, and some kyanite grains contained in the quartz lenses show curved growth texture (bottom left of Fig. 3k). The conventional Grt-Bt geothermometer (Bhattacharya et al., 1992; Holdaway, 2000) and GASP geobarometer (Holdaway, 2001) applied to the Grt + Ky + Pl + Bt + Qtz assemblage seen in the quartz lens and adjacent pelitic schist domain (Fig. 2e) yielded ~610 °C and ~0.92 GPa (Fig. 4). The two different calibrations of Grt-Bt geothermometer gave almost identical temperature estimates.

Pelitic schists with more than 1 vol% tourmaline sometimes show different microtexture. In sample 505A, garnet shows discontinuous core/rim zoning and the rim is dark under the BSE image. This kind of discontinuous zoning in garnet is rare in other samples. Plagioclase is An-rich (An₆₉₋₈₀)

and includes tourmaline crystals (Fig. 3b). In a black pelitic schist sample 109B collected from the boundary between St- and Ky-zones (Table 1), tourmaline enclosed in garnet defines an internal foliation that is continuous to the matrix schistosity defined by the preferred orientation of biotite, muscovite and tourmaline (Fig. 3c).

Pelitic schists from the St zone are represented by the mineral assemblage Grt + St + Bt + Ms + Qtz $\pm$ Pl (Fig. 1b; Table 1). Staurolite and muscovite are coarser-grained near the quartz lenses. In sample 908, plagioclase cores with anorthite-rich composition (An₈₀₋₈₅) is replaced by anorthite-poor plagioclase rims (An₂₅₋₃₉), which are considered to be in equilibrium with other matrix minerals such as tourmaline. Conventional *P-T* estimate by Grt-Bt geothermometers in combination with the Grt-Bt-Ms-Pl geobarometer (Wu, 2015) gave scattered estimates depending on the calibration of the Grt-Bt geothermometers: that of Bhattacharya et al. (1992) yielded ~580 °C and ~0.66 GPa, whereas that of Holdaway (2000) yielded ~655 °C and ~0.78 GPa (Fig. 4). Plagioclase with a composition of ~An₃₂ that is in chemical equilibrium with matrix tourmaline was used for these estimates (Table 1). In a pelitic schist with more than 1vol% tourmaline from the St zone (sample 602, Table 1), garnet that encloses abundant tourmaline crystals shows bell-shaped Mn zoning indicative of its prograde growth (Fig. 3e). For this sample, the *P-T* condition for the matrix mineral assemblage estimated by the Grt-Bt geothermometer (Holdaway, 2000) in combination with the Grt-Bt-Ms-Pl geobarometer (Wu, 2015) was ~570 °C and ~0.80 GPa. A slightly lower *P-T* estimate of ~550 °C and ~0.76 GPa was

obtained by the Grt-Bt geothermometer (Bhattacharya et al., 1992) in combination with the same geobarometer.

Pelitic schists from the Grt zone are represented by the mineral assemblage of Grt + Bt + Ms + Chl + Qtz $\pm$ Pl (Fig. 1b). The P - T estimate by Grt-Bt geothermometers (Bhattacharya et al., 1992; Holdaway, 2000) and the Grt-Bt-Ms-Pl geobarometer (Wu, 2015) gave ~ 575 °C and ~ 0.79 GPa (Fig. 4). Two calibrations of the Grt-Bt geothermometer yielded almost identical temperature.

Pelitic schists from the Bt zone are represented by the assemblage of Bt + Chl + Ms + Qtz (Fig. 1b; Table 1). Pelitic schist with more than 1vol% tourmaline (sample 2-807) was found near the boundary between the Grt- and Bt-zones (Fig. 1b).

4.2 Actinolite schists in the Lesser Himalayan Sequences

Actinolite schists are commonly intercalated with pelitic and psammitic schists from the Bt- to the Ky-zones of the LHS, and are green-colored in outcrop. Radial crystals of actinolite form flat, oval-shaped aggregates arranged parallel to the sedimentary layering of protolith and define the schistosity. Some of them in the Ky zone are intercalated with orange-colored, dolomite-rich parts (Fig. 2b). In such samples, green actinolite selvages fill cracks that cut the schistosity, with offshoots parallel to the schistosity (Fig. 2b; sample 104). The main mineral assemblage in the orange-colored part is Dol ($X_{Mg} = 0.86-0.87$) + Bt ($X_{Mg} = 0.67-0.73$), whereas that in the greenish-part is Act ($X_{Mg} = 0.79-0.84$)

+ Cal. Minor relic dolomite is present in the greenish, actinolite schist part. Some actinolite grains enclose cores of magnesiohornblende ($X_{Mg} = 0.70-0.76$). In pelitic schists near the actinolite schists, abundant grains of secondary margarite and anorthite-rich plagioclase cut the schistosity of the metapelites within several to ~10 meters from metadolostone layers (Fig. 2f).

4.3 Pelitic gneiss from the High Himalayan Crystallines

Pelitic gneiss is the main rock type in the Formation I of the HHC. Tourmaline-bearing leucogranitic layers, either concordant (Fig. 2c) or discordant (Fig. 2d) to the gneissosity, are common in the pelitic gneisses. Sillimanite is rare, and is typically fibrolitic occurring at grain boundaries of matrix minerals (Table 1). Two types of garnet are seen in some pelitic gneisses: garnet with rounded, nearly euhedral shape shows Mn-bell-shaped zoning, whereas that with elongated shape is mostly homogeneous in major element composition (Fig. 3l-n; sample 604). The elongated garnet includes euhedral plagioclase (Fig. 3l) and has composition similar to the thin outermost rims of the rounded garnet (Fig. 3m-n). Tourmaline is included in the Mn-bell-shaped domains and rims of the rounded garnet, and it is also enclosed in a garnet grain showing similar composition with the elongated garnet (top left of Fig. 3l-n).

The P - T estimate of sample 604 by the Grt-Bt geothermometers (Bhattacharya et al., 1992; Holdaway, 2000) and GASP geobarometer (Holdaway, 2001) gave ~665 °C and ~1.13 GPa (Fig. 4).

The Zr-in-rutile thermometer (Tomkins et al., 2007) applied to rutile grains included in the elongated garnet (Fig. 3l-n) also gave ~665 °C at 1.13 GPa. For sample 201A, the Grt-Bt geothermometer (Bhattacharya et al., 1992; Holdaway, 2000) and GASP geobarometer (Holdaway, 2001) gave ~630 °C and ~1.13 GPa, and the Zr-in-rutile thermometer (Tomkins et al., 2007) gave ~670 °C at ~1.13 GPa (Fig. 4). For sample 201A, *P-T* estimate using the Zr-in-rutile thermometer is preferred.

5 Tourmaline composition and textures

5.1 Pelitic schists with less than 1 vol% tourmaline in the Lesser Himalayan Sequences

Tourmaline in pelitic schists with less than 1 vol% tourmaline (Table 1) in the Lesser Himalayan Sequences shows chemical zoning consisting of several domains (Fig. 3a). Cores are in most cases detrital in origin and differ in composition from one to another, whereas they are considered to be metamorphic in origin in the few cases where their compositions define a chemical trend towards the rims representative of increasing metamorphism (Fig. 5b-d).

Tourmaline inclusions in garnet porphyroblasts together with cores, mantles and rims of matrix tourmaline commonly show increase in $X_{Mg} [=Mg/(Mg+Fe^{2+})]$ in each sample (Fig. 5c-e). This chemical trend, commonly observed in metamorphic tourmaline in general, is considered to reflect the increase of metamorphic grade as the tourmaline grows (Henry and Dutrow, 1996). On the other hand, $X_{Ca} [=Ca/(Na+Ca)]$ does not always increase as a function of X_{Mg} (Fig. 5a, e). Similarly, X-site

vacancy does not always decrease as often observed as metamorphic grade increases (Fig. S1). Based on the chemical zoning from the cores to the rims that follows the trend of increasing metamorphism (Figs. 5c-d, S1b, S1d-e), tourmaline contained in the pelitic schists with less than 1 vol% tourmaline in the MCT zone of the LHS is considered to have grown during the prograde metamorphism.

In addition to tourmaline zoning observed in each sample, rims of matrix tourmaline in each metamorphic zone systematically change in composition as metamorphic grade increases. The rims of matrix tourmaline show increase in X_{Mg} from the Grt zone to the Ky zone (Fig. 5f), representing progressive increase in metamorphic grade (Henry and Dutrow, 1996). Change of X_{Ca} and X-site vacancy is again not straightforward (Fig. 5f, S1f).

5.2 Pelitic schists with more than 1 vol% tourmaline in the Lesser Himalayan Sequences

Pelitic schists that contain more than 1 vol% tourmaline are termed “tourmaline-rich pelitic schists” hereafter. They are either associated with or without quartz lenses (Table 1). The tourmaline-rich pelitic schists not accompanied by quartz veins with tourmalinization are common in the Grt- to Ky-zone rocks (Table 1). In such samples, tourmaline tends to be abundant in muscovite-rich layers, and also included in garnet (Fig. 3c-d; samples 505A, 109B, 602 and 803).

Tourmaline in the tourmaline-rich pelitic schists commonly define different chemical trends from that in the pelitic schists with less than 1 vol% tourmaline: They show significant increase of X_{Ca}

value from cores to rims at almost constant X_{Mg} value (Fig. 6g). The X-site vacancy values vary widely at almost constant X_{Mg} in some samples (Fig. S2b, f, g). These compositional trends are commonly observed for matrix tourmaline in the Grt-zone to the Ky-zone rocks, while tourmaline enclosed in garnet sometimes follow or constitute a part of the trends as well (Figs. 6d-h, S2d-h). For example, in a pelitic schist from the St zone (sample 602, Table 1) tourmaline enclosed in garnet follows the compositional trend that mantles and rims of matrix tourmaline define, i.e., increasing X_{Ca} and decreasing X-site vacancy at almost constant X_{Mg} (Figs. 6f, S2f). On the other hand, large compositional variations of the tourmaline cores that are commonly observed in pelitic schists with more than 1 vol% tourmaline (Fig. 6d-g) can be ascribed to their detrital origin, supported by the irregular shape of the cores under BSE images.

5.3 Pelitic gneisses from the High Himalayan Crystallines

Tourmaline is found as matrix mineral (Fig. 3l) as well as inclusions in garnet. The matrix tourmaline is commonly euhedral, but some are developed as xenomorphic grains along the matrix grain boundaries, indicating later crystallization. Composition of tourmaline in Formation I gneisses is homogeneous within a sample, while it varies between samples (Fig. 5g, S1g).

5.4 Veins associated with tourmalinization in the kyanite zone of the Lesser Himalayan

Sequences

Veins discordantly cutting the schistosity of metapelites and associated with tourmalinization in the wall rock were found at three localities in the Ky zone (Fig. 2h). In these localities, tourmaline replaces mafic minerals such as biotite and staurolite that are concordantly arranged with the schistosity of the wall rock.

Sample 808-2 is a tourmaline-quartz vein (Table 1). In the wall rock, kyanite and staurolite are surrounded by secondary muscovite aggregates and by secondary chlorite. The tourmaline is considered to be entirely of metasomatic origin. The X_{Ca} value of tourmaline increases from metamorphic cores to mantles and rims at constant X_{Mg} (Figs. 6a), and the X-site vacancy value systematically decreases from the cores to mantles and rims (Fig. S2a).

Sample 107-1 is a plagioclase-quartz vein that crosscuts the compositional layering of the wall rock at a high angle (Fig. 2h; Table 1). The wall rock is mainly pelitic schists locally intercalated with actinolite-rich layers (e.g., Fig. 2b). The vein itself is mainly composed of Pl (An88) + Qtz with accessory Chl + Ms, whereas a selvage rich in tourmaline is developed in the wall rock along the vein. Tourmaline in the wall rock is concentrated in the partly folded, muscovite-rich layers (Fig. 3f). Further away from the contact with the vein, pre-existing schistose layers consisting of biotite and staurolite are significantly tourmalinized (Fig. 3f). Schistose layers rich in muscovite envelope garnet and staurolite crystals, but do not envelope metasomatic tourmaline. This indicates that the

compositional banding defined by the arrangement of peak metamorphic minerals in the wall rock served as sites for tourmaline nucleation and growth. Rims of staurolite include tourmaline that has chemical zoning identical to the wall rock tourmaline. Tourmaline formed in the wall rock is fractured normal to the c-axis and shows pulling apart of the fragments (Fig. 3f). New tourmaline is locally developed on the pre-existing tourmaline in the space opened by the pulling and breaking apart of the pre-existing tourmaline. Tourmaline included in garnet shows variation of X_{Ca} and X-site vacancy at almost constant X_{Mg} (Figs. 6b, S2b). The cores of the matrix tourmaline show similar composition with rims of tourmaline inclusions in garnet (Fig. 6b). Temperature estimate using interplanar Ca/Na partitioning of tourmaline (Henry and Dutrow, 1996; van Hinsberg and Schumacher, 2007) developed in the wall rock gave ~530-590 °C.

In sample 101 from the Ky zone (Table 1; Fig. 3g), tourmaline-quartz vein (area 3; Fig. 3h) almost vertically cuts the schistosity, and tourmalinized domains replacing biotite and staurolite stem out parallel to the schistosity. The mineral assemblage of the wall rock changes as a function of the distance from the vein, that is, from $Chl + Tur + Qtz \pm Grt$ at the contact with the vein (area 2; Fig. 3i) to $Tur + Chl + Qtz + Bt + St \pm Grt$ at about 4 cm distant from the vein (area 1; Fig. 3j). Plagioclase and K-feldspar are absent in this sample. Biotite and staurolite are partly replaced by tourmaline and chlorite in the area 1, indicating incomplete progress of tourmalinization reactions consuming them. The X_{Ca} decreases from areas 3 and 2 to area 1 at almost constant X_{Mg} (Fig. 6c). Compositional

variation tends to be the largest in area 1 compared to areas 2 and 3.

5.5 Quartz veins in the Main Central Thrust zone of the Lesser Himalayan Sequence

Abundant quartz lenses showing top-to-the-S sense of shear (Fig. 2a) are found in the Ky zone near the MCT to the Grt zone distant from the MCT zone. They are the most obvious evidence for the pre- to syn-kinematic fluid activities in the MCT zone. Quartz lenses several centimeters to several decimeters in length are found in most pelitic layers. The quartz lenses are not associated with tourmalinized selvages in pelitic host rocks, and the selvages are in most cases biotite or chlorite depending on the metamorphic grade. In sample 402-3, kyanite and garnet are coarser-grained in the vicinity of and in the quartz lenses, and some kyanite grains in the quartz vein show curved growth texture (Fig. 3k). The *P-T* condition recorded by these coarse-grained garnet, kyanite and quartz, and proximal plagioclase and biotite is estimated at ~610 °C and ~0.92 GPa by applying the Grt-Bt geothermometers and GASP geobarometer (Bhattacharya et al., 1992; Holdaway, 2000; 2001) (Fig. 4)

6 Discussion

6.1 Compositional constraints on the tourmalinization- and metamorphic-fluids

Boron-bearing fluid infiltration in the MCT zone of the LHS took place continuously from the prograde metamorphic stage to the final stage of schistosity-forming deformation possibly during early

retrograde metamorphism. The former is evidenced by the presence of abundant tourmaline inclusions in prograde garnet (Fig. 3c, e). The latter is evidenced by the presence of veins accompanied by tourmaline-rich selvages cross-cutting the schistosity (sample 107-1; Fig. 2h) whose formation temperature is estimated to be ~530-590 °C from tourmaline thermometry, and by the microstructures indicating that staurolite + garnet was stable at the time of B-bearing fluid infiltration.

Temperature condition of the experiment by von Goerne et al. (2011) (600 °C) is similar to that estimated for the St and Ky zone samples (~600 °C; Fig. 4), and broadly similar to that for tourmaline-forming vein sample (~530-590 °C). Therefore, in order to estimate the coexisting fluid composition, the equations $Na_{fluid}(mol/l) = 1.39X_{Na} - 1.04X_{Na}^2$ and $Ca_{fluid}(mol/l) = 0.60X_{Ca} - 0.35X_{Ca}^2$ were calculated from the experimental data reported by von Goerne et al. (2011) for 600 °C, where $X_{Na} = Na/(Na+Ca)$ and $X_{Ca} = Ca/(Ca+Na)$ in tourmaline (cf. Dutrow and Henry, 2016). These equations are applied to the studied samples, keeping in mind that extrapolating 0.20 GPa experiments to higher-*P*, chemically complex natural samples is associated with large uncertainty. Assuming coexisting anion to be Cl, fluid compositions calculated for vein samples, Tur-rich pelitic schists, and even pelitic schists with less than 1 vol% tourmaline all showed salinity (~0.44-0.59 mol/l NaCl+CaCl₂) similar to the present-day sea water (~0.6 mol/l NaCl) as summarized in Table 1. Fluid compositions for the Formation I samples are given for reference only (Table 1) because at least part of tourmaline crystals are shown to have coexisted with euhedral plagioclase indicating their magmatic

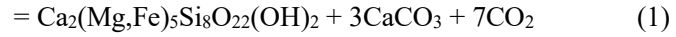
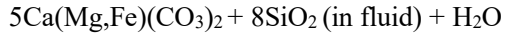
origin (Fig. 3n-l). A magmatic origin of tourmaline in the Formation I samples is also indicated by its occurrence as a euhedral mineral in leucosome (Fig. 2c-d).

Tourmaline and plagioclase are known to show almost identical X_{Ca} values when they are in chemical equilibrium (von Goerne et al., 2011). As shown in Fig. 7, compositions of plagioclase and tourmaline in several samples such as a vein associated with tourmalinization (sample 107-1) and pelitic schists with more than 1 vol% tourmaline (samples 505A and 505B) do not plot on the equilibrium line defined by the experimental study of von Goerne et al. (2011), suggesting that plagioclase and tourmaline in these samples are in disequilibrium relationship. Because there is a possibility that fluid-mineral equilibrium is not attained in these samples, estimated fluid compositions are only given for reference for these samples as well (Table 1). Although anorthite-rich cores of plagioclase show disequilibrium relationship with matrix tourmaline in sample 908, plagioclase rims and matrix tourmaline show equilibrium relationship (Fig. 7). Therefore, matrix tourmaline composition is used in estimating fluid compositions for sample 908.

6.2 Ca-metasomatism in the Main Central Thrust zone

Some actinolite schists in the Ky zone are intercalated with orange-colored, dolomite-rich portions (Fig. 2b). In such samples, selvages of green actinolite fill cracks that cut the schistosity, with offshoots parallel to the schistosity (Fig. 2b; sample 104). These textures clearly show that the orange

dolomitic portions are the protolith of greenish actinolite-rich regions, and that the hydration reaction



took place locally along the crack and parallel to the schistosity into which H₂O-rich fluid infiltrated.

The actinolite-rich parts developed parallel to the schistosity become thinner away from the crack (Fig.

2b), suggesting that H₂O infiltration from the crack along the schistosity was necessary for the progress

of the reaction (1), and that H₂O was consumed during the reaction along the schistosity. Therefore, it

is highly likely that the actinolite schists in the study area were originally metadolostones that

underwent water-rock interaction as represented by reaction (1).

Abundant grains of secondary margarite and anorthite-rich plagioclase cut the schistosity of

the metapelites within several to ~10 meters from the actinolite schist (i.e., metadolostone) layers (Fig.

2f). This suggests that some of the CaCO₃ and CO₂ components in the product side of the reaction (1)

were presumably contained in the H₂O fluid and removed from the actinolite schists during the

progress of reaction (1). Infiltration of such Ca-bearing fluids into surrounding pelitic schists possibly

caused Ca-metasomatism especially in the vicinity of the metadolostone layers, and produced

observed anorthite-rich plagioclase and margarite (Fig. 2f). The An-rich nature of plagioclase in the

plagioclase-quartz vein (Fig. 2h; sample 107-1) is also indicative of movement of the Ca-bearing fluid,

and the development of tourmaline-rich selvages in the wall rock (Fig. 2g-h) points to the presence

of B in such fluids. The An-rich plagioclase contained in some of the tourmaline-rich pelitic schists (e.g., Fig. 3b; Table 1) would be the products of Ca-metasomatism similar to that observed in the vicinity of actinolite schists (metadolostones). Drastic change of X_{Ca} in the tourmaline enclosed in garnet in the tourmaline-rich pelitic schists (e.g., Fig. 6d) suggests that such Ca-metasomatism took place during the garnet growth, i.e., during the prograde metamorphism of the LHS. Enrichment of some pelitic schists in tourmaline indicates that B was also introduced into the pelitic schists by the same metasomatic fluid. This is consistent with the case of veins associated with tourmalinization in which Ca and B were also carried by the metasomatic fluid as discussed above.

6.3 Pressure-temperature conditions of the fluid infiltration event that formed quartz-lenses

As described above, garnet and kyanite are coarse-grained only in and around the quartz lenses developed parallel to the schistosity (Fig. 2e), suggesting that the fluid infiltration event that formed the quartz lenses (originally veins) took place during prograde to peak metamorphism when these porphyroblasts grew in the Ky zone. In a pelitic schist sample 402-3, some kyanite grains in the quartz lenses show curved growth texture possibly indicating the fluid flow during their growth (Fig. 3k). Presence of such kyanite and plagioclase in the quartz lenses suggests that they crystallized in a fluid, and Si, Al, Na and Ca were likely contained in the fluid. The P - T condition of $\sim 610^\circ\text{C}$ and ~ 0.92 GPa, estimated by applying the conventional geothermometers and geobarometers to the Grt + Ky + Pl +

Bt + Qtz assemblage found in the vein and in the adjacent wall rock, probably represents the P - T condition of the fluid infiltration (Fig. 4). These lens-shaped quartz veins are not associated with tourmalinization, and thus the B content of the fluid might have been lower than that of the fluid which formed the schistosity-cutting veins associated with tourmalinization.

6.4 Origin of tourmaline-rich pelitic schists and tourmaline-veins

In the veins associated with tourmalinization from the Ky zone, biotite and staurolite in the wall rock are gradually replaced by tourmaline with decreasing distance from a tourmaline-quartz vein (Figs. 2g-h; 3g-j). This texture indicates that B-bearing fluids infiltrated into the wall rock using schistosity as a pathway of the B-bearing fluids, and selectively consumed biotite and staurolite to form tourmaline. A similar process probably took place in forming the tourmaline-rich pelitic schists. Pelitic schists with more than 1 vol% tourmaline are sporadically distributed in the MCT zone of the LHS as shown in Fig. 1b. In such rocks, tourmaline is commonly localized in muscovite-rich aluminous layers. The tourmaline-rich micaceous layers tend to be poor in biotite, although biotite not coexisting with abundant tourmaline is present elsewhere in the same sample (Fig. 3d). This probably reflects the control of local bulk composition in the progression of tourmaline precipitation either locally or ubiquitously during the infiltration of B-bearing fluids. In domains of appropriate bulk composition, biotite was selectively consumed as a reactant to supply Mg, Fe and Al when B-bearing fluids

infiltrated to form tourmaline. Presence of biotite not coexisting with abundant tourmaline in the same sample suggests that the fluid infiltration was localized and channeled. Localized and channeled nature of the fluid movement in the MCT zone of the LHS is also supported by the H₂O-rich fluid infiltration recorded in metadolostones (Fig. 2b) and sporadic occurrence of tourmaline-rich pelitic schists. Such a B-bearing fluid infiltration probably started during the prograde metamorphic stage, because garnet with prograde chemical zoning (bell-shaped zoning of Mn; Fig. 3e) includes abundant tourmaline crystals, and lasted until the post tectonic, tourmaline-rich vein formation stage.

Tourmaline in the tourmaline-rich pelitic schists is characterized by a large variation in X_{Ca} at almost constant X_{Mg} value (Fig. 6). Previous studies on metamorphic tourmaline show that X_{Ca} and X_{Mg} tend to increase as metamorphic grade increases (Henry and Dutrow, 1996). However, the chemical trend observed in tourmalines in the tourmaline-rich pelitic schists of this study contrasts with the trend representative of increasing metamorphic grade elsewhere. We consider that the large variation of X_{Ca} at nearly constant X_{Mg} reflects change of whole-rock X_{Ca} at constant metamorphic grade, i.e., Ca-metasomatism at constant P - T condition. Because the inverted metamorphism is observed in the MCT zone, a potential source of B-bearing fluids that infiltrated into the MCT zone could be structurally lower metapelites of lower metamorphic grades, because syn-metamorphic dehydration reactions of B-bearing hydrous minerals in low- to medium-grade metapelites such as illite and muscovite (Henry and Dutrow, 1996) can supply H₂O, B and other incompatible elements

into the fluid phase that migrate upwards into the higher-grade metamorphic zones. The metadolostone layers (actinolite schists) commonly intercalated with the pelitic schist in the MCT zone texturally preserve evidence for hydration and decarbonation reactions as represented by reaction (1) (Fig. 2b). Upward migration of the B-bearing fluids that originated from metapelites and reaction with metadolostone layers likely produced B- and Ca-rich metasomatic fluids. Infiltration of B- and Ca-rich fluids into the higher structural levels resulted in the Ca-metasomatism that produced anorthite and margarite in the overlying metapelites (Fig. 2f). The compositional trend recorded in tourmalines in the tourmaline-rich pelitic schists and in the tourmalinization domains along the veins, i.e., increase of X_{Ca} at constant X_{Mg} , can be ascribed to the infiltration of the B- and Ca-rich fluids into the pelitic schists and precipitation of tourmaline whose composition reflect that of the fluids. Disequilibrium relationship between tourmaline and coexisting An-rich plagioclase (Fig. 7) in some of the vein samples (sample 107-1) and tourmaline-rich pelitic schists (samples 505A, 505B, 908; Fig. 7) can be also explained by the short-lived infiltration of such fluids along cracks and schistosity. On the other hand, in the samples with equilibrium tourmaline-plagioclase pairs, reaction between the pelitic schists and the infiltrated B- and Ca-rich fluids were likely buffered by the pelitic schists, probably smaller amount of fluid infiltrated for longer period. In sample 908, plagioclase cores with anorthite-rich composition (An₈₀₋₈₅) is replaced by anorthite-poor plagioclase rims (An₂₅₋₃₉), suggesting that plagioclase formation took place at several discrete stages. Presence of several formation stages of

different tourmaline-plagioclase pairs, either disequilibrium and equilibrium (Figs. 3a, 5c and 7), points to multistage fluid infiltration events during the metamorphism (e.g., Dutrow et al., 1999).

Pelitic schists with less than 1 vol% tourmaline in the MCT zone of the LHS are probably the rocks that were less affected by the infiltration of B- and Ca-rich fluids. However, the change of X_{Ca} and X-site vacancy of tourmaline as a function of metamorphic grade is not straightforward as proposed in Henry and Dutrow (1996) even in some of the pelitic schists with less than 1 vol% tourmaline (Figs. 5a, e, S1). This probably reflects the effect of B- and Ca-rich fluid infiltration even for some of the pelitic schists with less than 1 vol% tourmaline, although the effect is likely weaker compared to the tourmaline-rich pelitic schists.

6.5 Significance of B-bearing aqueous fluid infiltration into the HHC in petrogenesis of tourmaline leucogranites

Our study has shown that there is abundant evidence of B-bearing aqueous fluid infiltration that took place during the prograde to post-peak metamorphism in the MCT zone of the LHS. These fluids most likely infiltrated into the structurally higher HHC across the MCT during the high- T metamorphism in the HHC. Microstructural constraints described above (e.g., Fig. 3l-m) shows that at least some of the tourmaline in the HHC grew in the presence of melt and thus the melt was B-bearing. Therefore, such fluid infiltration provides support for the concept of fluid-fluxed melting of the HHC (Le Fort,

1981). Fluid-fluxed melting has been considered unimportant for the formation of granitic bodies because melts formed at wet solidus cannot rise without crystallizing. However, if the T conditions of the HHC rocks into which the H_2O -rich fluid have infiltrated is sufficiently higher than the wet solidus, the melting reaction can be incongruent, forming water-undersaturated melt and peritectic phases such as garnet (Weinberg and Hasalová, 2015). Compared to a melt formed on the wet solidus, such melt can rise without crystallizing. In addition, the rising melt can form more melt because the maximum amount of water that can be incorporated in the melt decreases as pressure decreases (Weinberg and Hasalová, 2015), especially in the case where the melt intrudes into the hotter HHC. Patiño Douce and Harris (1998) melted a pelitic schist from the HHC under 1.0 GPa and 700°C with 4 wt % added H_2O , and observed a reaction as follows:



This reaction successfully accounts for the phases present in the Formation I gneisses of the Dhankuta area, and the P - T conditions of this reaction (2) is also consistent with the estimated P - T conditions for the Formation I rocks there (~670 °C at 1.13 GPa), taking the solidus-lowering effect of B (Pichavant, 1987) into account. It should be also noted that with the salinity of the fluid estimated by this study, activity of H_2O is not lowered significantly from unity (e.g., Aranovich and Newton, 1996; Johannes and Holtz, 1996). Tourmaline-bearing leucogranite patches observed in the HHC just above the MCT in this study would be a product of fluid fluxed melting of the HHC because it has a diffuse

boundary with the host gneiss (Fig. 2d) indicative of fluid-fluxed melting (Weinberg and Hasalová, 2015). This leucogranite patch, however, failed to be extracted from the site of formation judging from the fact that it occurs just above the MCT (Fig. 1b).

Guo and Wilson (2012) pointed out that the whole-rock major and trace elements and Sr–Nd isotope data from the HHL suggest that the HHL could have formed by the partial melting of the HHC metasomatized by the fluid derived from the LHS. Their data are consistent with our evidence for widespread movement of B-bearing fluid in the MCT zone of the LHS, and its possible infiltration into the structurally higher HHC. Therefore, influx of B-bearing aqueous fluids released from the LHS into the hot HHC during the inverted metamorphism of the MCT is one of the likely processes for partial melting of the HHC, and potentially an important process for the formation of tourmaline-bearing HHL in the studied area.

7. Conclusions

(1) Tourmaline in the MCT zone of the LHS records channeled syn-metamorphic fluid flow through an inverted metamorphic sequence.

(2) Dehydration of low-grade pelitic rocks likely released B-bearing fluids. Upward movement and interaction of such fluids with metadolostone layers made them enriched in Ca.

(3) Such syn-metamorphic B- and Ca-rich fluids infiltrated to form tourmaline showing significant

increases of XCa at constant XMg from the cores or mantles to the rims. Salinity of such fluids was estimated to be almost equivalent to the present-day sea water.

(4) The B- and Ca-rich fluids that infiltrated into the HHC caused vapor-fluxed melting of pelitic gneisses and produced tourmaline leucogranites.

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Figure captions

Fig. 1. (a) Simplified geological map of the Himalayas in eastern Nepal (after Catlos et al., 2001) showing the study area (red box). Area in pink - Tethys Himalayan Sequence (THS); area in yellow – High Himalayan Crystallines (HHC); area in green – Lesser Himalayan Sequences (LHS); area

in orange - Siwalik Group. Lines – South Tibetan Detachment (STD); Main Boundary Thrust (MBT) and Main Frontal Thrust (MFT). (b) Geological map of the Dhankuta area with metamorphic mineral assemblage observed in the LHS. Thin blue lines – rivers; thick black broken lines - boundaries of metamorphic zones; red line - MCT, area in yellow - HHC, area in green - LHS. Location of the MCT is after Sato et al. (in revision).

Fig. 2. Field photos of representative rock types from Dhankuta area. Pen as a scale. (a) Pelitic schist with quartz lenses showing top-to-the-S sense of shear from the LHS. (b) Metadolostone from the Ky zone of the LHS. Orange part is mainly composed of Dol + Bt and green part is mainly composed of Amp + Cal. Sample 104. (c) Pelitic migmatite with tourmaline-bearing (black crystal) leucosome from the HHC. (d) Pelitic migmatite with tourmaline-bearing leucocratic patch cutting the gneissosity from the HHC. (e) Ky-grade pelitic schist from the uppermost part of the LHS. Garnet and kyanite are coarser-grained in and around the quartz lenses. Sample 402-3. (f) Randomly-oriented, secondary margarite crystals (white) cutting the schistosity of pelitic schist in the LHS. An-rich plagioclase is commonly associated with margarite. Ky zone. (g) Tourmaline-quartz vein (indicated by red arrows) cutting the schistosity of chlorite-rich metapelite. Red box indicates sample 101. Ky zone. (h) Tourmalinization at the boundary between wall rock pelitic schist and a plagioclase-quartz vein. Red box indicates sample 107-1. Ky zone.

632

633 Fig. 3. (a) A BSE image of tourmaline cut parallel to the c-axis from the St zone pelitic schist (sample
634 908). Bright detrital core shows a xenomorphic outline. Preferential growth indicates that a top
635 corresponds to the +c pole. (b) A BSE image of An-rich plagioclase enclosing tourmaline. Sample
636 505A from the Ky zone. (c) Muscovite-rich matrix is surrounding garnet that is enclosing
637 tourmaline. Sample 109B from the boundary between the St and Ky zones. PPL. (d) Abundant
638 tourmaline in the Ms-rich matrix of the St zone pelitic schist. Sample 602. PPL. (e) X-ray elemental
639 map showing abundant tourmaline (light green) enclosed in garnet and present in the matrix (left
640 map) and bell-shaped Mn zoning of garnet indicative of its prograde growth (right map). Sample
641 602 from the St zone. (f) Tourmaline selectively replaces pre-existing biotite and staurolite, which
642 are oriented parallel to the schistosity, resulting in development of tourmaline-rich layers in the
643 wall rock of a plagioclase-quartz vein. Fractured parts of tourmaline are indicated by red arrows.
644 Sample 107-1 from the Ky zone. (g) A slab photo of sample 101 from the Ky zone hosting a
645 tourmaline-quartz vein (black). Note that pre-existing mafic minerals distributed in the vicinity of
646 the vein are selectively tourmalinized. (h) Enlargement of the boxed area (area 3) in Fig. 3g. The
647 vein is composed of quartz and green to blue tourmaline, and the schistosity of the host pelitic
648 schist is defined by the preferred orientation of chlorite that has replaced biotite. (i) Enlargement
649 of the boxed area (area 2) in Fig. 3g. Aggregates of greenish tourmaline have grown subparallel to

the schistosity, possibly replacing pre-existing staurolite and biotite. Schistosity is now mainly defined by the parallel orientation of chlorite. (j) Enlargement of the boxed area (area 1) in Fig. 3g. Greenish tourmaline surrounding and replacing staurolite oriented parallel to the schistosity. The schistosity is defined by the parallel orientation of chlorite and minor biotite. (k) Thin section photo of sample 402-3 from the Ky zone. (l) Thin section photo of sample 604 from Formation I showing the mode of occurrence of two types of garnet and matrix tourmaline. Euhedral plagioclase is included in elongate garnet. PPL. (m), (n) X-ray elemental maps of garnets shown in Fig. 3l. Note the difference of chemical zoning preserved in the round and elongate garnets. Euhedral plagioclase is included in elongate garnet that has the same chemical composition with another garnet grain enclosing tourmaline (top left). Sample 604. Lighter blue color indicates the higher X-ray intensity of a mapped element. (m) Ca map. (n) Mn map.

Fig. 4. *P-T* diagram showing the *P-T* estimates from the HHC (samples 604 and 201A shown by orange circles; Zr-in-Rt thermometry results) and from the LHS (samples 806, 908 and 402-3 shown by green circles) in the Dhankuta area. *P-T* grid and tourmaline-stable/unstable regions are from Dutrow and Henry (2011).

Fig. 5. Composition of tourmaline from the pelitic schists with less than 1 vol% tourmaline. X_{Mg} vs

X-site vacancy plot for samples (a) 407-1 from the Ky zone with 0.4 vol% tourmaline, (b) 3-807 from the Ky zone with 0.2 vol% tourmaline, (c) 908 from the St zone with 0.6 vol% tourmaline, (d) 605 from the Grt zone with 0.9 vol% tourmaline, and (e) 806 from the Grt zone with 0.8 vol% tourmaline. Blue arrows signify the chemical zoning trends observed from cores to rims, except for (e) signifying a zoning from mantles to rims. (f) Rim compositions of matrix tourmaline from the pelitic schists from the Ky, St and Grt zones. X_{Mg} vs X_{Ca} plot. (g) Rim and mantle compositions of tourmaline from the HHC.

Fig. 6 Composition of tourmaline from the veins associated with tourmalinization and pelitic schists with more than 1 vol% tourmaline (tourmaline-rich pelitic schists). X_{Mg} vs X_{Ca} plot for samples (a) 808-2 from the Ky zone with abundant tourmaline, (b) 107-1 from the Ky zone with abundant tourmaline, (c) 101 from the Ky zone with abundant tourmaline, (d) 505A from the Ky zone with 4.2 vol% tourmaline, (e) 109B from the boundary between the St and the Ky zones with 1.8 vol% tourmaline, (f) 602 from the St zone with 12.2 vol% tourmaline, (g) 803 from the Grt zone with 3.7 vol% tourmaline, and (h) 406B from the Formation I just above the MCT with 5.7 vol% tourmaline. Blue arrows signify the chemical zoning trends observed from cores to rims, except for (g) signifying a zoning from mantles to rims.

Fig. 7. Plot showing the relationship between X_{Ca} of rims of matrix tourmaline and average X_{Ca} of rims of coexisting matrix plagioclase except for sample 908. For sample 908, anorthite-rich cores and less calcic rims are both plotted in this figure in order to show that the rims rather than the cores are in equilibrium with matrix tourmaline rims.

Table 1. Summary of samples used in this study.

Table 2. Representative analyses of tourmaline. Tourmaline composition was normalized to 15 T+Z+Y cations (Henry and Dutrow, 1996; Henry et al., 2011), assuming three B atoms per formula unit. Full dataset is available as a supplementary material ([Table S1](#)).

Table 3. Representative analyses of rock-forming minerals other than tourmaline.

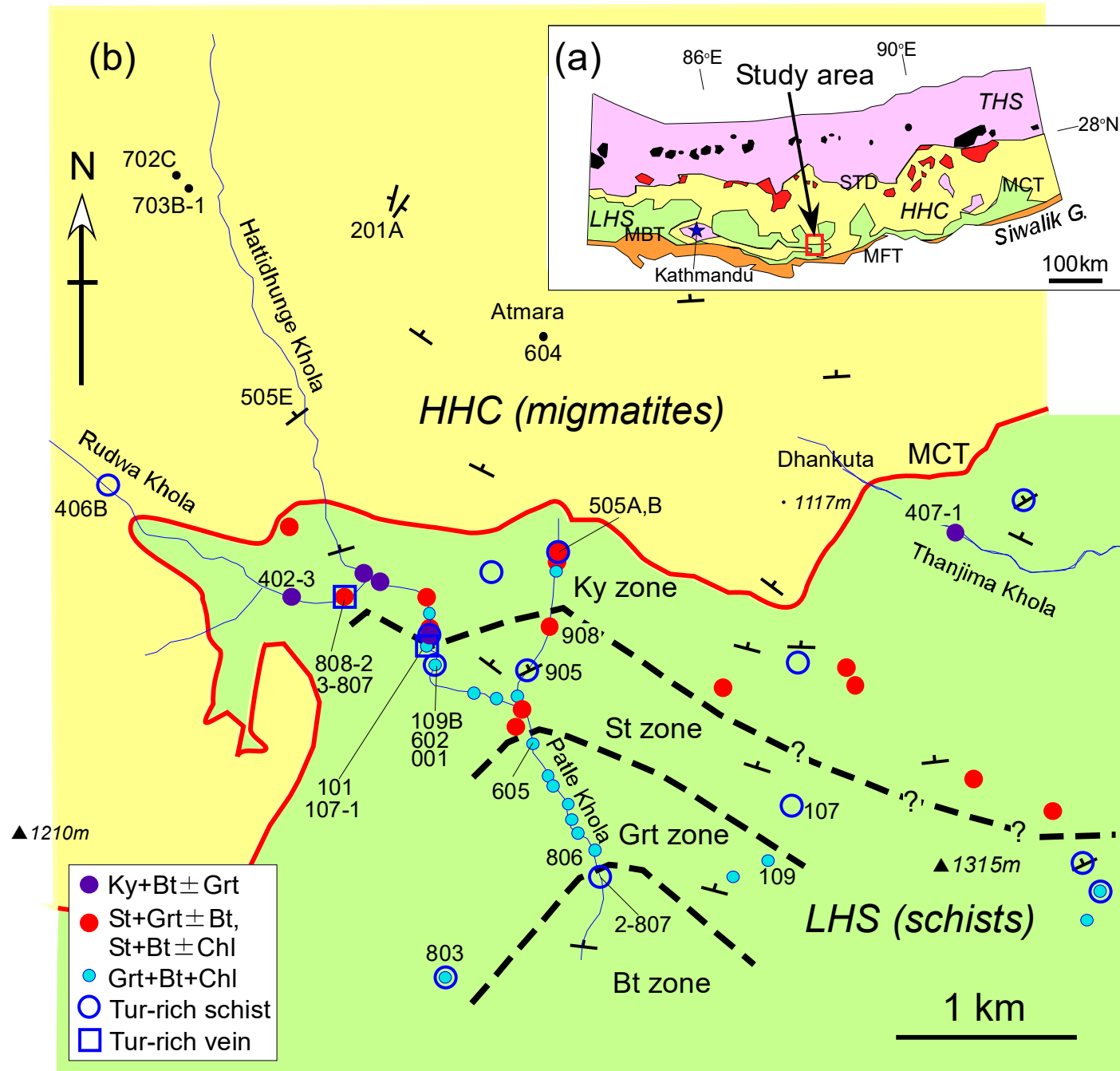
Electronic Supplementary Figures and Tables

Fig. S1 Composition of tourmaline from the pelitic schists with less than 1 vol% tourmaline. X_{Mg} vs X_{Ca} plot for samples (a) 407-1 from the Ky zone, (b) 3-807 from the Ky zone, (c) 908 from the St zone, (d) 605 from the Grt zone, and (e) 806 from the Grt zone. (f) Rim compositions of matrix tourmaline from the pelitic schists from the Ky, St and Grt zones. X_{Mg} vs X-site vacancy plot. Note

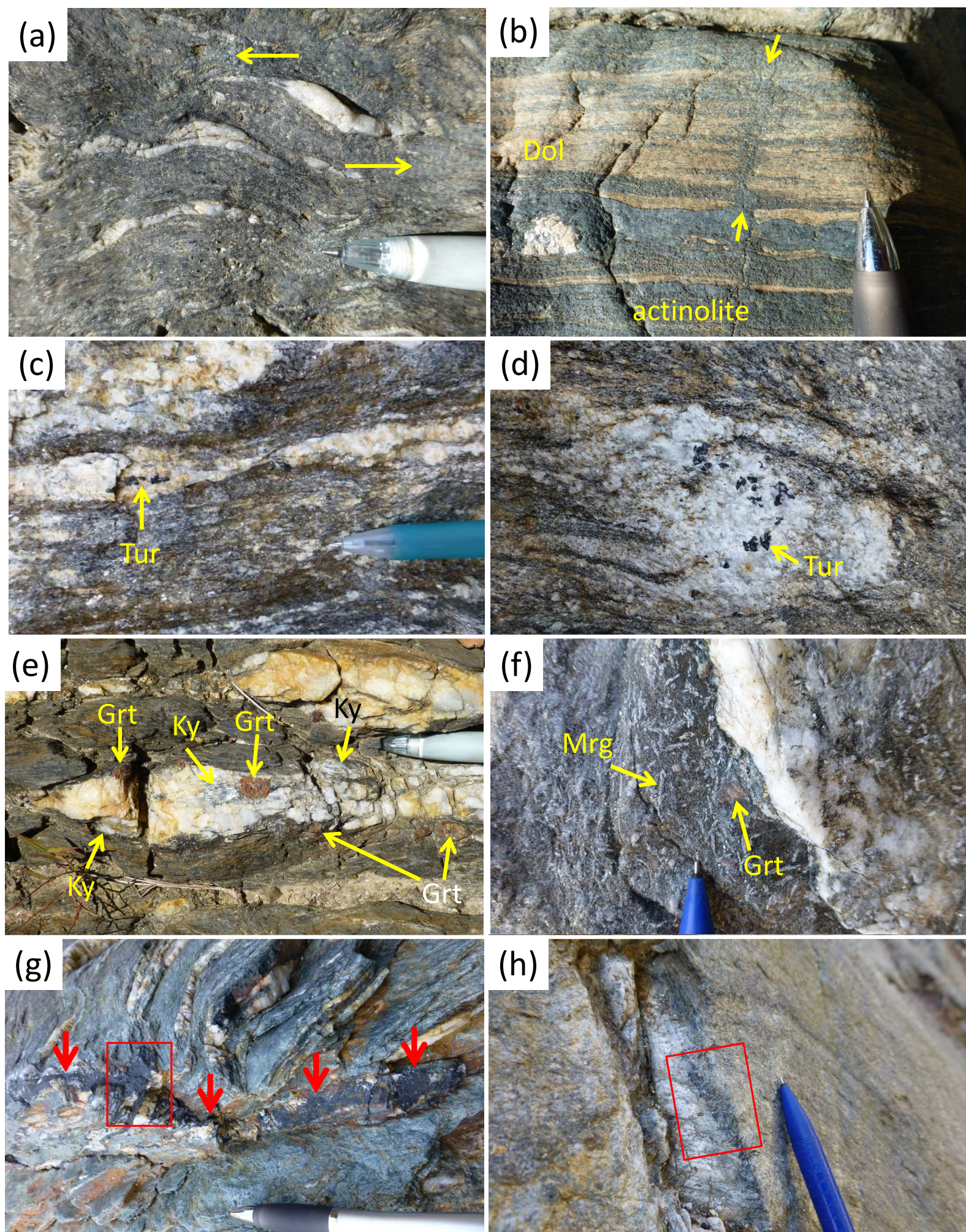
the progressive chemical change towards higher X_{Mg} and lower or almost constant X-site vacancy as an increase of metamorphic grade. (g) Rim and mantle compositions of tourmaline from the HHC.

Fig. S2 Composition of tourmaline from the veins associated with tourmalinization and pelitic schists with more than 1 vol% tourmaline (tourmaline-rich pelitic schists). X_{Mg} vs X-site vacancy plot for samples (a) 808-2 from the Ky zone, (b) 107-1 from the Ky zone, (c) 101 from the Ky zone, (d) 505A from the Ky zone, (e) 109B from the boundary between the St and the Ky zones, (f) 602 from the St zone, (g) 803 from the Grt zone, and (h) 406B from the Formation I just above the MCT.

Table S1. Full dataset of tourmaline analyses used in this study. Tourmaline composition was normalized to 15 T+Z+Y cations (Henry and Dutrow, 1996; Henry et al., 2011), assuming three B atoms per formula unit.



Kawakami et al. Fig. 1



Kawakami et al. Fig. 2

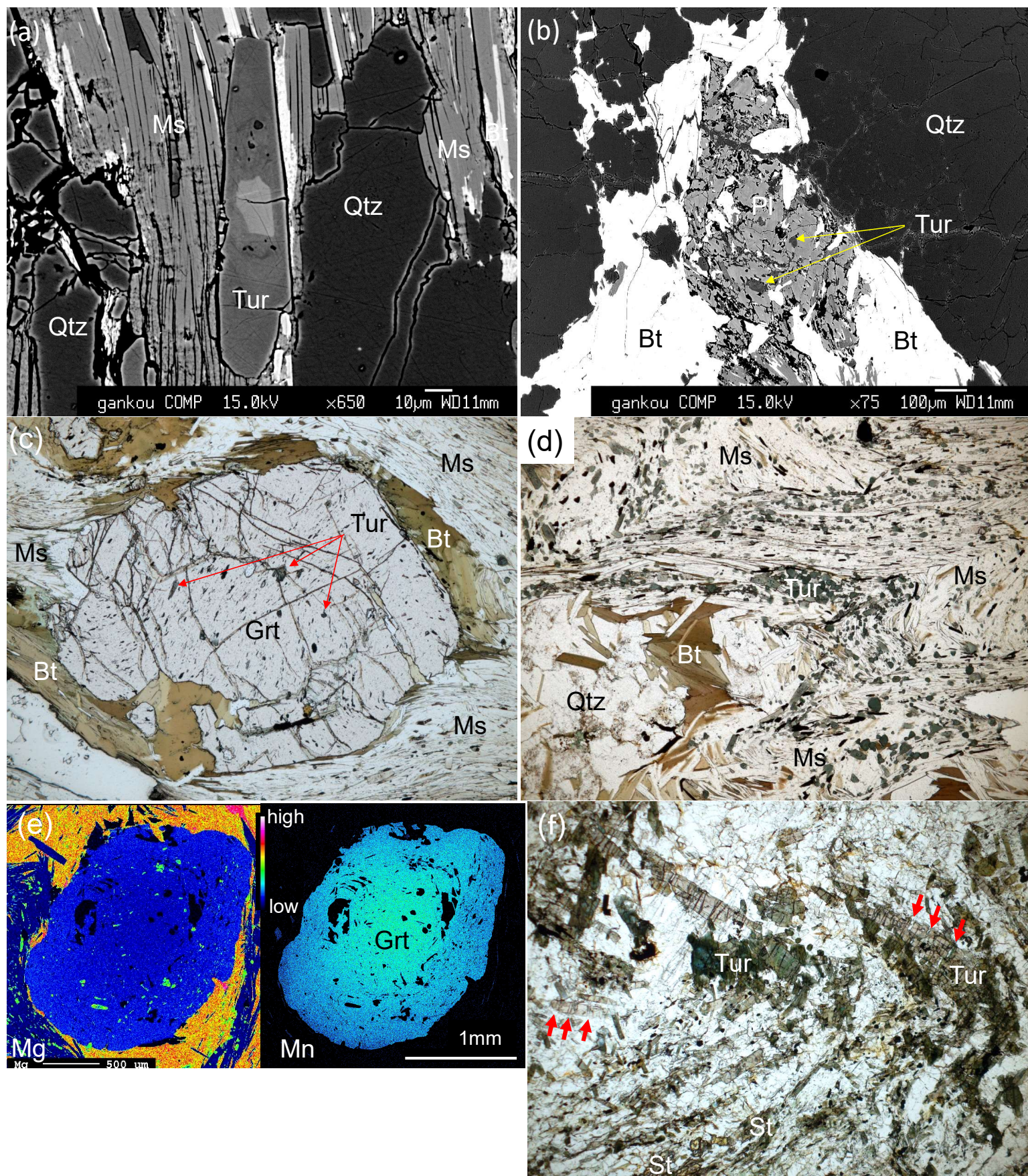


Fig. 3 Kawakami et al.

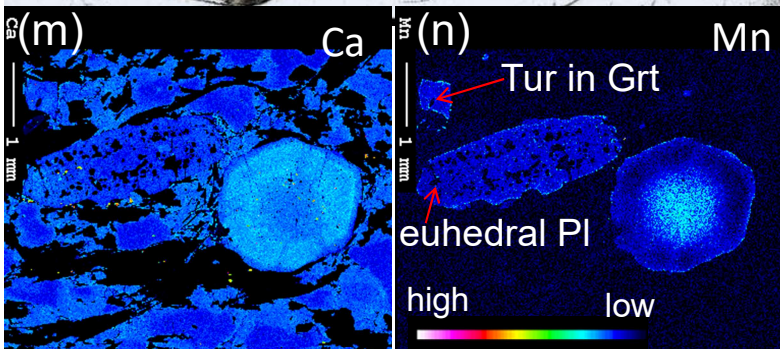
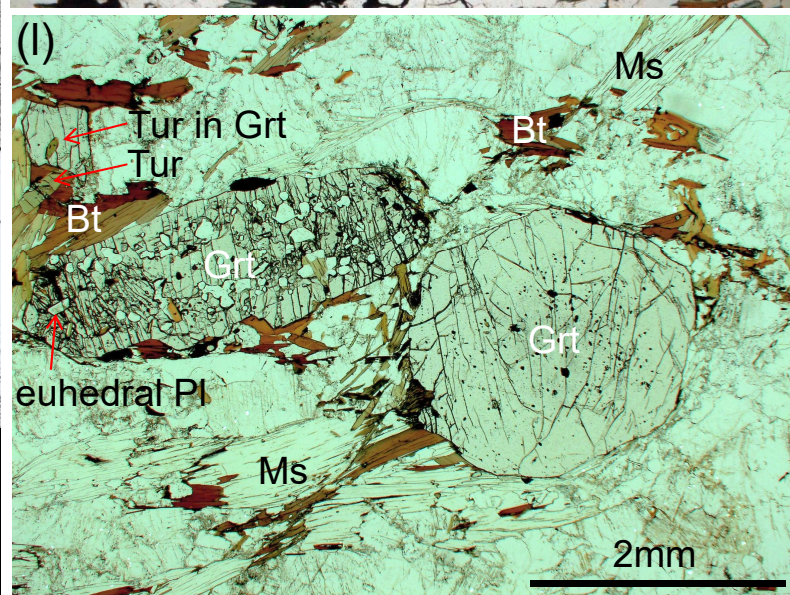
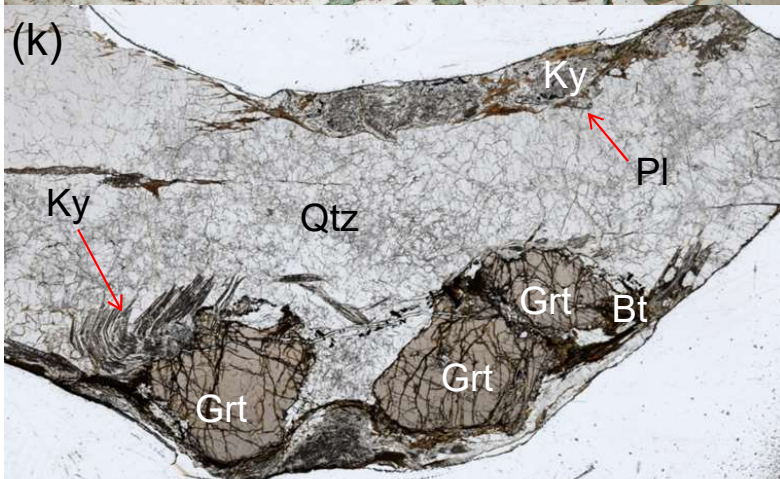
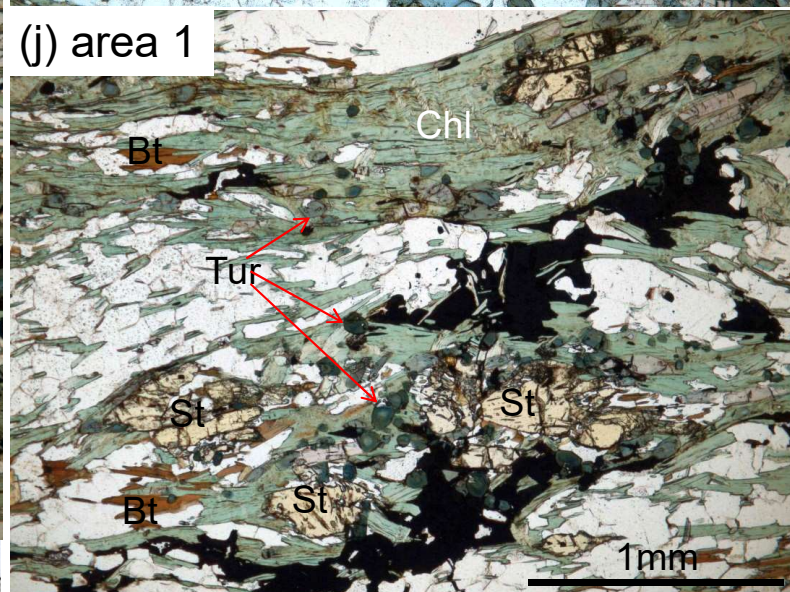
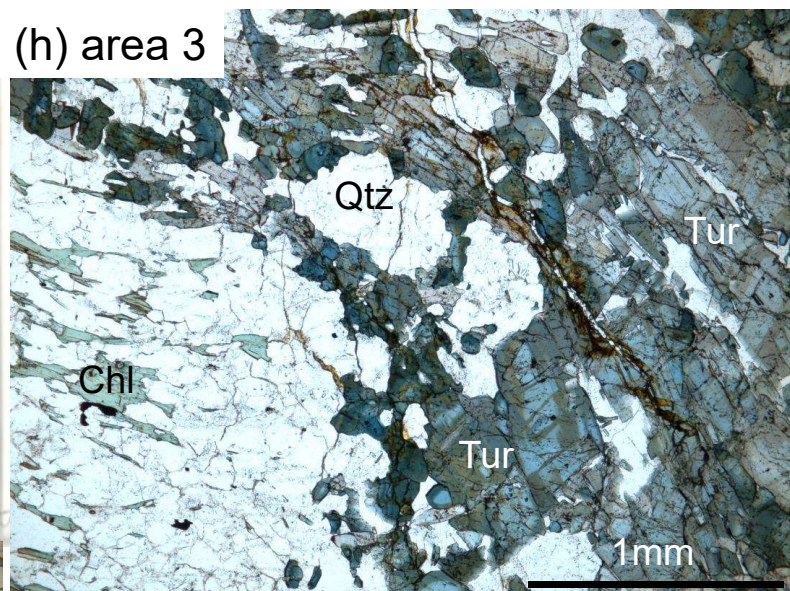
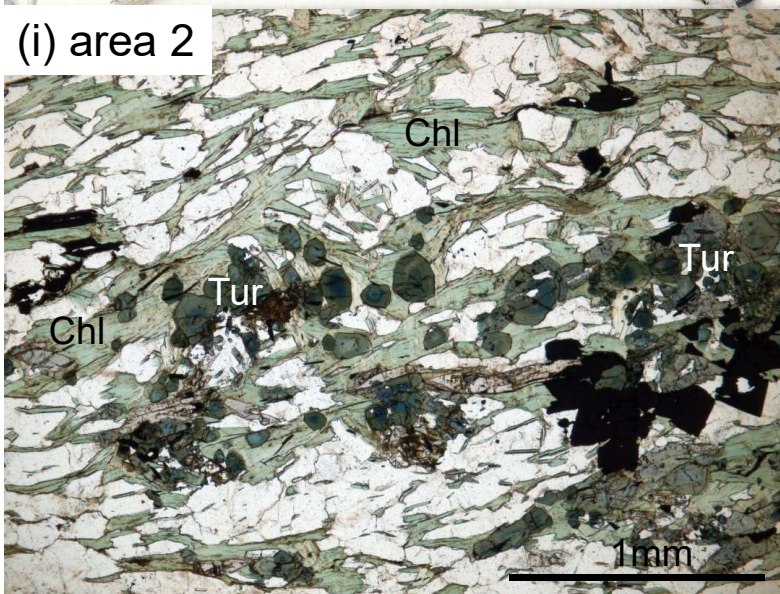
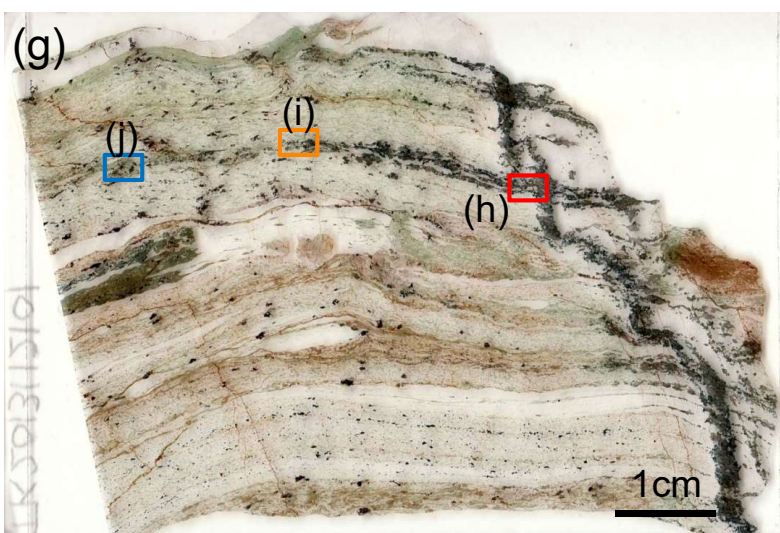
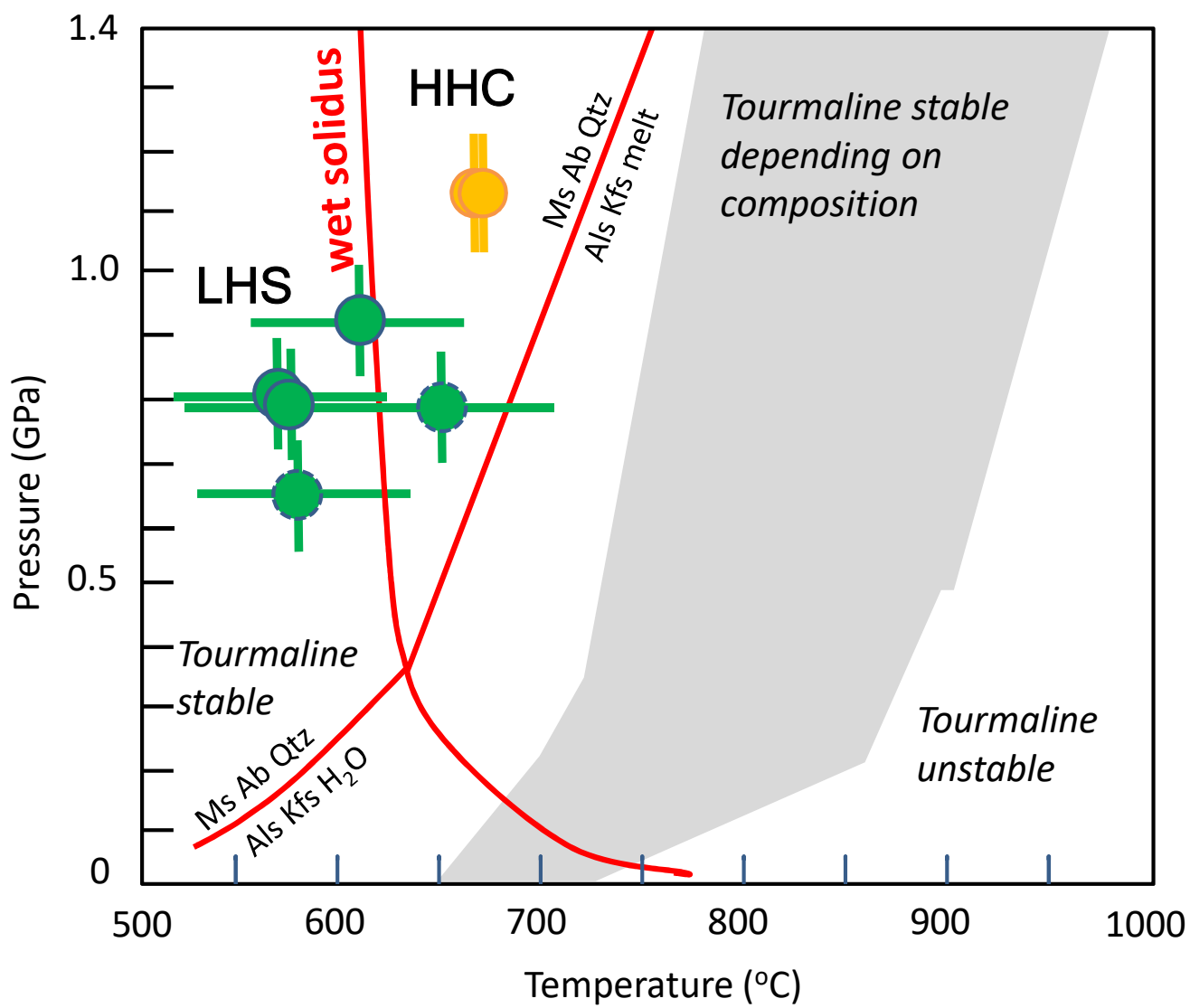
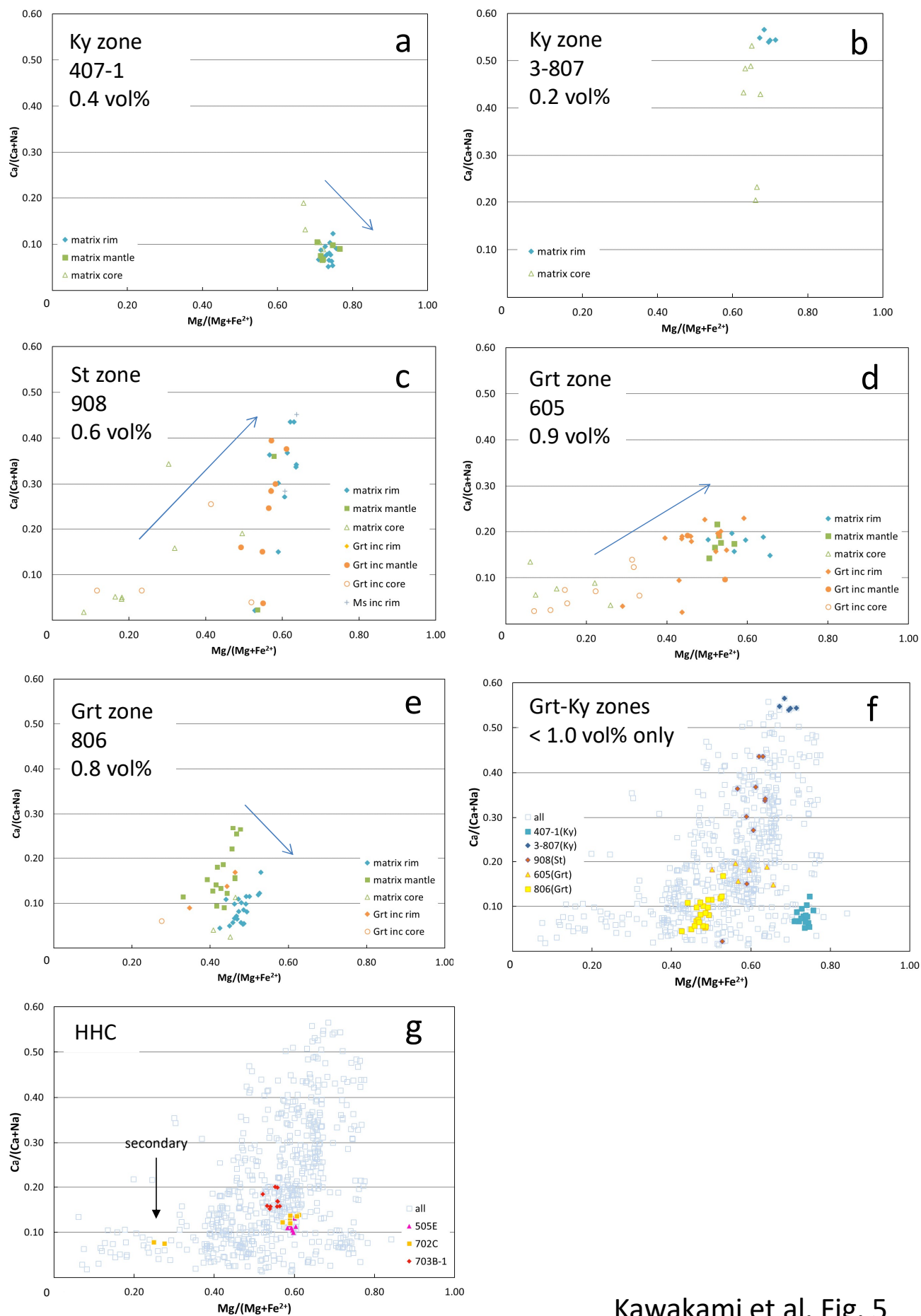


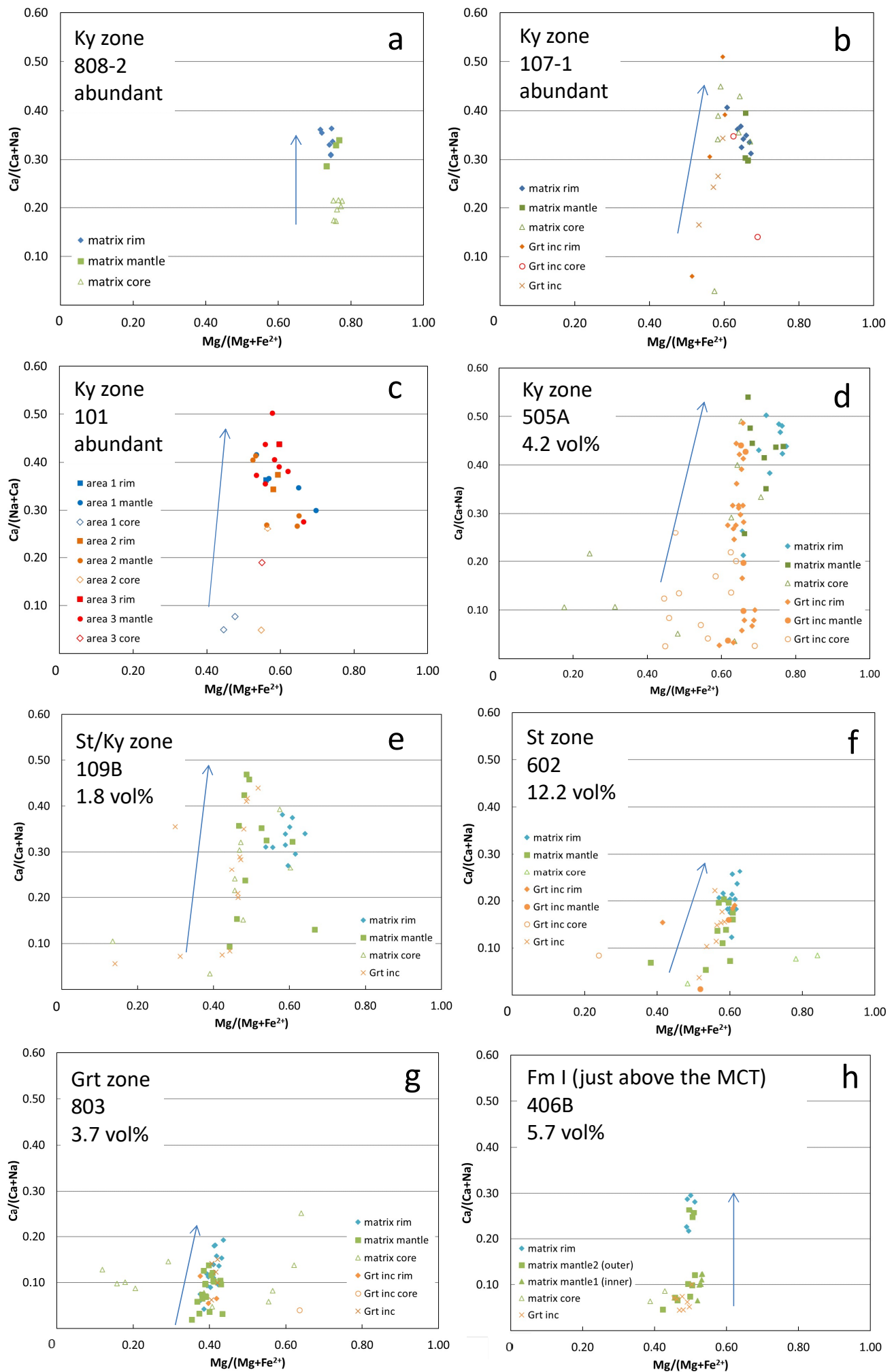
Fig. 3 continued Kawakami et al.



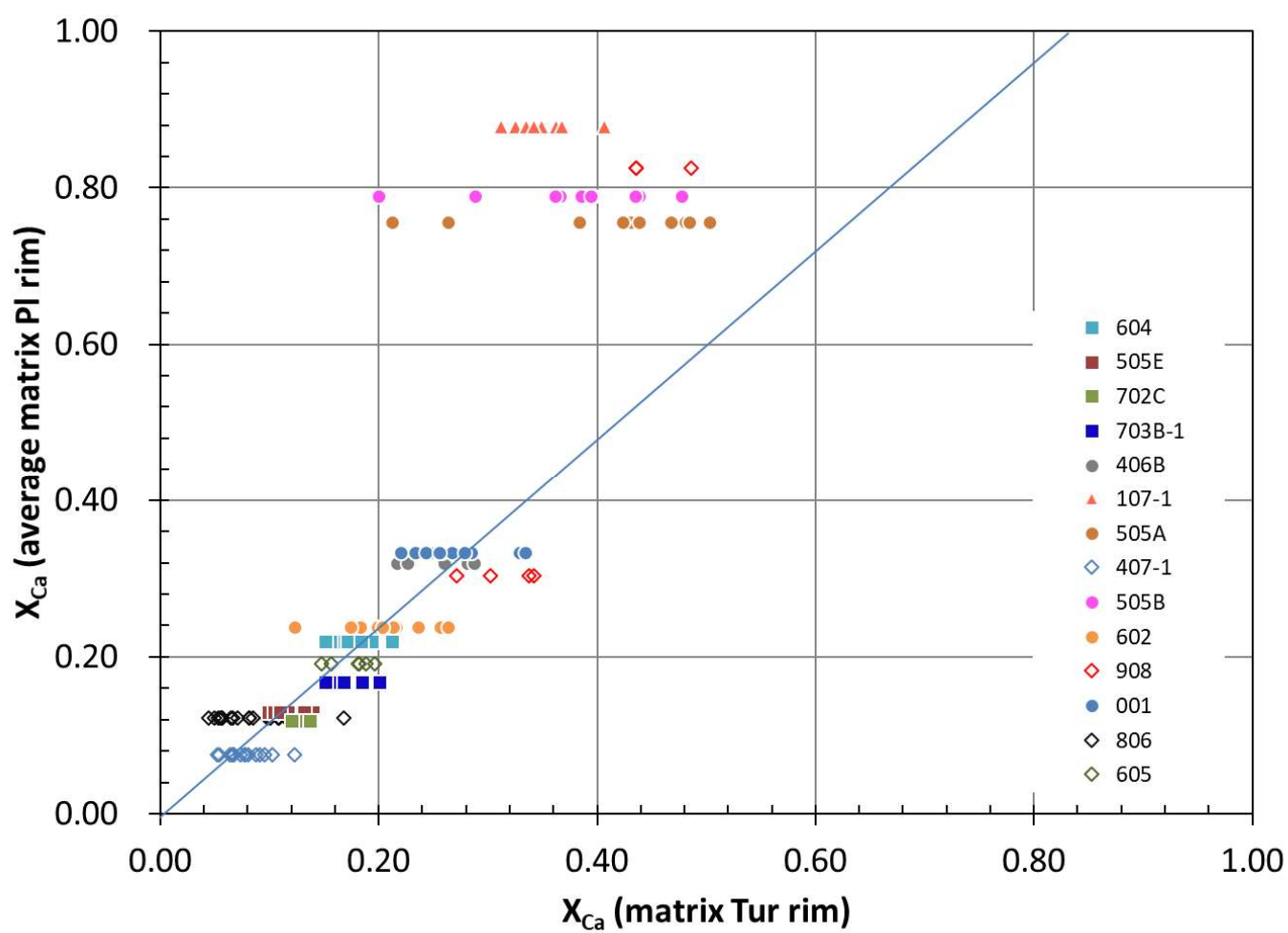
Kawakami et al. Fig. 4



Kawakami et al. Fig. 5



Kawakami et al. Fig. 6



Kawakami et al. Fig. 7

Table 1

Sample number	metamorphic zone/unit	lithology	Modal amount of Tur (vol%)	Major mineral assemblage in matrix [+secondary]	accessory minerals	EPMA analysis	Matrix Tur rim (apfu)**		Fluid (mol/l)***		comments	sample locality		original sample number
							Na	Ca	Na	Ca		Latitude	Longitude	
505E	FmI	pelitic gneiss	n.d.	Grt+Bt+Ms+Tur+Pl(An9-15)+Kfs+Qtz [+Chl]	Ap+Ilm+Rt+Tn+Zrn	○	0.74-0.78	0.08-0.12	(0.46)	(0.05-0.07)	partial melting	26°58'32.07"N	87°19'2.01"E	TK2013111505E
702C	FmI	pelitic gneiss	n.d.	Grt+Bt+Ms+Tur+Pl(An4-16)+Kfs+Qtz [+Chl]	Ap+Gr+Ilm+Zrn	○	0.71-0.77	0.10-0.12	(0.46)	(0.06-0.07)	partial melting	26°59'11.58"N	87°18'40.20"E	TK2013111702C
604	FmI	pelitic gneiss	n.d.	Grt+Bt+Ms+Sil+Tur+Pl(An22)+Kfs+Qtz	Ap+Ep+Ilm+Mnz+Rt+Zrn	○	0.45-0.59	0.07-0.16	(0.42-0.46)	(0.04-0.06)	partial melting	26°58'44.67"N	87°19'51.92"E	TK2013111604
703B-1	FmI	pelitic gneiss	n.d.	Grt+Bt+Ms+Tur+Pl(An16)+Kfs+Qtz	Gr+Mnz+Zrn	○	0.67-0.72	0.13-0.17	(0.46-0.47)	(0.07-0.09)	partial melting	26°59'7.54"N	87°18'44.20"E	TK2013111703B-1
201A	FmI	pelitic gneiss	n.d.	Grt+Bt+Ms+Sil+Tur+Pl(An13-18)+Kfs+Qtz	Ap+Ccp+Ep+Gr+Ilm+Mnz+Py+Rt+Zrn	○	0.66-0.68	0.13-0.14	(0.47)	(0.07)	partial melting. Tur is minor.	26°59'9.91"N	87°19'25.97"E	TK2012111201A
406B	MCT	Tur-rich pelitic gneiss	5.7	Grt+Bt+Ms+Tur+Pl(An31-32)+Kfs+Qtz	Ap+Ep+Ilm+Zrn	○	0.60-0.71	0.18-0.26	0.46	0.10-0.13	Just above the MCT. FmI origin?	26°58'19.84"N	87°18'23.26"E	TK2013111406B
808-2	Ky	vein + tourmalinized wall rock	abundant	vein: Tur+Qtz, wall rock: Bt+Ky+St+Ms+Tur+Qtz [+Chl]	Ap+Ep+Ilm+Py+Zrn	○	0.45-0.50	0.21-0.27	0.42-0.44	0.11-0.14		26°57'58.54"N	87°19'13.09"E	TK2013111808-2
107-1	Ky	vein + tourmalinized wall rock	abundant	vein: Pl(An88)+Qtz+Ms+Chl+Tur, wall rock: Grt+St+Bt+Ms+Qtz+Tur	Ap+Ilm+Py+Zrn	○	0.34-0.39	0.18-0.23	(0.35-0.39)	(0.10-0.12)	Disequilibrium between Tur and Pl.	26°57'54.22"N	87°19'28.49"E	TK2013112107-1
101	Ky	vein + tourmalinized wall rock	abundant	vein: Tur+Qtz (area3), wall rock: Chl+Tur+Qtz±Grt (area2), Tur+Chl+Qtz+Bt+St±Grt (area1)	Ap+Ccp+Ilm+Py+Zrn	○	(3)0.32-0.57 (2)0.42-0.59 (1)0.44-0.56	(3)0.22-0.32 (2)0.20-0.29 (1)0.24-0.32	(3)0.34-0.46 (2)0.40-0.46 (1)0.41-0.45	(3)0.11-0.16 (2)0.11-0.15 (1)0.12-0.15	(3) to (1) represent zone numbers.	26°57'55.71"N	87°19'28.92"E	TK2013112101
505A	Ky	Tur-rich pelitic schist with Qtz lens	4.2	Grt+Ky+Ms+Bt+Pl(An69-80)+Qtz+Tur	Ap+Ep+Ilm+Py+Rt+Tn+Zrn	○	0.37-0.57	0.15-0.38	(0.37-0.46)	(0.08-0.18)	Disequilibrium between Tur and Pl.	26°58'5.07"N	87°19'54.44"E	TK2012111505A
505B	Ky	Tur-rich pelitic schist near Qtz lens	1.7	Grt+Bt+Ms+Pl(An74-84)+Tur+Qtz	Ap+Ep+Gr+Ilm+Py+Rt+Zrn	○	0.36-0.65	0.16-0.37	(0.36-0.47)	(0.09-0.18)	Disequilibrium between Tur and Pl.	26°58'5.07"N	87°19'54.44"E	TK2012111505B
407-1	Ky	pelitic schist	0.4	Bt+St+Ky+Ms(Paragonite)+Chl+Pl(An6-9)+Qtz	Ap+Py+Rt+Tur+Zrn	○	0.66-0.77	0.04-0.10	0.46-0.47	0.02-0.06		26°58'8.50"N	87°21'17.64"E	TK2012111407-1
3-807	Ky	pelitic schist	0.2	St+Ky+Bt+Ms+Chl+Qtz	Ap+Ep+Rt+Tur+Zrn (+Ilm in St)	○	0.30-0.34	0.26-0.27	0.29-0.30	0.15-0.16		26°57'58.54"N	87°19'13.09"E	TK2013111807
402-3	Ky	pelitic schist with Qtz lens	0	Grt+Ky+Bt+Pl(An19-22)+Qtz [+Ms+Chl]	Ap+Gr+Ilm+Zrn	○	—	—	—	—	Tur absent.	26°57'57.79"N	87°19'1.88"E	TK2013111402-3
104	Ky	intercalation of Dol-rich rock and Act-schist	0	orange part: Dol + Bt greenish-part: Act + Cal	Py+Zrn	○	—	—	—	—	Tur absent.	26°57'55.71"N	87°19'28.92"E	TK2013112104
109B	St/Ky*	Tur-rich pelitic schist with Qtz lens	1.8	Grt+Ms+Bt+Qtz+Tur	Ap+Ccp+Ilm+Py+Tn+Zrn	○	0.39-0.57	0.18-0.26	0.38-0.46	0.10-0.13	Pl absent.	26°57'50.49"N	87°19'27.53"E	TK2013112109B
602	St	Tur-rich pelitic schist	12.2	Grt+Ms+Bt+Pl(An21-27)+Qtz+Tur [+Chl]	Ap+Ccp+Ep+Ilm+Py+Zrn	○	0.59-0.73	0.10-0.23	0.46-0.47	0.06-0.12		26°57'47.38"N	87°19'31.22"E	TK2012111602
908	St	pelitic schist	0.6	Grt+Bt+Ms+Chl+An+St+Qtz+Pl(An80-85 is replaced by An25-39. An7-11 occurs enclosed in Bt flakes in matrix)	Ap+Ep+Ilm+Tur+Zrn	○	0.63, 0.41-0.51	0.01-0.11, 0.16-0.32	0.40-0.47	0.01-0.16	St also occurs as an inclusion in Grt. All Tur compositions are used for the calculation of fluid composition.	26°57'53.20"N	87°19'53.64"E	TK2012111908
001	St	Tur-rich pelitic schist	9.36	Grt+Bt+Ms+Chl+Tur+Pl(An30-36)+Qtz	Ap+Ep+Ilm+Zrn	○	0.49-0.60	0.16-0.26	0.43-0.46	0.09-0.13		26°57'50.49"N	87°19'27.53"E	TK2012112001
107	St	Tur-rich pelitic schist	2.25	Bt+Ms+Cal+Tur+Qtz	Ap+Cal+Ep+Gr+Ilm+Rt+Tn+Zrn	×	n.d.	n.d.	n.d.	n.d.		26°57'22.53"N	87°20'40.41"E	TK2012112107
905	St	Tur-rich pelitic schist	7.85	Bt+Ms+Tur+Qtz	Ap+Ep+Ilm+Py+Tn+Zrn	×	n.d.	n.d.	n.d.	n.d.		26°57'45.29"N	87°19'48.84"E	TK2012111905
605	Grt	pelitic schist	0.9	Grt+Bt+Ms+Chl+Pl(An18-20)+Qtz	Ap+Ccp+Ilm+Py+Tur+Zrn	○	0.55-0.62	0.06-0.08	0.45-0.46	0.06-0.08		26°57'32.44"N	87°19'48.24"E	TK2012111605
806	Grt	pelitic schist	0.8	Grt+Bt+Ms+Chl+Pl(An6-16)+Qtz	Ap+Ep+Ilm+Tur+Zrn	○	0.54-0.75	0.03-0.11	0.45-0.47	0.02-0.06		26°57'13.22"N	87°20'0.93"E	TK2012111806
803	Grt	Tur-rich pelitic schist with Qtz lens	3.7	Grt+Bt+Ms+Chl+Tur+Qtz	Ap+Ep+Ilm+Zrn	○	0.46-0.73	0.03-0.13	0.42-0.46	0.02-0.07	Tur included in Grt. Pl absent.	26°56'46.96"N	87°19'30.42"E	TK2013111803
109	Grt	pelitic schist	0.86	Grt+Bt+Ms+Chl+Qtz	Ap+Ep+Ilm+Py+Tur+Zrn	×	n.d.	n.d.	n.d.	n.d.		26°57'11.12"N	87°20'36.89"E	TK2012112109
2-807	Bt	Tur-rich pelitic schist	1.07	Bt+Chl+Ms+Tur+Qtz	Ap+Ep+Gr+Ilm+Tn+Zrn	×	n.d.	n.d.	n.d.	n.d.	Pl absent.	26°57'7.94"N	87°20'3.65"E	TK2012111807

n.d. : not determined ** Mantle and rim compositions are given for sample 101.

*** Calculated based on expressions $\text{Na}_{\text{fluid}}(\text{mol/l}) = 1.39\text{X}_{\text{Na}} - 1.04\text{X}_{\text{Na}}^2$, and $\text{Ca}_{\text{fluid}}(\text{mol/l}) = 0.60\text{X}_{\text{Ca}} - 0.35\text{X}_{\text{Ca}}^2$ constructed from experimental data for intermediate Na-Ca tourmalines at 600°C of von Goerne et al. (2011). Data for samples 505A, 505B, 107-1 and Formation I samples in parentheses are only for reference. See text for details.

Table 2. Representative analyses of tourmaline

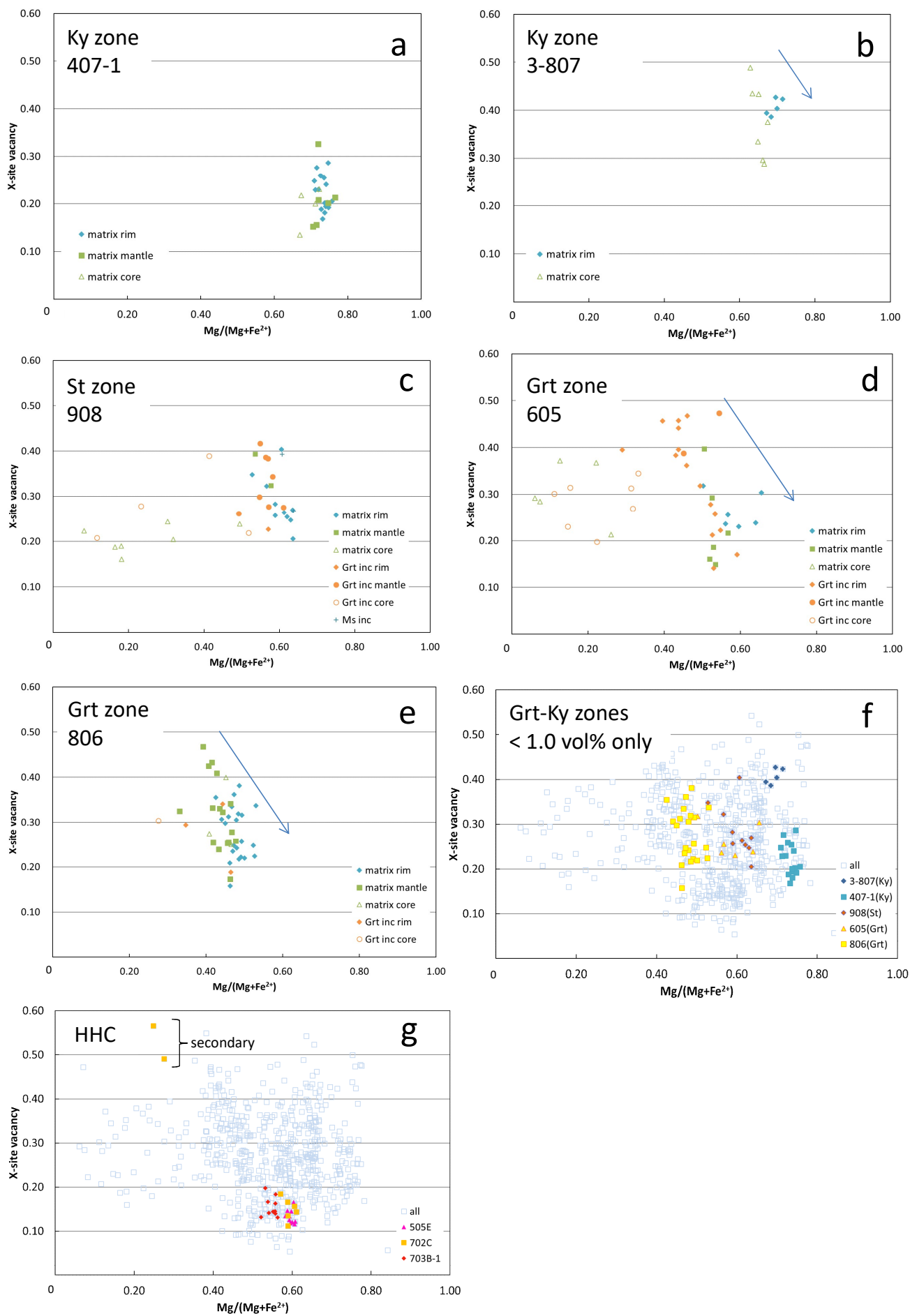
Metamorphic zone	migmatite		tourmaline-poor pelitic schist					tourmaline-rich pelitic schist					tourmaline-rich wall rock/vein		
	Fml	Fml	Ky	Ky	St	Grt	Grt	Ky	St/Ky	St	St	Grt	Ky	Ky	Ky
	Sample name	Sample name	407-1	3-807	908	605	806	505B	109B	602	001	803	808-2	107-1	101
Analysis number	t65	604-38	tur5	807-64	tur2	4	68	59	9B-8	tur1	40	604-55	t6	tur/mica87	136
core/mantle/rim	matrix rim	matrix rim	matrix rim	matrix rim	matrix rim	matrix rim	matrix -c rim	matrix rim	matrix -c rim	matrix rim	matrix rim	matrix +c rim	matrix rim	matrix rim	area3 rim
SiO ₂	36.08	35.99	37.15	36.24	35.89	36.54	36.89	37.42	36.25	36.13	36.39	35.86	36.85	36.20	36.14
TiO ₂	0.56	0.82	0.69	0.50	0.53	0.49	0.33	0.78	0.61	0.55	0.50	0.98	1.02	0.69	0.47
B ₂ O ₃ *	10.38	10.45	10.67	10.52	10.44	10.54	10.49	10.51	10.52	10.43	10.51	10.49	10.57	10.59	10.48
Al ₂ O ₃	32.06	32.89	32.48	33.01	31.54	33.39	32.62	30.89	32.54	30.87	31.94	32.74	32.02	33.34	32.81
Cr ₂ O ₃	0.06	0.03	0.07	0.08	0.01	0.00	0.02	0.05	0.06	0.03	0.09	0.01	0.08	0.00	0.02
Fe ₂ O ₃ *	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FeO	8.18	9.45	5.37	5.75	7.69	6.06	8.41	6.40	7.52	8.18	6.68	11.01	5.37	7.20	7.35
MnO	0.03	0.08	0.03	0.00	0.00	0.02	0.00	0.06	0.09	0.00	0.02	0.06	0.00	0.02	0.01
MgO	5.66	4.58	7.78	6.98	6.82	6.48	5.31	7.31	6.24	6.86	7.14	4.07	7.59	6.26	6.12
CaO	0.95	0.56	0.29	1.91	1.49	0.58	0.62	0.92	1.04	0.84	1.45	0.40	1.54	1.33	1.57
BaO	0.11	0.00	0.00	0.06	0.00	0.00	0.08	0.50	0.06	0.17	0.00	0.00	0.17	0.00	0.00
Na ₂ O	2.08	1.69	2.27	0.81	1.41	1.85	1.69	2.05	1.55	2.07	1.64	1.72	1.50	1.07	1.11
K ₂ O	0.05	0.03	0.02	0.07	0.07	0.01	0.06	0.05	0.03	0.04	0.02	0.07	0.03	0.02	0.00
F	0.09	0.11	0.00	0.08	0.03	0.16	0.17	0.22	0.02	0.10	0.09	0.08	0.09	0.10	0.01
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00
H ₂ O*	3.54	3.55	3.68	3.59	3.58	3.56	3.54	3.52	3.61	3.55	3.58	3.58	3.60	3.60	3.61
-O≡F, Cl	0.04	0.05	0.00	0.03	0.01	0.07	0.07	0.09	0.01	0.04	0.04	0.04	0.04	0.04	0.01
Total	99.8	100.2	100.5	99.6	99.5	99.6	100.2	100.6	100.1	99.8	100.0	101.0	100.4	100.4	99.7
formula															
T site															
Si	6.04	5.99	6.05	5.99	5.98	6.02	6.11	6.19	5.99	6.02	6.02	5.94	6.06	5.94	5.99
Al(IV)	0.00	0.01	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.06	0.00	0.06	0.01
Z site															
Al(Z)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Fe ³⁺	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Y site															
Al(Y)	0.32	0.43	0.23	0.41	0.17	0.49	0.37	0.02	0.33	0.06	0.22	0.34	0.21	0.39	0.41
Cr	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00
Ti	0.07	0.10	0.08	0.06	0.07	0.06	0.04	0.10	0.08	0.07	0.06	0.12	0.13	0.09	0.06
Fe ²⁺	1.14	1.31	0.73	0.79	1.07	0.84	1.17	0.88	1.04	1.14	0.92	1.53	0.74	0.99	1.02
Mg	1.41	1.13	1.89	1.72	1.69	1.59	1.31	1.80	1.54	1.70	1.76	1.01	1.86	1.53	1.51
Mn	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00
Y-site total	2.96	3.00	2.95	3.00	3.00	2.98	2.89	2.81	3.00	2.97	2.98	3.00	2.93	3.00	3.00
X site															
Ca	0.17	0.10	0.05	0.34	0.27	0.10	0.11	0.16	0.18	0.15	0.26	0.07	0.27	0.23	0.28
Na	0.68	0.54	0.72	0.26	0.46	0.59	0.54	0.66	0.50	0.67	0.53	0.55	0.48	0.34	0.36
K	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00
Ba	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.00	0.01	0.00	0.00
vacancy	0.14	0.35	0.23	0.38	0.26	0.30	0.33	0.14	0.31	0.16	0.21	0.36	0.24	0.42	0.36
V, W sites															
F	0.04	0.06	0.00	0.04	0.02	0.08	0.09	0.11	0.01	0.05	0.05	0.04	0.05	0.05	0.01
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
OH	3.96	3.94	4.00	3.96	3.98	3.92	3.91	3.89	3.99	3.95	3.95	3.96	3.95	3.95	3.99
Mg/(Mg+Fe ²⁺)	0.55	0.46	0.72	0.68	0.61	0.66	0.53	0.67	0.60	0.60	0.66	0.40	0.72	0.61	0.60

* Calculated based on stoichiometric constraints.

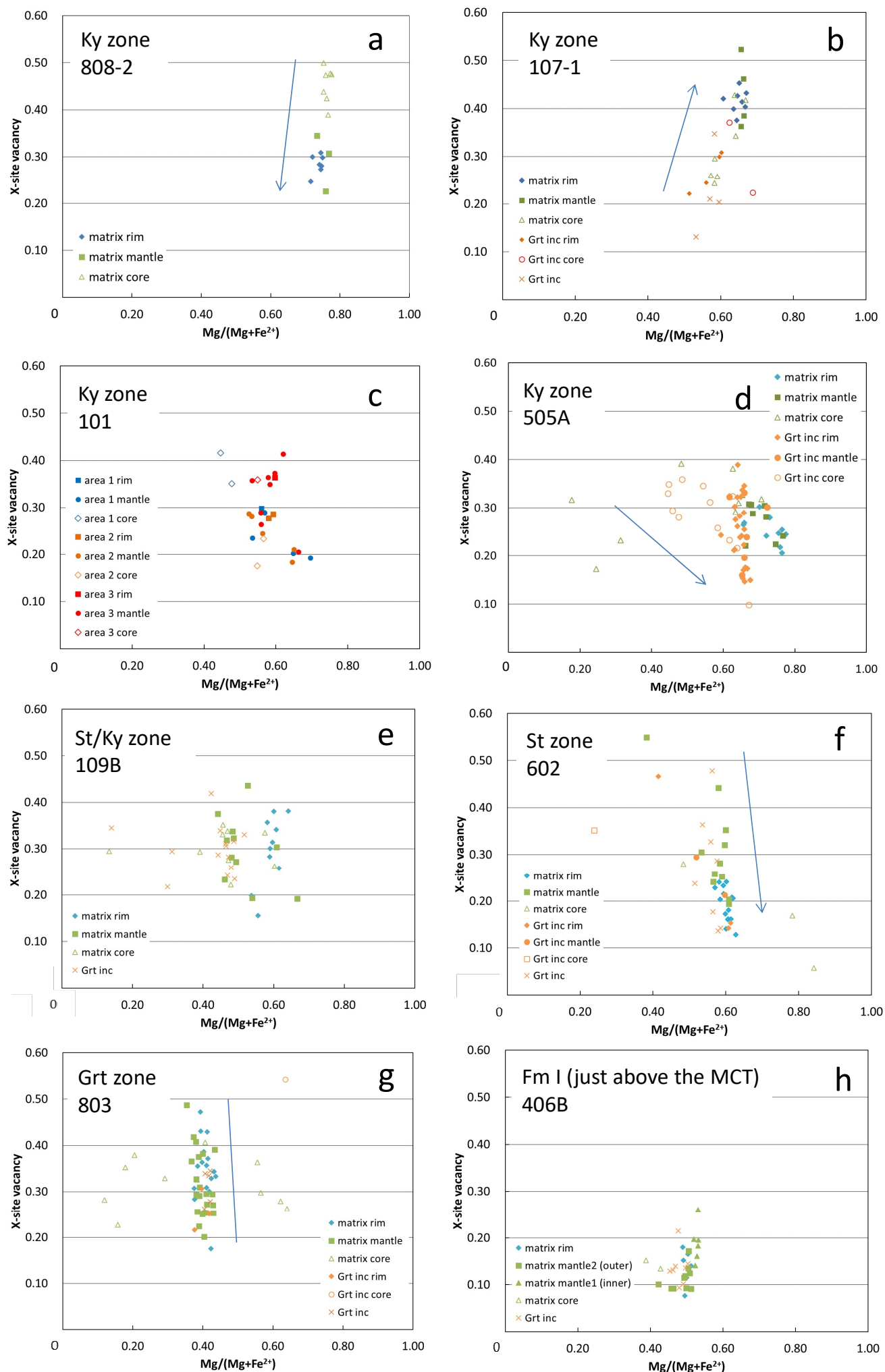
Table 3. Representative analyses of minerals other than tourmaline

Sample name	604 (Formation I)				402-3 (Ky zone)				908 (St zone)						605 (Grt zone)			
Mineral	Grt	Bt	Ms	Pl	Grt	Bt	Pl	Ms	Grt	St	Bt	Ms	Pl	Pl	Grt	Bt	Ms	Pl
Occurrence	matrix	matrix	matrix	matrix	matrix	matrix	matrix	secondary	matrix	inclusion in Grt rim	matrix	matrix	replaced by An- poor Pl	replacing An-rich Pl	matrix	matrix	matrix	matrix
core/mantle/rim	rim			rim	rim				rim				core	rim	rim			
analysis number	604-3	604-5	604-6	604-44	line100	tur/mica3	110	tur/mica15	44	42	34	25	32	39	line1	37	13	12
SiO ₂	37.95	36.87	48.02	63.61	38.45	37.65	62.91	47.81	38.00	28.53	37.07	46.68	47.23	59.26	37.41	35.43	46.86	63.80
TiO ₂	b.d.	2.61	1.41	b.d.	b.d.	2.08	0.08	0.82	0.11	0.66	1.38	0.26	b.d.	b.d.	0.08	1.61	0.31	b.d.
Al ₂ O ₃	22.00	19.07	31.58	23.06	21.48	18.65	22.65	34.44	21.57	53.49	18.31	33.54	34.16	25.35	21.39	18.28	35.60	22.43
Cr ₂ O ₃	0.01	b.d.	0.02	0.02	0.06	0.07	b.d.	0.01	0.03	0.03	b.d.	b.d.	n.d.	n.d.	0.01	b.d.	0.05	b.d.
FeO	33.72	20.21	1.90	b.d.	32.90	15.00	0.13	1.35	25.87	13.24	19.34	2.94	0.11	0.04	35.53	20.07	0.96	b.d.
MnO	0.64	b.d.	b.d.	0.01	1.12	0.06	b.d.	0.02	8.03	0.27	0.16	0.02	b.d.	0.03	0.13	b.d.	0.04	b.d.
MgO	3.10	7.93	1.48	b.d.	4.16	11.51	b.d.	1.14	2.62	2.22	10.00	0.98	0.01	b.d.	2.54	9.79	0.54	0.03
CaO	4.32	b.d.	b.d.	4.46	3.48	0.02	4.51	0.04	4.63	0.03	0.05	0.02	17.18	7.26	3.42	0.02	0.03	4.08
BaO	b.d.	0.13	0.17	0.06	b.d.	0.50	b.d.	0.23	0.21	b.d.	0.44	0.40	b.d.	b.d.	b.d.	0.06	0.00	0.17
Na ₂ O	0.03	0.22	0.66	8.76	0.09	0.23	9.18	0.91	0.04	0.02	0.09	0.70	1.65	7.80	0.03	0.19	1.71	9.42
K ₂ O	b.d.	8.76	9.71	0.11	b.d.	7.47	0.14	7.83	0.01	b.d.	8.34	8.59	0.05	0.10	0.01	8.65	6.95	0.05
F	b.d.	0.04	0.11	n.d.	n.d.	0.27	n.d.	0.06	b.d.	b.d.	0.19	0.07	n.d.	n.d.	n.d.	0.18	0.08	n.d.
Cl	b.d.	0.01	b.d.	n.d.	n.d.	0.04	n.d.	b.d.	0.01	b.d.	0.02	b.d.	n.d.	n.d.	n.d.	0.04	b.d.	n.d.
-O≡F	0.00	0.02	0.05			0.11		0.02	0.00	0.00	0.08	0.03				0.08	0.03	
-O≡Cl	0.00	0.00	0.00			0.01		0.00	0.00	0.00	0.00	0.00				0.01	0.00	
Total	101.76	95.82	95.01	100.10	101.73	93.42	99.60	94.62	101.12	98.48	95.32	94.18	100.39	99.84	100.54	94.23	93.09	99.98
number of O	12	22	22	8	12	22	8	22	12	24.5	22	22	8	8	12	22	22	8
Si	2.98	5.56	6.41	2.81	3.01	5.66	2.80	6.31	3.00	4.18	5.61	6.29	2.16	2.65	2.99	5.46	6.25	2.82
Ti	0.00	0.30	0.14	0.00	0.00	0.23	0.00	0.08	0.01	0.07	0.16	0.03	0.00	0.00	0.00	0.19	0.03	0.00
Al	2.04	3.39	4.97	1.20	1.98	3.30	1.19	5.36	2.01	9.23	3.26	5.32	1.84	1.34	2.02	3.32	5.60	1.17
Cr	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Fe	2.21	2.55	0.21	0.00	2.15	1.89	0.00	0.15	1.71	1.62	2.45	0.33	0.00	0.00	2.38	2.59	0.11	0.00
Mn	0.04	0.00	0.00	0.00	0.07	0.01	0.00	0.00	0.54	0.03	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.00
Mg	0.36	1.78	0.29	0.00	0.48	2.58	0.00	0.22	0.31	0.48	2.26	0.20	0.00	0.00	0.30	2.25	0.11	0.00
Ca	0.36	0.00	0.00	0.21	0.29	0.00	0.21	0.01	0.39	0.00	0.01	0.00	0.84	0.35	0.29	0.00	0.00	0.19
Ba	0.00	0.01	0.01	0.00	0.00	0.03	0.00	0.01	0.01	0.00	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Na	0.00	0.06	0.17	0.75	0.01	0.07	0.79	0.23	0.01	0.00	0.03	0.18	0.15	0.68	0.00	0.06	0.44	0.81
K	0.00	1.68	1.66	0.01	0.00	1.43	0.01	1.32	0.00	0.00	1.61	1.48	0.00	0.01	0.00	1.70	1.18	0.00
F	0.00	0.02	0.05			0.13		0.02	0.00	0.00	0.09	0.03				0.09	0.03	
Cl	0.00	0.00	0.00			0.01			0.00	0.00	0.00	0.00				0.01	0.00	
Total cation	8.00	15.33	13.87	4.97	8.01	15.20	5.01	13.70	7.99	15.63	15.42	13.85	5.00	5.02	8.00	15.57	13.73	5.00
Mg/(Fe _{total} +Mg)	0.14	0.41	0.58		0.18	0.58		0.60	0.15	0.23	0.48	0.37			0.11	0.47	0.50	
Ca/(Ca+Na)				0.22			0.21						0.85	0.34				0.19

b.d.= below detection limit; n.d.= not determined.



Kawakami et al. Fig. S1



Kawakami et al. Fig. S2

original sample number		TK13111406Blinp																									
metamorphic zone mineral	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT	just above MCT
	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
site of occurrence	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix
core/mantle/rim	no zoning	no zoning	no zoning	no zoning	no zoning	no zoning	no zoning	no zoning	rim	rim	rim	rim	rim	rim	rim	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)	mantle2(ou ter)
analysis number	t18	t19	t20	t21	t22	t23	t24	t25	t27	t32	t37	t47	t55	t57	t57	t26	t29	t31	t38	t41	t42	t46	t51	t52	t56	t28	t39
SiO ₂	36.20	36.47	36.55	36.19	36.49	36.18	36.44	36.37	35.29	36.39	35.46	36.38	35.72	35.76	35.76	36.11	35.82	36.58	36.27	35.53	36.18	36.50	36.44	35.83	36.76	36.88	36.40
TiO ₂	0.74	0.48	0.99	1.27	1.22	0.87	0.80	0.58	0.78	0.75	1.15	1.01	0.84	1.17	0.74	0.80	0.91	0.98	1.32	0.80	0.99	1.08	1.51	0.87	0.41	1.07	
Al ₂ O ₃	31.82	32.00	31.06	31.68	31.26	31.04	31.53	32.21	31.11	31.09	31.12	31.27	30.90	31.56	31.02	31.28	31.10	31.06	31.27	31.22	31.39	31.16	31.28	31.35	32.78	32.75	
Cr ₂ O ₃	0.03	0.03	0.00	0.05	0.00	0.00	0.03	0.03	0.05	0.02	0.00	0.01	0.02	0.04	0.03	0.01	0.00	0.00	0.10	0.07	0.05	0.05	0.01	0.06	0.02	0.05	
B ₂ O ₃ calc	10.37	10.48	10.48	10.45	10.42	10.40	10.49	10.45	10.33	10.41	10.36	10.47	10.31	10.43	10.38	10.38	10.39	10.37	10.33	10.39	10.49	10.48	10.48	10.49	10.53	10.61	
Fe ₂ O ₃ calc	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
FeO calc	9.48	10.06	10.72	9.40	9.27	10.45	10.09	9.33	9.86	9.76	9.77	9.99	9.42	9.82	10.62	9.82	10.08	10.94	9.19	9.35	9.82	9.87	9.82	9.55	8.63	8.80	
FeO	9.48	10.06	10.72	9.40	9.27	10.45	10.09	9.33	9.86	9.76	9.77	9.99	9.42	9.82	10.62	9.82	10.08	10.94	9.19	9.35	9.82	9.87	9.82	9.55	8.63	8.80	
MnO	0.08	0.09	0.14	0.03	0.09	0.09	0.13	0.03	0.04	0.03	0.01	0.02	0.07	0.03	0.02	0.04	0.01	0.10	0.03	0.03	0.02	0.04	0.01	0.06	0.04	0.00	
MgO	4.84	4.98	5.00	5.21	5.28	5.05	5.23	5.06	5.54	5.37	5.56	5.36	5.55	5.31	5.02	5.41	4.89	4.49	5.34	5.51	5.35	5.50	5.63	5.46	5.24	5.62	
CaO	0.32	0.22	0.35	0.25	0.48	0.33	0.23	0.31	1.44	1.10	1.19	1.03	1.32	1.35	0.36	1.28	0.33	0.23	1.24	0.61	0.50	0.38	1.13	0.47	0.30	0.56	
BaO	0.00	0.00	0.22	0.17	0.00	0.00	0.33	0.22	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.11	0.22	0.00	0.22	0.22	0.00	0.00	0.00	0.00	0.17	0.22	
Na ₂ O	2.22	2.54	2.49	2.51	2.38	2.47	2.68	2.60	1.89	2.20	1.87	1.94	1.87	1.85	2.57	1.97	2.58	2.60	1.98	2.44	2.46	2.58	1.91	2.39	2.34	2.22	
K ₂ O	0.03	0.02	0.05	0.06	0.00	0.04	0.04	0.02	0.04	0.06	0.06	0.07	0.05	0.04	0.04	0.07	0.06	0.07	0.03	0.05	0.02	0.05	0.06	0.07	0.02	0.01	
F	0.05	0.12	0.08	0.10	0.11	0.03	0.13	0.15	0.20	0.18	0.15	0.15	0.17	0.10	0.07	0.13	0.05	0.12	0.16	0.07	0.16	0.14	0.14	0.19	0.08	0.12	
Cl	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	
H ₂ O calc	3.55	3.56	3.57	3.55	3.54	3.57	3.56	3.53	3.46	3.50	3.50	3.54	3.47	3.55	3.55	3.52	3.56	3.52	3.48	3.55	3.54	3.55	3.55	3.53	3.59	3.60	
Total	99.72	101.10	101.70	100.91	100.54	100.52	101.70	100.89	100.03	100.86	100.19	101.73	99.70	101.02	100.52	100.62	100.74	100.75	100.23	100.48	101.30	101.30	101.35	101.25	101.02	102.05	
O=F, Cl	0.02	0.05	0.04	0.05	0.05	0.01	0.05	0.06	0.08	0.08	0.06	0.06	0.07	0.04	0.03	0.05	0.02	0.05	0.07	0.03	0.07	0.06	0.06	0.08	0.03	0.05	
TOTAL	99.70	101.05	101.66	100.87	100.50	100.51	101.64	100.83	99.94	100.79	100.13	101.66	99.63	100.98	100.49	100.57	100.72	100.69	100.16	100.45	101.23	101.29	101.16	100.98	102.00		
Si	6.07	6.05	6.06	6.02	6.09	6.05	6.04	6.05	5.94	6.08	5.95	6.04	6.02	5.96	6.04	6.00	6.12	6.08	5.98	6.05	6.05	6.04	5.94	6.09	6.09	5.96	
Ti	0.09	0.06	0.12	0.16	0.15	0.11	0.10	0.07	0.10	0.09	0.14	0.13	0.11	0.15	0.09	0.10	0.11	0.12	0.17	0.10	0.12	0.13	0.19	0.11	0.05	0.13	
Al	6.29	6.25	6.07	6.21	6.14	6.11	6.16	6.32	6.17	6.12	6.15	6.12	6.14	6.20	6.12	6.13	6.13	6.20	6.15	6.13	6.09	6.11	6.12	6.38	6.32		
Cr	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01	
Fe	1.33	1.40	1.49	1.31	1.29	1.46	1.40	1.30	1.39	1.36	1.37	1.39	1.33	1.37	1.49	1.37	1.41	1.53	1.29	1.31	1.36	1.37	1.36	1.32	1.19	1.21	
Mn	0.01	0.01	0.02	0.00	0.01	0.01	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	
Mg	1.21	1.23	1.24	1.29	1.31	1.26	1.29	1.25	1.39	1.34	1.39	1.33	1.39	1.32	1.25	1.35	1.22	1.12	1.34	1.37	1.32	1.36	1.39	1.35	1.29	1.37	
Ca	0.06	0.04	0.06	0.04	0.09	0.06	0.04	0.06	0.26	0.20	0.21	0.18	0.24	0.24	0.06	0.23	0.06	0.04	0.22	0.11	0.09	0.07	0.20	0.08	0.05	0.10	
Ba	0.00	0.00	0.01	0.01	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.01	
Na	0.72	0.82	0.80	0.81	0.77	0.80	0.86	0.84	0.62	0.71	0.61	0.62	0.61	0.60	0.84	0.64	0.84	0.65	0.79	0.79	0.83	0.61	0.77	0.75	0.70	0.70	
K	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.02	0.00	0.00	
F	0.03	0.06	0.04	0.05	0.06	0.01	0.07	0.08	0.11	0.09	0.08	0.08	0.09	0.05	0.04	0.07	0.03	0.06	0.09	0.04	0.08	0.07	0.07	0.10	0.04	0.06	
Cl	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
Formula	B	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
T	Si	6.07	6.05	6.06	6.02	6.09	6.05	6.04	6.05	5.94	6.08	5.95	6.04	6.02	5.96	6.04	6.00	6.12	6.08	5.98	6.05	6.05	6.04	5.94	6.09	6.09	5.96
	Al(IV)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.05	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.06	0.00	0.00	0.04
	T-site total	6.07	6.05	6.06	6.02	6.09	6.05	6.04	6.05	6.00	6.08	6.00	6.04	6.02	6.00	6.04	6.00	6.12	6.08	6.00	6.05	6.04	6.00	6.09	6.09	6.00	6.00
Z	Al(Z)	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
	Fe ³⁺	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Z-site total	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
Y	Al(Y)	0.29	0.25	0.07	0.21	0.14	0.11	0.16	0.32	0.11	0.12	0.10	0.12	0.16	0.12	0.17	0.13	0.13	0.18	0.15	0.13	0.09	0.06	0.12	0.38	0.28	
	Cr	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	
	Ti	0.09	0.06	0.12	0.16	0.15	0.11	0.10	0.07	0.10	0.09	0.14	0.13	0.11	0.15	0.09	0.10	0.11	0.12	0.17	0.10	0.12	0.13	0.19	0.11	0.05	0.13
	Fe ²⁺	1.33	1.40	1.49	1.31	1.29	1.46	1.40	1.30	1.39	1.36	1.37	1.39	1.33													

[illegible]

TK2013112107-1

Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix
rim	rim	rim	rim	rim	mantle	mantle	mantle	core	core	core	core	core	core	core	core	rim	rim	rim	rim	rim	rim	rim	rim	mantle	mantle	mantle	core	core
t9	t11	t13	t16	t17	t2	t4	t15	t1	t3	t5	t8	t10	t12	t14	tur/mica87	tur/mica89	tur/mica94	tur/mica98	tur/mica99	tur/mica101	tur/mica102	tur/mica103	tur/mica86	tur/mica88	tur/mica91	tur/mica92	tur/mica84	tur/mica85
36.46	36.66	36.70	36.94	36.00	36.65	36.90	36.56	37.69	37.26	37.77	37.92	37.57	38.29	37.29	36.20	36.90	36.31	37.16	36.31	36.71	36.90	36.86	36.30	37.16	36.67	37.46	36.27	36.98
0.49	0.66	0.63	0.76	0.61	0.77	0.79	0.62	0.14	0.18	0.36	0.34	0.31	0.06	0.14	0.69	0.31	0.59	0.36	0.53	0.30	0.74	0.82	0.80	0.14	0.73	0.34	0.84	0.64
33.30	33.51	32.83	33.19	33.79	33.88	33.73	33.41	34.51	33.81	33.89	34.34	34.09	34.66	34.73	33.34	34.79	33.84	34.69	34.02	34.23	34.88	33.42	33.83	34.52	34.02	34.10	34.25	33.97
0.00	0.05	0.00	0.00	0.01	0.03	0.02	0.02	0.06	0.02	0.01	0.01	0.01	0.01	0.01	0.00	0.09	0.00	0.02	0.05	0.02	0.00	0.04	0.02	0.04	0.03	0.01	0.02	0.02
10.59	10.70	10.54	10.70	10.60	10.67	10.63	10.61	10.75	10.62	10.76	10.85	10.72	10.89	10.76	10.59	10.77	10.61	10.72	10.56	10.65	10.82	10.66	10.66	10.66	10.70	10.73	10.61	10.57
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4.58	5.23	4.68	4.79	4.64	4.76	4.01	4.37	3.88	4.04	4.24	4.03	4.31	4.38	4.20	7.20	6.44	6.11	5.58	6.05	5.83	6.16	6.44	6.26	5.76	6.05	5.92	6.18	5.45
4.58	5.23	4.68	4.79	4.64	4.76	4.01	4.37	3.88	4.04	4.24	4.03	4.31	4.38	4.20	7.20	6.44	6.11	5.58	6.05	5.83	6.16	6.44	6.26	5.76	6.05	5.92	6.18	5.45
0.01	0.00	0.00	0.01	0.02	0.00	0.06	0.01	0.02	0.00	0.03	0.00	0.04	0.00	0.02	0.01	0.00	0.00	0.02	0.00	0.02	0.00	0.01	0.02	0.00	0.00	0.05	0.02	0.00
7.69	7.56	7.52	7.84	7.60	7.34	7.42	7.69	7.38	7.41	7.58	7.80	7.33	7.47	7.42	6.56	6.30	6.61	6.38	6.20	6.56	6.46	6.54	6.70	6.15	6.68	6.51	6.12	6.18
1.35	1.41	1.33	1.29	1.20	1.07	1.34	1.44	0.61	0.75	0.65	0.65	0.69	0.51	0.52	1.33	1.25	1.16	1.02	1.05	1.14	1.09	1.31	1.43	0.82	1.05	0.91	1.14	1.11
0.28	0.34	0.00	0.11	0.11	0.00	0.00	0.00	0.11	0.00	0.11	0.00	0.00	0.22	0.00	0.00	0.00	0.33	0.00	0.06	0.44	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00
1.46	1.42	1.49	1.59	1.49	1.47	1.44	1.63	1.32	1.50	1.47	1.32	1.40	1.33	1.39	1.07	1.22	1.19	1.24	1.20	1.25	1.16	1.24	1.21	1.04	1.36	1.19	1.14	1.21
0.00	0.03	0.02	0.01	0.03	0.03	0.00	0.02	0.02	0.02	0.02	0.01	0.02	0.02	0.00	0.02	0.03	0.02	0.01	0.03	0.02	0.00	0.03	0.03	0.02	0.02	0.03	0.04	0.01
0.08	0.07	0.05	0.09	0.04	0.02	0.05	0.08	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.03	0.02	0.01	0.06	0.09	0.02	0.00	0.01	0.06	0.00	0.02	0.01
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.61	3.66	3.61	3.65	3.64	3.67	3.64	3.62	3.70	3.66	3.71	3.74	3.70	3.75	3.71	3.60	3.71	3.64	3.68	3.63	3.64	3.68	3.67	3.68	3.67	3.66	3.70	3.65	3.64
99.89	101.29	99.41	100.97	99.77	100.35	100.03	100.07	100.21	99.28	100.59	101.01	100.19	101.59	100.18	100.42	101.81	100.45	100.88	99.68	100.48	102.42	101.04	100.91	100.00	101.26	100.94	100.30	99.78
0.03	0.03	0.02	0.04	0.02	0.01	0.02	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00	0.01	0.01	0.01	0.03	0.04	0.01	0.00	0.01	0.03	0.00	0.01	0.00
99.86	101.27	99.39	100.93	99.76	100.35	100.01	100.04	100.20	99.28	100.59	101.01	100.19	101.59	100.18	100.37	101.81	100.44	100.87	99.67	100.45	102.38	101.03	100.91	99.99	101.23	100.94	100.29	99.77
5.99	5.96	6.05	6.00	5.90	5.97	6.03	5.99	6.09	6.10	6.10	6.07	6.09	6.11	6.02	5.94	5.95	5.95	6.03	5.97	5.99	5.93	6.01	5.92	6.06	5.96	6.07	5.94	6.08
0.06	0.08	0.08	0.09	0.08	0.09	0.10	0.08	0.09	0.02	0.04	0.04	0.04	0.11	0.02	0.09	0.04	0.07	0.04	0.07	0.04	0.09	0.10	0.10	0.02	0.09	0.04	0.10	0.08
6.44	6.42	6.38	6.35	6.53	6.50	6.45	6.48	6.51	6.52	6.45	6.48	6.51	6.52	6.61	6.45	6.61	6.53	6.64	6.60	6.58	6.61	6.42	6.50	6.64	6.51	6.61	6.58	6.58
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00
0.63	0.71	0.65	0.65	0.64	0.65	0.55	0.60	0.52	0.55	0.57	0.54	0.58	0.58	0.57	0.99	0.87	0.84	0.76	0.83	0.80	0.83	0.88	0.85	0.79	0.82	0.80	0.85	0.75
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00
1.88	1.83	1.85	1.90	1.86	1.78	1.81	1.88	1.78	1.81	1.82	1.86	1.77	1.78	1.78	1.53	1.51	1.61	1.54	1.52	1.59	1.55	1.59	1.63	1.49	1.62	1.57	1.49	1.51
0.24	0.25	0.24	0.22	0.21	0.19	0.24	0.25	0.11	0.13	0.11	0.11	0.12	0.09	0.09	0.23	0.22	0.20	0.18	0.18	0.20	0.19	0.23	0.25	0.14	0.18	0.16	0.20	0.20
0.02	0.02	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00
0.47	0.45	0.48	0.50	0.47	0.46	0.46	0.52	0.41	0.48	0.46	0.41	0.44	0.41	0.44	0.34	0.38	0.38	0.39	0.38	0.39	0.36	0.39	0.38	0.33	0.43	0.37	0.36	0.39
0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00
0.04	0.03	0.03	0.05	0.02	0.01	0.03	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.02	0.01	0.01	0.03	0.05	0.01	0.00	0.01	0.03	0.00	0.01	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
5.99	5.96	6.05	6.00	5.90	5.97	6.03	5.99	6.09	6.10	6.10	6.07	6.09	6.11	6.02	5.94	5.95	5.95	6.03	5.97	5.99	5.93	6.01	5.92	6.06	5.96	6.07	5.94	6.08
0.01	0.04	0.00	0.00	0.10	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.05	0.05	0.00	0.03	0.01	0.07	0.00	0.08	0.00	0.04	0.00	0.06	0.00
6.00	6.00	6.05	6.00	6.00	6.00	6.03	6.00	6.09	6.10	6.10	6.07	6.09	6.11	6.02	6.00	6.00	6.00	6.03	6.00	6.00	6.01	6.00	6.06	6.00	6.00	6.07	6.00	6.08
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
0.43	0.37	0.38	0.35	0.43	0.47	0.50	0.44	0.58	0.52	0.45	0.48	0.51	0.52	0.61	0.39	0.57	0.48	0.63	0.57	0.57	0.54	0.42	0.42	0.64	0.47	0.51	0.55	0.58
0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
0.06	0.08	0.08	0.09	0.08	0.09	0.10	0.08	0.02	0.02	0.04</																		

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Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	
matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	
core	core	core	core	core	rim	rim	rim	rim	rim	core	core	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	mantle	mantle	mantle
tur/mica90	tur/mica93	tur/mica96	tur/mica97	tur/mica100	tur/mica108	tur/mica112	tur/mica113	tur/mica116	tur/mica105	tur/mica115	tur1	tur8	tur10	tur14	tur32	tur34	tur37	tur39	tur40	tur42	tur44	tur47	tur49	tur51	tur52	tur2	tur6	tur7					
36.28	36.59	36.38	37.23	35.80	35.78	36.67	35.94	36.40	37.24	36.13	36.04	36.60	35.97	36.38	35.85	35.98	36.70	36.44	36.28	36.31	36.39	35.99	36.55	36.64	36.89	36.15	35.99						
0.36	0.41	0.62	0.15	0.41	0.56	1.06	0.22	0.58	0.57	0.37	0.55	0.34	0.49	0.19	0.64	0.27	0.66	0.58	0.62	0.56	0.48	0.48	0.73	0.59	0.82	0.05	0.52	0.60					
31.81	33.32	31.84	31.48	31.76	32.26	31.05	32.00	30.57	34.02	31.92	30.87	30.28	30.32	31.33	31.34	30.42	30.78	31.16	31.14	30.92	30.48	30.92	30.58	30.54	31.73	32.66	31.67	30.98					
0.62	0.08	0.00	0.53	0.04	0.04	0.00	0.00	0.00	0.02	0.02	0.03	0.07	0.04	0.00	0.07	0.01	0.02	0.04	0.12	0.04	0.09	0.00	0.10	0.08	0.04	0.04	0.00	0.07					
10.46	10.67	10.56	10.58	10.51	10.56	10.55	10.59	10.44	10.72	10.71	10.43	10.32	10.38	10.29	10.36	10.34	10.31	10.45	10.38	10.39	10.29	10.31	10.30	10.35	10.45	10.44	10.40	10.30					
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
7.85	6.78	8.32	8.37	8.40	8.01	9.85	8.48	9.08	6.96	6.39	8.18	8.12	7.89	7.68	7.79	8.14	8.06	8.35	7.73	7.73	7.44	7.22	7.22	7.38	7.39	7.02	7.42	7.89					
7.85	6.78	8.32	8.37	8.40	8.01	9.85	8.48	9.09	6.96	6.39	8.18	8.12	7.99	7.68	7.79	8.14	8.06	8.35	7.73	7.73	7.44	7.22	7.22	7.38	7.39	7.02	7.42	7.89					
0.00	0.01	0.03	0.05	0.00	0.06	0.03	0.06	0.10	0.08	0.11	0.00	0.05	0.02	0.00	0.04	0.03	0.02	0.04	0.00	0.06	0.04	0.07	0.00	0.07	0.02	0.00	0.04	0.05					
6.15	6.80	6.54	6.30	6.79	6.80	5.84	7.02	6.50	6.48	7.92	6.86	6.86	6.79	6.28	6.06	7.05	6.62	6.22	6.34	6.67	6.65	6.53	6.83	6.75	6.27	5.90	6.45	6.20					
1.45	1.60	1.56	0.13	1.87	1.52	0.26	2.02	1.29	1.26	0.63	0.84	0.97	0.57	0.84	0.91	1.16	0.91	0.89	0.79	1.00	0.93	0.79	1.25	1.03	0.74	0.26	0.72	0.81					
0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.00	0.39	0.00	0.17	0.00	0.00	0.00	0.22	0.22	0.00	0.06	0.00	0.28	0.00	0.00	0.00	0.00	0.28	0.00	0.06	0.00	0.00	0.00	0.00		
1.55	1.17	1.35	2.24	1.26	1.30	2.28	1.07	1.63	1.31	2.11	2.07	2.09	2.24	1.87	1.82	1.86	1.93	1.90	1.96	2.03	2.02	1.96	1.94	1.85	1.94	1.84	2.08	1.75					
0.00	0.04	0.00	0.02	0.03	0.04	0.02	0.00	0.00	0.01	0.03	0.04	0.01	0.05	0.02	0.03	0.02	0.01	0.00	0.03	0.01	0.04	0.04	0.06	0.03	0.00	0.04	0.01	0.00					
0.04	0.04	0.10	0.02	0.05	0.12	0.09	0.07	0.06	0.05	0.14	0.10	0.11	0.12	0.12	0.18	0.13	0.23	0.11	0.08	0.14	0.15	0.12	0.14	0.21	0.18	0.03	0.16	0.16					
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.59	3.66	3.59	3.63	3.60	3.58	3.60	3.62	3.57	3.67	3.63	3.55	3.50	3.52	3.49	3.48	3.51	3.44	3.55	3.54	3.51	3.48	3.50	3.48	3.47	3.52	3.59	3.51	3.47					
100.25	101.16	100.88	100.72	100.52	100.62	101.29	101.35	100.07	101.92	101.20	99.84	98.75	99.11	98.08	99.32	99.01	98.71	100.04	99.19	99.61	98.37	98.34	98.63	98.92	100.03	98.75	99.18	98.26					
0.02	0.02	0.04	0.01	0.02	0.05	0.04	0.03	0.03	0.02	0.06	0.04	0.05	0.05	0.05	0.08	0.05	0.10	0.05	0.03	0.06	0.06	0.05	0.06	0.09	0.08	0.01	0.07	0.07					
100.24	101.15	100.84	100.71	100.50	100.57	101.26	101.32	100.05	101.90	101.14	99.79	98.70	99.06	98.03	99.24	98.96	98.62	99.99	99.16	99.55	98.31	98.29	98.57	98.83	99.96	98.73	99.11	98.19					
6.03	5.96	5.99	6.12	5.92	5.89	6.04	5.90	6.04	5.90	6.05	6.02	6.07	6.13	6.07	6.10	6.02	6.06	6.11	6.10	6.07	6.13	6.13	6.07	6.14	6.09	6.14	6.04	6.07					
0.04	0.05	0.08	0.02	0.05	0.07	0.13	0.03	0.07	0.07	0.05	0.07	0.04	0.06	0.02	0.08	0.03	0.08	0.07	0.08	0.07	0.06	0.06	0.09	0.07	0.10	0.01	0.07	0.08					
6.23	6.40	6.18	6.10	6.19	6.26	6.03	6.19	6.00	6.50	6.11	6.06	6.01	5.99	6.24	6.19	6.03	6.11	6.11	6.14	6.10	6.07	6.14	6.08	6.04	6.22	6.41	6.24	6.16					
0.08	0.01	0.00	0.07	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01					
1.09	0.92	1.15	1.15	1.16	1.10	1.36	1.16	1.27	0.94	0.87	1.14	1.14	1.12	1.08	1.09	1.14	1.14	1.16	1.08	1.08	1.05	1.02	1.02	1.04	1.03	0.98	1.04	1.11					
0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01					
1.52	1.65	1.60	1.54	1.67	1.67	1.43	1.72	1.61	1.57	1.92	1.70	1.72	1.69	1.58	1.52	1.77	1.60	1.54	1.58	1.66	1.67	1.64	1.72	1.69	1.55	1.46	1.61	1.56					
0.26	0.28	0.27	0.02	0.33	0.27	0.05	0.36	0.23	0.22	0.11	0.15	0.17	0.10	0.15	0.16	0.21	0.16	0.16	0.14	0.18	0.17	0.14	0.23	0.19	0.13	0.05	0.13	0.15					
0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00		
0.50	0.37	0.43	0.71	0.40	0.42	0.73	0.34	0.52	0.41	0.66	0.67	0.68	0.73	0.61	0.59	0.61	0.63	0.61	0.64	0.66	0.66	0.64	0.63	0.60	0.63	0.59	0.67	0.57					
0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00		
0.02	0.02	0.05	0.01	0.03	0.06	0.04	0.03	0.03	0.03	0.07	0.05	0.06	0.06	0.07	0.10	0.07	0.12	0.06	0.04	0.07	0.08	0.06	0.08	0.11	0.10	0.02	0.09	0.08					
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00		
6.03	5.96	5.99	6.12	5.92	5.89	6.04	5.90	6.04	5.90	6.05	6.02	6.07	6.13	6.07	6.10	6.02	6.06	6.11	6.10	6.07	6.13	6.13	6.07	6.14	6.09	6.14	6.04	6.07					
0.00	0.04	0.01	0.00	0.08	0.11	0.00	0.10	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
<i>6.03</i>	<i>6.00</i>	<i>6.00</i>	<i>6.12</i>	<i>6.00</i>	<i>6.00</i>	<i>6.04</i>	<i>6.00</i>	<i>6.04</i>	<i>6.00</i>	<i>6.05</i>	<i>6.02</i>	<i>6.07</i>	<i>6.13</i>	<i>6.07</i>	<i>6.10</i>	<i>6.02</i>	<i>6.06</i>	<i>6.11</i>	<i>6.10</i>	<i>6.07</i>	<i>6.13</i>	<i>6.13</i>	<i>6.07</i>	<i>6.14</i>	<i>6.09</i>	<i>6.14</i>	<i>6.04</i>	<i>6.04</i>	<i>6.07</i>				
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.99	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00																

[illegible]

Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt core inc	Grt core inc	Grt core inc	Grt core inc	Grt core inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc	Grt rim inc
rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	mantle/rim	mantle/rim	mantle/rim	mantle	mantle	core	core	core
34	35	37	38	39	40	42	46	89	90	91	92	95	101	104	105	108	109	20	21	28	103	19	107	17	23
36.54	37.27	36.64	37.13	36.44	36.27	37.31	36.51	35.46	36.90	36.32	36.91	36.55	36.53	36.57	36.76	36.80	36.77	36.91	37.34	36.77	36.99	36.97	36.71	36.97	36.54
0.88	0.89	0.67	0.80	0.30	0.80	0.14	0.50	0.65	0.77	0.52	0.66	0.95	0.56	0.66	0.58	0.97	0.71	0.22	0.43	0.58	0.90	0.99	0.83	0.16	0.53
31.18	31.45	31.91	31.11	32.89	31.48	32.50	31.75	31.73	30.67	32.47	31.65	32.18	32.52	32.39	32.06	31.50	31.59	32.05	31.46	31.47	31.00	31.06	32.61	32.32	33.46
0.00	0.03	0.04	0.00	0.00	0.00	0.00	0.05	0.02	0.05	0.05	0.00	0.01	0.00	0.02	0.02	0.07	0.01	0.04	0.00	0.06	0.07	0.00	0.05	0.04	0.00
10.55	10.65	10.57	10.63	10.59	10.53	10.67	10.55	10.37	10.45	10.56	10.64	10.52	10.61	10.62	10.59	10.62	10.56	10.56	10.52	10.46	10.59	10.58	10.63	10.53	10.48
0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
7.37	6.98	6.73	7.07	6.85	7.48	7.94	7.21	6.60	6.80	6.68	7.11	6.35	7.47	6.87	7.16	7.16	7.30	7.46	6.44	6.48	6.95	7.07	5.30	10.30	9.30
7.37	6.98	6.73	7.11	6.85	7.48	7.94	7.21	6.60	6.80	6.68	7.11	6.35	7.47	6.87	7.16	7.16	7.30	7.46	6.44	6.48	6.97	7.07	5.30	10.30	9.30
0.06	0.01	0.03	0.00	0.05	0.02	0.02	0.00	0.02	0.01	0.02	0.05	0.06	0.01	0.06	0.05	0.03	0.06	0.02	0.03	0.05	0.00	0.01	0.06	0.06	0.03
7.32	7.43	7.26	7.65	6.85	7.15	6.51	7.18	7.11	7.29	7.08	7.44	6.87	6.75	7.12	6.95	7.34	7.03	6.74	7.16	7.02	7.54	7.42	7.74	4.68	4.19
1.13	0.28	1.30	1.22	1.23	1.38	0.11	1.70	1.89	0.76	1.45	1.25	1.51	1.04	1.57	1.00	1.35	1.06	0.61	0.16	1.59	0.90	0.47	1.72	0.09	0.45
0.11	0.00	0.23	0.22	0.11	0.17	0.45	0.00	0.06	0.00	0.00	0.28	0.06	0.11	0.28	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.39	0.39	0.34	0.00
1.64	2.51	1.55	1.72	1.20	1.65	2.25	1.17	1.11	2.12	1.25	1.63	1.18	1.51	1.19	1.70	1.65	1.60	1.77	2.29	1.18	2.02	2.36	1.21	1.91	1.75
0.04	0.01	0.05	0.03	0.03	0.03	0.00	0.02	0.04	0.06	0.05	0.03	0.03	0.04	0.04	0.04	0.01	0.01	0.02	0.00	0.03	0.02	0.00	0.04	0.00	0.02
0.07	0.11	0.19	0.16	0.04	0.12	0.03	0.06	0.07	0.12	0.11	0.16	0.05	0.08	0.10	0.10	0.09	0.05	0.03	0.04	0.05	0.18	0.02	0.09	0.00	0.06
0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00
3.60	3.62	3.55	3.59	3.63	3.57	3.66	3.61	3.54	3.55	3.59	3.59	3.60	3.62	3.62	3.60	3.62	3.62	3.63	3.61	3.58	3.56	3.63	3.62	3.63	3.58
100.51	101.25	100.72	101.38	100.20	100.66	101.60	100.32	98.66	99.54	100.14	101.40	99.91	100.83	101.09	100.62	101.19	100.35	100.07	99.47	99.28	100.77	100.69	100.68	101.09	100.81
0.03	0.05	0.08	0.07	0.02	0.05	0.01	0.03	0.03	0.05	0.05	0.07	0.02	0.03	0.04	0.04	0.04	0.02	0.02	0.02	0.08	0.01	0.04	0.00	0.03	0.04
100.48	101.20	100.64	101.31	100.18	100.61	101.59	100.29	98.63	99.49	100.09	101.33	99.89	100.80	101.05	100.57	101.15	100.33	100.05	99.45	99.26	100.69	100.68	100.64	101.09	100.78
6.02	6.08	6.02	6.07	5.98	5.98	6.08	6.01	5.94	6.13	5.98	6.03	6.04	5.98	5.99	6.03	6.02	6.05	6.07	6.11	6.07	6.07	6.00	6.10	6.06	6.12
0.11	0.11	0.08	0.10	0.04	0.10	0.02	0.06	0.08	0.10	0.06	0.08	0.12	0.07	0.08	0.07	0.12	0.09	0.03	0.05	0.07	0.11	0.12	0.10	0.02	0.07
6.05	6.05	6.18	5.99	6.36	6.12	6.24	6.16	6.27	6.10	6.27	6.28	6.25	6.20	6.08	6.08	6.17	6.21	6.12	6.12	6.00	6.02	6.28	6.54	5.93	5.97
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01
1.02	0.95	0.92	0.97	0.94	1.03	1.08	0.99	0.92	0.95	0.92	0.97	0.88	1.02	0.94	0.98	0.98	1.00	1.03	0.89	0.90	0.96	0.97	0.72	1.42	1.29
0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
1.80	1.81	1.78	1.86	1.67	1.76	1.58	1.76	1.78	1.81	1.73	1.81	1.69	1.65	1.74	1.70	1.79	1.72	1.65	1.76	1.74	1.85	1.82	1.89	1.15	1.03
0.20	0.05	0.23	0.21	0.22	0.24	0.02	0.30	0.34	0.14	0.26	0.22	0.27	0.18	0.28	0.18	0.24	0.19	0.11	0.03	0.28	0.16	0.08	0.30	0.02	0.08
0.01	0.00	0.01	0.01	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.03	0.03	0.02
0.52	0.79	0.49	0.54	0.38	0.53	0.71	0.37	0.36	0.68	0.40	0.52	0.38	0.48	0.38	0.54	0.52	0.51	0.57	0.73	0.38	0.64	0.75	0.38	0.61	0.56
0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01
0.04	0.06	0.10	0.08	0.02	0.06	0.02	0.03	0.04	0.06	0.06	0.08	0.03	0.04	0.05	0.05	0.05	0.02	0.02	0.02	0.02	0.09	0.01	0.05	0.00	0.03
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
6.02	6.08	6.02	6.07	5.98	5.98	6.08	6.01	5.94	6.13	5.98	6.03	6.04	5.98	5.99	6.03	6.02	6.05	6.07	6.11	6.07	6.07	6.00	6.10	6.06	6.12
0.00	0.00	0.00	0.00	0.02	0.02	0.00	0.00	0.06	0.00	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6.02	6.08	6.02	6.07	6.00	6.00	6.08	6.01	6.00	6.13	6.00	6.03	6.04	6.00	6.00	6.03	6.02	6.05	6.07	6.17	6.11	6.07	6.07	6.00	6.10	6.06
6.00	6.00	6.00	5.99	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.93
0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
0.05	0.05	0.18	0.00	0.34	0.11	0.24	0.16	0.21	0.01	0.27	0.10	0.27	0.26	0.23	0.20	0.08	0.13	0.21	0.12	0.17	0.00	0.02	0.28	0.29	0.54
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00
0.11	0.11	0.08	0.10	0.04	0.10	0.02	0.06	0.08	0.10	0.06	0.08	0.12	0.07	0.08	0.07	0.12	0.09	0.03	0.05	0.07	0.11	0.12	0.10	0.02	0.07
1.02	0.95	0.92	0.97	0.94	1.03	1.08	0.99	0.92	0.95	0.92	0.97	0.88	1.02	0.94	0.98	0.98	1.00	1.03	0.89	0.90	0.95	0.97	0.72	1.42	1.29
1.80	1.81	1.78	1.86	1.67	1.76	1.58	1.76	1.78	1.81	1.73	1.81	1.69	1.65	1.74	1.70	1.79	1.72	1.65	1.76	1.74	1.85	1.82	1.89	1.15	1.03
0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00
2.98	2.92	2.98	2.93	3.00	3.00	2.92	2.99	3.00	2.87	3.00	2.97	2.96	3.00	3.00	2.97	2.98	2.95	2.93	2.83	2.89	2.93	2.93	3.00	2.90	2.94
0.20	0.05	0.23	0.21	0.22	0.24	0.02	0.30	0.34	0.14	0.26	0.22	0.27	0.18</												

	Ky	Ky	Ky	Ky	Ky	Ky	Ky	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	
GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT rim inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	GrT inc	
core	core	core	core	core	core	core	core	rim	dark mantle tur41	dark mantle tur45	dark mantle tur46	dark mantle tur47	dark mantle tur49	dark mantle tur54	dark mantle tur55	dark mantle tur57	core	core	core	core	mantle	mantle	mantle/rim	rim	rim	rim	rim	rim	
33	36	43	96	102	106	110	tur20										tur19	tur51	tur53	tur56	tur5	tur8	tur33	tur2	tur3	tur6	tur7	tur9	tur13
35.96	36.91	36.57	36.62	36.43	36.33	36.71	36.28	36.20	36.60	36.11	37.23	35.92	36.46	36.20	36.70	37.80	35.94	35.39	35.11	37.32	36.99	37.18	35.89	36.75	36.61	36.23	36.61	36.30	
1.03	0.20	0.88	0.08	1.14	0.88	1.01	0.28	0.43	0.23	0.47	0.21	0.52	0.28	0.80	0.34	0.36	0.64	0.77	0.57	0.21	0.57	0.13	0.53	0.14	0.40	0.60	0.17	0.50	
33.43	32.92	31.26	33.02	32.90	32.77	33.29	31.41	32.40	32.63	31.65	32.57	32.78	32.99	31.39	32.20	29.08	33.54	33.24	32.47	31.98	32.08	32.30	31.54	31.86	32.16	31.99	32.79	30.98	
0.11	0.02	0.05	0.00	0.02	0.00	0.03	0.01	0.02	0.03	0.06	0.06	0.04	0.07	0.01	0.02	0.04	0.00	0.00	0.06	0.06	0.00	0.00	0.01	0.01	0.00	0.05	0.03	0.01	
10.47	10.58	10.63	10.47	10.60	10.60	10.56	10.55	10.48	10.63	10.51	10.51	10.46	10.67	10.56	10.68	10.38	10.55	10.23	10.16	10.45	10.60	10.44	10.44	10.55	10.52	10.55	10.53	10.39	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8.68	8.04	7.62	8.03	9.96	7.88	6.47	8.97	7.86	8.42	8.62	8.00	9.25	8.58	8.04	9.29	8.98	10.50	11.93	14.48	8.34	8.21	8.51	7.69	8.64	6.97	7.53	7.27	8.06	
8.68	8.04	7.62	8.03	9.96	7.88	6.47	8.97	7.86	8.42	8.62	8.00	9.25	8.58	8.04	9.29	10.84	10.50	11.93	14.48	8.34	8.21	8.51	7.69	8.64	6.97	7.53	7.27	8.06	
0.04	0.04	0.04	0.04	0.07	0.03	0.04	0.12	0.02	0.11	0.07	0.06	0.12	0.08	0.07	0.09	0.04	0.11	0.17	0.12	0.00	0.07	0.00	0.01	0.02	0.08	0.04	0.06		
4.58	5.81	7.56	5.37	4.73	6.20	6.05	6.68	6.14	6.26	6.44	5.46	5.03	6.22	7.07	6.30	5.42	4.15	2.04	1.07	5.39	6.30	5.08	6.82	6.34	6.81	6.91	6.28	6.49	
0.49	0.16	0.87	0.25	0.33	0.70	0.51	1.23	1.11	1.00	1.61	0.12	0.66	0.86	1.54	0.60	0.17	0.87	0.26	0.28	0.08	1.38	0.06	1.49	1.39	1.38	1.81	0.91	0.62	
0.00	0.00	0.00	0.00	0.22	0.28	0.28	0.33	0.00																					

St	St	St	St	St	St	St	St	St	St	St	St	St	St	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	
Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix
rim	rim	rim	rim	core	core	core	core	core	core	core	rim	rim	mantle	mantle	mantle	mantle	mantle	mantle	mantle	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim
tur14	tur30	tur37	tur40	tur1	tur4	tur12	tur28	tur32	tur36	tur39	tur21	tur22	tur7	tur10	tur18	tur25	tur29	tur35	tur4	tur5	tur8	tur11	tur12	tur19	tur22	tur23	tur26	tur28									
37.65	36.15	37.21	36.59	35.60	35.70	35.68	35.90	35.54	35.08	35.66	35.84	36.87	36.98	36.97	37.25	37.48	37.25	37.49	37.88	37.15	37.22	37.22	37.31	37.22	36.86	37.19	36.63	37.56									
0.01	0.32	0.70	0.40	0.37	0.23	1.28	0.80	0.94	0.30	1.99	0.43	0.13	0.61	0.28	0.16	0.53	0.39	0.26	0.73	0.69	0.78	0.29	0.61	0.50	0.43	0.60	0.80	0.53									
31.88	31.25	31.89	31.89	32.49	29.28	29.08	33.33	30.99	32.24	30.20	31.33	32.58	31.60	32.28	31.69	32.36	32.36	32.60	32.04	32.48	31.66	32.53	31.84	31.75	32.28	31.99	31.78	32.54									
0.02	0.02	0.02	0.01	0.00	0.00	0.03	0.02	0.00	0.00	0.00	0.01	0.01	0.04	0.01	0.00	0.01	0.02	0.00	0.02	0.07	0.00	0.01	0.02	0.05	0.00	0.04	0.00	0.06									
10.52	10.41	10.67	10.63	10.22	10.24	10.19	10.49	10.02	10.16	10.14	10.40	10.52	10.54	10.58	10.58	10.63	10.58	10.62	10.74	10.67	10.59	10.61	10.60	10.58	10.52	10.59	10.47	10.63									
0.00	0.00	0.00	0.00	0.00	1.11	1.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
8.75	7.22	8.22	7.65	15.22	13.93	13.37	8.90	13.61	14.04	14.40	7.21	7.24	5.53	5.36	5.84	4.41	4.73	5.22	5.30	5.37	5.06	4.86	4.71	4.91	4.69	5.21	4.77	5.24									
8.75	7.22	8.22	7.65	15.22	14.92	14.43	8.90	13.61	14.04	14.40	7.21	7.24	5.53	5.36	5.84	4.41	4.73	5.22	5.30	5.37	5.06	4.86	4.71	4.91	4.69	5.21	4.77	5.24									
0.03	0.02	0.02	0.00	0.23	0.05	0.04	0.01	0.09	0.05	0.09	0.01	0.00	0.04	0.03	0.01	0.00	0.01	0.03	0.00	0.03	0.02	0.06	0.02	0.02	0.07	0.02	0.06	0.01									
5.49	7.08	6.61	7.30	0.76	3.66	3.26	4.89	1.50	1.73	1.79	7.12	6.27	7.78	7.76	7.85	8.08	7.83	7.51	8.11	7.78	8.07	7.82	8.22	8.17	7.76	7.81	7.80	7.40									
0.08	1.50	1.23	1.87	0.08	0.68	1.40	0.81	0.22	0.20	0.23	1.83	0.97	0.36	0.31	0.51	0.40	0.45	0.26	0.38	0.29	0.47	0.33	0.41	0.56	0.22	0.44	0.28	0.36									
0.00	0.39	0.28	0.11	0.17	0.00	0.06	0.11	0.06	0.00	0.11	0.00	0.00	0.06	0.00	0.06	0.00	0.00	0.28	0.62	0.00	0.00	0.28	0.00	0.11	0.00	0.00	0.11	0.11									
1.98	1.59	1.57	1.34	2.30	2.01	1.48	1.90	2.26	2.31	2.38	1.23	1.35	2.44	2.32	2.39	2.25	2.26	1.99	2.45	2.27	2.26	2.21	2.27	2.23	2.09	2.29	2.32	2.09									
0.02	0.06	0.04	0.01	0.04	0.04	0.06	0.05	0.05	0.04	0.03	0.03	0.01	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.03	0.03	0.01	0.00									
0.02	0.11	0.11	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.02	0.03	0.08	0.05	0.05	0.06	0.01	0.05	0.00	0.09	0.02	0.07	0.06	0.04	0.00	0.04	0.03									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
3.61	3.53	3.63	3.62	3.52	3.53	3.51	3.62	3.45	3.50	3.49	3.54	3.62	3.62	3.61	3.63	3.64	3.62	3.66	3.68	3.61	3.65	3.62	3.62	3.60	3.65	3.65	3.59	3.65									
100.06	99.65	102.19	101.52	100.99	100.34	100.50	100.82	98.73	99.65	100.52	99.08	99.59	99.61	99.57	99.99	99.86	99.56	99.92	101.99	100.50	99.83	99.90	99.71	99.77	98.58	99.85	98.67	100.22									
0.01	0.05	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01	0.01	0.03	0.02	0.02	0.03	0.00	0.02	0.00	0.04	0.01	0.03	0.07	0.02	0.02	0.00	0.02									
100.05	99.60	102.14	101.48	100.99	100.34	100.50	100.82	98.72	99.65	100.52	99.04	99.58	99.59	99.54	99.97	99.84	99.53	99.91	101.97	100.50	99.80	99.89	99.68	99.74	98.56	99.85	98.65	100.21									
6.22	6.04	6.06	5.98	6.05	6.06	6.09	5.95	6.17	6.00	6.11	5.99	6.09	6.10	6.07	6.12	6.13	6.12	6.13	6.13	6.05	6.11	6.10	6.12	6.11	6.09	6.10	6.08	6.14									
0.00	0.04	0.09	0.05	0.03	0.16	0.10	0.12	0.04	0.26	0.05	0.02	0.08	0.03	0.02	0.06	0.05	0.03	0.09	0.08	0.10	0.04	0.07	0.06	0.05	0.07	0.10	0.06	0.10									
6.21	6.15	6.12	6.04	6.15	5.86	5.85	6.51	6.34	6.50	6.10	6.17	6.35	6.14	6.25	6.14	6.24	6.26	6.29	6.11	6.23	6.12	6.28	6.15	6.16	6.29	6.19	6.22	6.27									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01									
1.21	1.01	1.12	1.05	2.16	2.12	2.06	1.23	1.97	2.01	2.06	1.01	1.00	0.76	0.74	0.80	0.60	0.65	0.71	0.72	0.73	0.69	0.67	0.65	0.67	0.65	0.72	0.66	0.72									
0.00	0.00	0.00	0.00	0.03	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.01								
1.35	1.76	1.60	1.78	0.19	0.92	0.83	1.21	0.39	0.44	0.46	1.77	1.54	1.91	1.90	1.92	1.97	1.92	1.83	1.95	1.89	1.97	1.91	2.01	2.00	1.91	1.91	1.93	1.80									
0.01	0.27	0.21	0.33	0.01	0.12	0.26	0.14	0.04	0.04	0.04	0.33	0.17	0.06	0.05	0.09	0.07	0.08	0.04	0.07	0.05	0.08	0.06	0.07	0.10	0.04	0.08	0.05	0.06									
0.00	0.03	0.02	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.04	0.00	0.00	0.02	0.00	0.01	0.00	0.00	0.01	0.01									
0.63	0.52	0.50	0.42	0.76	0.66	0.49	0.61	0.76	0.76	0.79	0.40	0.43	0.78	0.74	0.76	0.71	0.72	0.63	0.77	0.72	0.72	0.70	0.72	0.71	0.67	0.73	0.75	0.66									
0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00									
0.01	0.06	0.06	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.01	0.04	0.02	0.02	0.03	0.01	0.03	0.00	0.04	0.01	0.03	0.03	0.02	0.00	0.02	0.02									
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00									
6.22	6.04	6.06	5.98	6.05	6.06	6.09	5.95	6.17	6.00	6.11	5.99	6.09	6.10	6.07	6.12	6.13	6.12	6.13	6.13	6.05	6.11	6.10	6.12	6.11	6.09	6.10	6.08	6.14									
0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00									
6.22	6.04	6.06	6.00	6.05	6.06	6.09	6.00	6.17	6.00	6.11	6.00	6.09	6.10	6.07	6.12	6.13	6.12	6.13	6.13	6.05	6.11	6.10	6.12	6.11	6.09	6.10	6.08	6.14									
6.00	6.00	6.00	6.00	6.00	5.86	5.85	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00																							

TK2012111605

Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	
Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix
rim	rim	rim	rim	rim	rim	core	core	core	core	rim	rim	rim	rim	rim	rim	mantle	mantle	mantle	mantle	mantle	mantle	core	core	core	core	core	core	rim	rim	
tur31	tur32	tur36	tur39	tur42	tur43	tur1	tur6	tur9	tur38	4	6	7	11	19	21	2	3	5	9	10	16	1	8	15	18	20	25	26		
37.01	37.72	36.79	36.85	37.01	36.36	37.24	37.12	36.43	37.15	36.54	36.47	36.27	37.12	36.64	36.15	36.17	36.49	35.90	36.15	37.02	36.74	35.20	35.88	34.31	33.72	34.96	36.52	37.11		
0.67	0.46	0.79	0.28	0.53	0.41	0.30	0.36	0.82	0.43	0.49	0.78	0.79	0.44	0.95	0.60	0.81	0.70	0.85	0.96	0.65	1.04	0.80	0.62	0.89	0.20	1.12	0.70	0.23		
32.40	32.85	31.88	32.28	32.57	32.49	31.57	31.58	29.87	32.05	33.39	32.73	32.38	32.46	32.15	31.72	32.22	31.81	32.06	30.95	32.83	32.01	32.94	32.50	32.98	33.84	33.93	32.84	33.89		
0.03	0.02	0.00	0.02	0.00	0.00	0.00	0.03	0.07	0.04	0.00	0.04	0.00	0.04	0.04	0.01	0.06	0.02	0.05	0.03	0.00	0.00	0.01	0.04	0.01	0.00	0.02	0.07	0.04		
10.61	10.69	10.53	10.50	10.63	10.51	10.51	10.52	10.32	10.57	10.54	10.48	10.49	10.55	10.54	10.36	10.50	10.51	10.42	10.36	10.51	10.61	10.20	10.34	10.18	10.08	10.12	10.38	10.67		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
5.50	5.04	5.00	4.90	5.49	4.94	5.50	6.28	6.11	5.30	6.06	7.66	7.52	6.61	9.33	8.06	8.18	9.08	8.96	8.93	8.58	9.26	12.41	12.82	15.23	14.80	11.88	9.40	9.95		
5.50	5.04	5.00	4.90	5.49	4.94	5.50	6.28	6.64	5.30	6.06	7.66	7.52	6.61	9.33	8.06	8.18	9.08	8.96	8.93	8.58	9.26	12.41	12.82	15.23	14.80	11.88	9.40	9.95		
0.04	0.01	0.00	0.00	0.05	0.00	0.01	0.04	0.00	0.04	0.02	0.01	0.00	0.00	0.06	0.04	0.00	0.05	0.02	0.01	0.00	0.04	0.10	0.11	0.32	0.07	0.14	0.02	0.01		
7.52	7.52	7.88	7.64	7.61	7.77	7.64	7.28	7.54	7.72	6.48	5.64	6.21	6.59	5.28	5.78	6.01	5.72	5.43	5.74	4.90	5.75	1.98	2.53	0.68	0.53	0.96	3.98	4.34		
0.29	0.31	0.37	0.22	0.30	0.29	0.47	0.58	0.90	0.39	0.58	0.65	0.78	0.81	0.70	0.83	0.76	0.88	0.78	0.82	0.48	0.86	0.31	0.18	0.24	0.50	0.26	0.32	0.08		
0.00	0.00	0.00	0.06	0.00	0.00	0.11	0.00	0.17	0.17	0.00	0.22	0.22	0.00	0.17	0.00	0.00	0.22	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.17	0.17	0.22	0.22		
2.21	2.18	2.35	2.20	2.27	2.32	2.24	2.11	2.15	2.20	1.85	1.94	1.94	1.93	1.72	1.88	2.00	2.05	2.16	2.13	1.60	1.72	1.74	2.26	1.99	1.78	1.72	1.72	1.68		
0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.01	0.03	0.04	0.02	0.04	0.02	0.03	0.00	0.01	0.05	0.02	0.05	0.02	0.08	0.06	0.09	0.04	0.00	0.00		
0.05	0.02	0.06	0.02	0.01	0.08	0.00	0.00	0.01	0.00	0.16	0.18	0.13	0.19	0.06	0.17	0.16	0.13	0.10	0.20	0.08	0.11	0.20	0.00	0.11	0.00	0.11	0.00	0.03		
0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00		
3.63	3.67	3.60	3.61	3.66	3.59	3.62	3.63	3.56	3.64	3.56	3.53	3.56	3.55	3.61	3.49	3.54	3.56	3.55	3.48	3.59	3.61	3.42	3.57	3.45	3.47	3.43	3.58	3.66		
99.96	100.50	99.26	98.58	100.13	98.77	99.21	99.55	98.49	99.70	99.68	100.36	100.34	100.29	101.28	99.10	100.45	100.99	100.52	99.81	100.25	102.02	99.32	100.93	100.46	99.24	98.87	99.76	101.90		
0.02	0.01	0.02	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.07	0.08	0.05	0.08	0.02	0.07	0.07	0.05	0.04	0.08	0.03	0.05	0.08	0.00	0.05	0.00	0.05	0.00	0.01		
99.94	100.49	99.24	98.57	100.13	98.74	99.21	99.55	98.49	99.70	99.61	100.29	100.29	100.21	101.26	99.03	100.38	100.93	100.47	99.73	100.23	101.97	99.23	100.93	100.41	99.24	98.82	99.76	101.88		
6.06	6.14	6.07	6.10	6.05	6.01	6.16	6.13	6.13	6.11	6.02	6.05	6.01	6.11	6.04	6.07	5.99	6.04	5.99	6.06	6.12	6.02	6.00	6.03	5.86	5.82	6.01	6.11	6.05		
0.08	0.06	0.10	0.04	0.06	0.05	0.04	0.05	0.10	0.05	0.06	0.10	0.10	0.05	0.12	0.08	0.10	0.09	0.11	0.12	0.08	0.13	0.10	0.08	0.11	0.03	0.15	0.09	0.03		
6.26	6.30	6.20	6.30	6.27	6.33	6.16	6.15	5.93	6.21	6.49	6.39	6.32	6.30	6.25	6.27	6.29	6.20	6.30	6.12	6.40	6.18	6.61	6.44	6.63	6.88	6.87	6.48	6.51		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01		
0.75	0.69	0.69	0.68	0.75	0.68	0.76	0.87	0.93	0.73	0.84	1.06	1.04	0.91	1.29	1.13	1.13	1.26	1.25	1.25	1.19	1.27	1.77	1.80	2.17	2.13	1.71	1.32	1.36		
0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.02	0.05	0.01	0.02	0.00	0.00		
1.83	1.82	1.94	1.88	1.85	1.92	1.88	1.79	1.89	1.89	1.59	1.39	1.53	1.62	1.30	1.45	1.48	1.41	1.35	1.44	1.21	1.40	0.50	0.63	0.17	0.14	0.25	0.99	1.05		
0.05	0.05	0.07	0.04	0.05	0.05	0.08	0.10	0.16	0.07	0.10	0.12	0.14	0.14	0.12	0.15	0.14	0.16	0.14	0.15	0.09	0.15	0.06	0.03	0.04	0.09	0.05	0.06	0.01		
0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.01		
0.70	0.69	0.75	0.71	0.72	0.75	0.72	0.68	0.70	0.70	0.59	0.62	0.62	0.62	0.55	0.61	0.64	0.66	0.70	0.69	0.51	0.55	0.57	0.74	0.66	0.60	0.57	0.56	0.53		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.01	0.02	0.01	0.00	0.00		
0.02	0.01	0.03	0.01	0.00	0.04	0.00	0.00	0.00	0.00	0.08	0.09	0.07	0.10	0.03	0.09	0.08	0.07	0.05	0.11	0.04	0.06	0.11	0.00	0.06	0.00	0.06	0.00	0.02		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
6.06	6.14	6.07	6.10	6.05	6.01	6.16	6.13	6.13	6.11	6.02	6.05	6.01	6.11	6.04	6.07	5.99	6.04	5.99	6.06	6.12	6.02	6.00	6.03	5.86	5.82	6.01	6.11	6.05		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.14	0.18	0.00	0.00	0.00			
6.06	6.14	6.07	6.10	6.05	6.01	6.16	6.13	6.13	6.11	6.02	6.05	6.01	6.11	6.04	6.07	6.00	6.04	6.00	6.06	6.12	6.02	6.00	6.03	6.00	6.00	6.01	6.11	6.05		
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.93	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
0.26	0.30	0.20	0.30	0.27	0.33	0.16	0.15	0.00	0.21	0.49	0.39	0.32	0.30	0.25	0.27	0.27	0.20	0.28	0.12	0.40	0.18	0.61	0.44	0.49	0.69	0.87	0.48	0.51		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01		
0.08	0.06	0.10</																												

Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Ky	Ky	Ky	Ky
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	matrix	matrix	matrix	matrix
rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	rim	mantle	mantle	core	core	core	core	core	core	core	core	core	rim	rim	rim	rim
28	29	31	32	34	37	38	40	42	43	45	54	56	30	49	27	33	36	39	44	48	53	55	59	69	70	72	73	
36.65	36.30	36.60	36.44	36.71	35.78	36.28	36.76	36.38	35.96	36.16	35.87	36.48	36.15	36.92	34.60	35.41	35.91	35.47	35.50	35.79	34.81	36.34	37.42	36.73	36.71	36.44	36.44	
1.08	0.43	0.49	0.48	0.46	0.49	0.83	0.63	1.12	0.83	0.67	0.82	1.07	0.78	0.12	0.74	0.89	0.23	0.00	0.75	0.41	0.52	0.09	0.78	0.43	0.90	0.82	0.60	
31.38	32.31	32.22	33.16	33.40	31.89	31.70	32.74	33.34	34.09	32.70	32.31	31.70	32.90	34.26	32.84	33.87	33.54	32.66	33.46	33.79	34.07	34.13	30.89	32.58	31.65	32.01	31.95	
0.07	0.01	0.04	0.02	0.04	0.02	0.08	0.06	0.05	0.00	0.00	0.04	0.01	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.07	0.02	0.02	0.00	
10.50	10.44	10.50	10.52	10.51	10.41	10.41	10.51	10.49	10.38	10.38	10.45	10.63	10.42	10.73	10.28	10.47	10.33	10.16	10.40	10.50	10.33	10.37	10.51	10.62	10.55	10.50	10.47	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8.97	8.82	8.47	9.60	9.62	7.84	8.74	9.58	10.11	10.79	9.64	9.42	9.69	9.44	8.26	15.03	11.71	13.66	12.70	11.64	11.68	14.62	14.14	6.40	6.57	6.69	6.27	6.37	
8.97	8.82	8.47	9.60	9.62	7.84	8.74	9.58	10.11	10.79	9.64	9.42	9.69	9.44	8.26	15.03	11.71	13.66	12.70	11.64	11.68	14.62	14.14	6.40	6.57	6.69	6.27	6.37	
0.01	0.00	0.01	0.00	0.01	0.04	0.01	0.05	0.01	0.14	0.01	0.05	0.00	0.06	0.02	0.12	0.05	0.10	0.08	0.05	0.09	0.10	0.15	0.06	0.05	0.00	0.04	0.00	
5.76	5.40	5.76	4.61	4.19	6.35	5.53	4.56	3.71	2.47	4.21	5.16	6.04	4.35	5.52	1.45	3.06	1.38	2.04	2.98	3.25	3.02	0.60	7.31	7.14	7.24	7.07	7.02	
0.84	0.63	0.70	0.54	0.63	1.06	0.91	0.68	0.57	0.13	0.59	0.86	0.88	0.66	0.29	0.31	0.50	0.17	0.31	0.53	0.23	0.12	0.08	0.92	1.58	1.16	1.40	1.41	
0.17	0.00	0.28	0.00	0.17	0.00	0.28	0.00	0.06	0.17	0.00	0.00	0.33	0.06	0.00	0.06	0.00	0.00	0.17	0.00	0.17	0.06	0.17	0.50	0.00	0.11	0.28	0.22	
1.85	1.88	2.02	1.36	1.54	1.97	2.14	1.61	1.37	1.77	1.38	1.64	2.00	1.53	1.52	2.16	1.97	1.96	2.21	1.80	1.89	2.05	1.56	2.05	1.12	1.58	1.23	1.35	
0.00	0.01	0.03	0.00	0.00	0.01	0.02	0.01	0.01	0.03	0.02	0.00	0.01	0.00	0.00	0.03	0.04	0.08	0.06	0.03	0.04	0.04	0.04	0.05	0.09	0.08	0.04	0.01	
0.13	0.15	0.16	0.05	0.00	0.10	0.09	0.00	0.00	0.01	0.02	0.09	0.19	0.05	0.05	0.00	0.00	0.00	0.21	0.00	0.01	0.30	0.00	0.22	0.00	0.08	0.10	0.11	
0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	
3.55	3.53	3.55	3.60	3.62	3.54	3.55	3.62	3.61	3.57	3.57	3.56	3.57	3.57	3.67	3.54	3.61	3.56	3.40	3.58	3.61	3.42	3.57	3.52	3.66	3.60	3.57	3.56	
100.98	99.91	100.82	100.38	100.90	99.49	100.57	100.82	100.82	100.34	99.33	100.26	102.61	99.96	101.42	101.14	101.58	100.93	99.47	100.74	101.47	101.45	101.25	100.67	100.63	100.35	99.79	99.50	
0.06	0.06	0.07	0.02	0.00	0.04	0.04	0.00	0.00	0.00	0.01	0.04	0.08	0.02	0.02	0.00	0.00	0.00	0.09	0.00	0.01	0.13	0.00	0.09	0.00	0.04	0.04	0.05	
100.92	99.85	100.76	100.36	100.90	99.45	100.53	100.82	100.82	100.34	99.33	100.23	102.53	99.94	101.40	101.14	101.58	100.93	99.38	100.74	101.46	101.46	101.33	101.25	100.58	100.63	100.31	99.74	
6.07	6.04	6.06	6.02	6.07	5.98	6.05	6.08	6.03	6.02	6.06	5.96	5.96	6.03	5.98	5.85	5.88	6.04	6.07	5.94	5.93	5.86	6.09	6.19	6.01	6.05	6.03	6.05	
0.13	0.05	0.06	0.06	0.06	0.06	0.10	0.08	0.14	0.11	0.08	0.10	0.13	0.10	0.01	0.09	0.11	0.03	0.00	0.09	0.05	0.07	0.01	0.10	0.05	0.11	0.10	0.08	
6.12	6.34	6.28	6.46	6.51	6.28	6.23	6.38	6.51	6.73	6.46	6.33	6.11	6.47	6.54	6.55	6.62	6.65	6.58	6.59	6.75	6.74	6.02	6.28	6.14	6.58	6.25	6.25	
0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	
1.24	1.23	1.17	1.33	1.33	1.09	1.22	1.32	1.40	1.51	1.35	1.31	1.32	1.32	1.12	2.13	1.63	1.92	1.82	1.63	1.62	2.06	1.98	0.88	0.90	0.92	0.87	0.88	
0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.02	0.00	0.01	0.00	0.01	0.00	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.00	0.01	0.00	
1.42	1.34	1.42	1.13	1.03	1.58	1.37	1.12	0.92	0.62	1.05	1.28	1.47	1.08	1.33	0.36	0.76	0.35	0.52	0.74	0.80	0.26	0.15	1.80	1.74	1.78	1.74	1.71	
0.15	0.11	0.12	0.09	0.11	0.19	0.16	0.12	0.10	0.02	0.11	0.15	0.15	0.12	0.05	0.06	0.09	0.03	0.06	0.09	0.04	0.02	0.01	0.16	0.28	0.20	0.25	0.26	
0.01	0.00	0.02	0.00	0.01	0.00	0.02	0.00	0.00	0.01	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.03	0.00	0.01	0.02	0.01	
0.59	0.61	0.65	0.44	0.49	0.64	0.69	0.52	0.44	0.58	0.45	0.53	0.63	0.49	0.48	0.71	0.63	0.64	0.73	0.58	0.61	0.67	0.51	0.66	0.36	0.50	0.39	0.40	
0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.00	0.02	
0.07	0.08	0.08	0.02	0.00	0.05	0.05	0.00	0.00	0.00	0.01	0.05	0.10	0.03	0.03	0.00	0.00	0.00	0.11	0.00	0.01	0.16	0.00	0.11	0.00	0.04	0.05	0.06	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
6.07	6.04	6.06	6.02	6.07	5.98	6.05	6.08	6.03	6.02	6.06	5.96	5.96	6.03	5.98	5.85	5.88	6.04	6.07	5.94	5.93	5.86	6.09	6.19	6.01	6.05	6.03	6.05	
0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.02	0.15	0.12	0.00	0.00	0.06	0.07	0.14	0.00	0.00	0.00	0.00	0.00	0.00	
6.07	6.04	6.06	6.02	6.07	6.00	6.05	6.08	6.03	6.02	6.06	6.00	6.00	6.03	6.00	6.00	6.00	6.04	6.07	6.00	6.00	6.00	6.09	6.19	6.01	6.05	6.03	6.05	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.12	0.34	0.28	0.46	0.51	0.26	0.23	0.38	0.51	0.73	0.46	0.30	0.07	0.47	0.52	0.40	0.50	0.65	0.58	0.53	0.52	0.61	0.74	0.02	0.28	0.14	0.25	0.25	
0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	
0.13	0.05	0.06	0.06	0.06	0.06	0.10	0.08	0.14	0.11	0.08	0.10	0.13	0.10	0.01	0.09	0.11	0.03	0.00	0.09	0.05	0.07	0.01	0.10	0.05	0.11	0.10	0.08	
1.24	1.23	1.17	1.33	1.33																								

Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	FmI	FmI	FmI	FmI	FmI
Tur area1	Tur area1	Tur area1	Tur area1	Tur area1	Tur area1	Tur area1	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area2	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur area3	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	
core light	mantle	mantle1 dark	mantle2 light	mantle3 dark	rim dark	light core	light core	mantle	mantle	mantle	mantle	mantle	mantle	rim	rim	light core	mantle	mantle	mantle	mantle	mantle	mantle	mantle	mantle	mantle	mantle	mantle	rim	rim	rim	rim	rim		
14	29	2	3	4	5	48	80	49	50	76	77	78	79	51	127	128	129	130	131	132	133	134	135	136	604-38	604-39	604-40	604-43	604-43					
36.99	36.50	36.43	35.63	35.59	35.72	36.47	36.27	36.51	36.06	36.31	36.78	35.73	35.84	35.90	36.89	36.21	35.50	36.54	35.88	35.84	36.59	36.14	35.87	36.14	35.99	36.21	36.27	36.48						
0.30	0.62	0.43	0.42	0.49	0.44	0.85	0.79	0.57	0.37	0.61	0.61	0.38	0.32	0.39	0.16	0.31	0.55	0.57	0.85	0.32	0.37	0.28	0.30	0.47	0.82	1.21	0.67	1.07						
31.93	31.13	31.28	31.80	31.61	32.49	30.71	29.90	31.47	31.63	30.55	31.22	32.03	32.02	31.81	32.32	31.32	30.68	32.16	31.81	33.12	33.69	32.76	31.71	32.81	32.89	32.22	32.20	32.05						
0.01	0.01	0.00	0.02	0.00	0.00	0.02	0.04	0.01	0.05	0.00	0.02	0.03	0.00	0.01	0.00	0.05	0.02	0.04	0.00	0.02	0.02	0.03	0.00	0.02	0.03	0.05	0.00	0.05						
10.51	10.37	10.49	10.40	10.35	10.46	10.53	10.46	10.58	10.49	10.51	10.58	10.50	10.46	10.36	10.65	10.45	10.29	10.52	10.42	10.46	10.59	10.43	10.47	10.48	10.45	10.45	10.53	10.40						
0.00	0.00	0.00	0.00	0.00	0.00	0.22	1.14	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
10.47	5.76	7.11	9.08	8.30	8.35	9.04	9.33	7.22	9.44	9.22	7.30	9.56	8.25	7.66	9.02	6.76	8.79	8.87	8.02	7.51	6.73	7.24	8.91	7.35	9.45	10.53	10.41	10.61						
10.47	5.76	7.11	9.08	8.30	8.35	9.24	10.36	7.22	9.44	9.53	7.30	9.56	8.25	7.66	9.02	6.76	8.79	8.87	8.02	7.51	6.73	7.24	8.91	7.35	9.45	10.53	10.41	10.61						
0.00	0.01	0.00	0.00	0.01	0.06	0.00	0.00	0.03	0.01	0.00	0.03	0.00	0.00	0.03	0.06	0.00	0.06	0.00	0.00	0.06	0.02	0.00	0.00	0.01	0.08	0.25	0.13	0.07						
4.73	7.41	7.36	5.86	6.14	5.97	6.61	6.34	7.52	6.02	6.66	7.46	5.92	6.40	6.26	6.18	7.46	6.25	5.70	6.17	5.90	6.16	6.00	6.32	6.12	4.58	4.04	4.90	3.84						
0.16	1.34	1.55	1.76	1.45	1.42	1.12	0.23	1.29	1.66	1.15	1.23	1.62	1.39	1.48	0.69	1.22	1.76	1.35	1.78	1.48	1.25	1.35	1.42	1.57	0.56	0.41	0.91	0.46						
0.03	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.00	0.10	0.02	0.08	0.00	0.00	0.00	0.00	0.09	0.04	0.09	0.04	0.05	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
1.72	1.73	1.61	1.37	1.38	1.38	1.75	2.43	1.76	1.30	1.72	1.87	1.32	1.47	1.37	1.63	1.76	1.25	1.26	0.98	1.20	1.12	1.17	1.42	1.11	1.69	1.56	1.77	1.39						
0.02	0.03	0.02	0.03	0.00	0.02	0.04	0.01	0.02	0.03	0.01	0.02	0.01	0.01	0.02	0.02	0.05	0.03	0.00	0.01	0.00	0.05	0.04	0.00	0.00	0.03	0.03	0.07	0.02						
0.00	0.14	0.08	0.04	0.07	0.01	0.03	0.01	0.05	0.00	0.07	0.04	0.01	0.02	0.07	0.01	0.03	0.05	0.00	0.00	0.01	0.02	0.00	0.03	0.01	0.11	0.12	0.18	0.11						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
3.62	3.51	3.58	3.57	3.54	3.60	3.62	3.60	3.62	3.62	3.59	3.63	3.61	3.59	3.54	3.67	3.59	3.52	3.63	3.59	3.60	3.64	3.59	3.59	3.61	3.55	3.54	3.54	3.53						
100.49	98.60	99.94	99.98	98.91	99.96	101.00	100.43	100.64	100.77	100.73	100.86	100.72	99.78	98.89	101.29	99.29	98.79	100.71	99.55	99.56	100.28	100.03	99.70	100.22	100.62	101.58	100.25							
0.00	0.06	0.03	0.01	0.03	0.00	0.01	0.01	0.02	0.00	0.03	0.02	0.01	0.01	0.03	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.05	0.05	0.08	0.05						
100.49	98.54	99.90	99.97	98.89	99.95	100.99	100.42	100.62	100.77	100.69	100.85	100.72	99.77	98.85	101.29	99.28	98.77	100.71	99.55	99.56	100.27	99.02	100.01	99.69	100.17	100.57	101.50	100.21						
6.12	6.12	6.04	5.95	5.98	5.94	6.02	6.03	6.00	5.98	6.01	6.04	5.91	5.96	6.02	6.02	6.02	6.00	6.04	5.99	5.96	6.00	6.02	5.96	5.99	5.99	6.02	5.99	6.10						
0.04	0.08	0.05	0.05	0.06	0.06	0.11	0.10	0.07	0.05	0.08	0.07	0.05	0.04	0.05	0.02	0.04	0.07	0.07	0.11	0.04	0.05	0.03	0.04	0.06	0.10	0.15	0.08	0.13						
6.23	6.15	6.11	6.26	6.26	6.36	5.97	5.86	6.09	6.18	5.96	6.05	6.25	6.27	6.29	6.22	6.14	6.11	6.26	6.26	6.49	6.52	6.44	6.21	6.41	6.45	6.32	6.27	6.31						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01						
1.45	0.81	0.98	1.27	1.17	1.16	1.28	1.44	0.99	1.31	1.32	1.00	1.32	1.15	1.07	1.23	0.94	1.24	1.22	1.12	1.04	0.92	1.01	1.24	1.02	1.31	1.47	1.44	1.48						
0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.04	0.02	0.01							
1.17	1.85	1.82	1.46	1.54	1.48	1.63	1.57	1.84	1.49	1.64	1.83	1.46	1.58	1.56	1.50	1.85	1.57	1.40	1.53	1.46	1.51	1.49	1.56	1.51	1.13	1.00	1.20	0.96						
0.03	0.24	0.28	0.32	0.26	0.25	0.20	0.04	0.23	0.29	0.20	0.22	0.29	0.25	0.27	0.12	0.22	0.32	0.24	0.32	0.26	0.22	0.24	0.25	0.28	0.10	0.07	0.16	0.08						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01						
0.55	0.56	0.52	0.44	0.45	0.44	0.56	0.78	0.56	0.42	0.55	0.60	0.42	0.47	0.44	0.52	0.57	0.41	0.40	0.32	0.39	0.36	0.38	0.46	0.36	0.54	0.50	0.57	0.45						
0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.00						
0.00	0.07	0.04	0.02	0.04	0.01	0.01	0.01	0.02	0.00	0.04	0.02	0.01	0.01	0.04	0.00	0.01	0.03	0.00	0.00	0.00	0.01	0.00	0.02	0.01	0.06	0.06	0.09	0.06						
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00						
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00						
6.12	6.12	6.04	5.95	5.98	5.94	6.02	6.03	6.00	5.98	6.01	6.04	5.91	5.96	6.02	6.02	6.02	6.00	6.04	5.99	5.96	6.00	6.02	5.96	5.99	5.99	6.02	5.99	6.10						
0.00	0.00	0.00	0.05	0.02	0.06	0.00	0.00	0.00	0.02	0.00	0.00	0.09	0.04	0.00	0.00	0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.04	0.01	0.01	0.00	0.01	0.00						
6.12	6.12	6.04	6.00	6.00	6.00	6.02	6.03	6.00	6.00	6.01	6.04	6.00	6.00	6.02	6.02	6.00	6.00	6.04	6.00	6.00	6.00	6.02	6.00	6.00	6.00	6.02	6.00	6.10						
6.00	6.00	6.00	6.00	6.00	6.00	5.97	5.86	6.00	6.00	5.96	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00						
0.00	0.00	0.0																																

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Fml	Fml	Fml	Fml	Fml	Fml	Fml	Fml	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Ky	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	
Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	
rim	rim	core	core	core	core	core	core	rim	rim	rim	rim	rim	core	core	core	core	core	core	core	-c rim	+c rim	-c rim	rim	rim	rim	rim	rim	rim	
604-46	604-48	604-32	604-35	604-37	604-42	604-45	604-47	807-64	807-67	807-69	807-74	807-80	807-65	807-66	807-68	807-73	807-78	807-79	807-81	68	69	70	71	72	73	82	83	84	
36.40	36.85	36.59	36.73	36.10	36.19	36.65	36.35	36.24	36.44	36.21	36.50	36.80	36.50	36.33	36.62	36.35	37.08	36.48	36.44	36.89	36.96	36.83	36.87	36.51	36.51	35.55	37.25	36.73	
1.11	0.55	0.80	0.53	0.97	0.76	0.94	0.78	0.50	1.01	0.41	0.25	0.98	0.64	0.57	0.66	0.76	0.85	0.57	0.78	0.33	0.21	0.40	0.83	0.59	1.18	0.84	0.48	0.53	
32.07	31.80	31.90	32.27	31.42	31.86	32.07	31.44	33.01	33.46	33.24	33.35	32.73	33.16	33.44	31.25	33.03	31.78	32.82	32.50	32.62	33.38	32.23	32.09	31.80	31.71	32.39	32.55	32.55	
0.00	0.00	0.04	0.04	0.01	0.06	0.00	0.00	0.08	0.01	0.00	0.00	0.07	0.04	0.09	0.00	0.01	0.02	0.06	0.00	0.02	0.06	0.00	0.09	0.02	0.00	0.00	0.00	0.01	
10.41	10.45	10.48	10.48	10.41	10.31	10.52	10.40	10.52	10.69	10.57	10.58	10.61	10.60	10.57	10.45	10.53	10.54	10.58	10.60	10.49	10.54	10.45	10.53	10.40	10.49	10.47	10.45	10.41	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10.22	10.29	8.28	8.45	8.69	9.74	8.74	7.59	5.75	5.35	5.57	6.03	5.59	6.83	6.55	6.51	6.26	6.38	6.11	6.79	8.41	8.74	8.57	9.63	9.29	10.10	10.69	9.28	8.75	
10.22	10.29	8.28	8.45	8.69	9.74	8.74	7.59	5.75	5.35	5.57	6.03	5.59	6.83	6.55	6.51	6.26	6.38	6.11	6.79	8.41	8.74	8.57	9.63	9.29	10.10	10.69	9.28	8.75	
0.24	0.05	0.00	0.00	0.00	0.06	0.04	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.08	0.11	0.02	0.13	0.14	
4.07	4.59	5.84	5.49	5.82	4.33	5.54	6.32	6.98	7.49	7.28	6.92	7.17	6.49	6.36	7.25	6.54	6.99	7.10	7.01	5.31	4.78	5.27	4.98	5.03	4.86	4.72	4.26	4.61	
0.44	0.46	0.55	0.51	0.62	0.35	0.53	0.65	1.91	1.76	1.79	1.83	1.73	1.24	1.52	0.91	1.69	0.80	1.49	1.82	0.62	0.31	0.49	0.43	0.42	0.29	0.42	0.19	0.20	
0.01	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.01	0.00	0.03	0.03	0.00	0.13	0.00	0.00	0.08	0.00	0.00	0.08	0.00	0.03	0.00	0.00	0.04	0.00	0.04	0.08	
1.49	1.82	2.09	2.29	2.31	2.35	2.36	2.23	0.81	0.81	0.83	0.83	0.82	0.90	0.90	1.67	0.82	1.73	1.10	1.05	1.69	1.94	2.02	2.09	2.14	2.28	1.89	2.03	1.97	
0.06	0.05	0.05	0.01	0.03	0.02	0.00	0.03	0.07	0.07	0.07	0.09	0.05	0.04	0.05	0.06	0.02	0.04	0.05	0.05	0.06	0.04	0.06	0.07	0.04	0.04	0.05	0.07	0.03	
0.14	0.23	0.11	0.05	0.06	0.03	0.10	0.07	0.08	0.09	0.06	0.05	0.01	0.02	0.03	0.10	0.11	0.08	0.11	0.04	0.17	0.15	0.14	0.09	0.11	0.17	0.21	0.12	0.10	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	
3.52	3.49	3.56	3.59	3.56	3.54	3.58	3.55	3.59	3.64	3.62	3.63	3.65	3.65	3.63	3.55	3.58	3.59	3.59	3.59	3.63	3.54	3.56	3.53	3.59	3.53	3.54	3.51	3.54	3.54
100.17	100.70	100.29	100.44	99.99	99.61	101.06	99.41	99.61	100.83	99.65	100.09	100.28	100.10	100.16	99.05	99.75	99.96	100.07	100.71	100.22	100.68	100.08	101.28	99.96	101.28	100.79	100.34	99.66	
0.06	0.10	0.05	0.02	0.03	0.01	0.04	0.03	0.03	0.04	0.02	0.02	0.01	0.01	0.01	0.04	0.05	0.03	0.05	0.02	0.07	0.06	0.06	0.04	0.05	0.07	0.09	0.04	0.04	
100.11	100.60	100.25	100.42	99.96	99.60	101.02	99.38	99.57	100.80	99.63	100.07	100.28	100.09	100.15	99.01	99.70	99.93	100.02	100.69	100.15	100.61	100.02	101.24	99.91	101.21	100.70	100.29	99.62	
6.08	6.13	6.07	6.09	6.03	6.10	6.06	6.07	5.99	5.92	5.96	5.99	6.03	5.98	5.98	6.09	6.00	6.12	5.99	5.98	6.11	6.10	6.13	6.09	6.10	6.05	5.90	6.20	6.13	
0.14	0.07	0.10	0.07	0.12	0.10	0.12	0.10	0.06	0.12	0.05	0.03	0.12	0.08	0.07	0.08	0.09	0.11	0.07	0.10	0.04	0.03	0.05	0.10	0.07	0.15	0.10	0.06	0.07	
6.31	6.23	6.23	6.31	6.18	6.33	6.25	6.19	6.43	6.41	6.44	6.35	6.32	6.41	6.48	6.32	6.43	6.18	6.35	6.28	6.37	6.49	6.32	6.24	6.26	6.19	6.34	6.38	6.41	
0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
1.43	1.43	1.15	1.17	1.21	1.37	1.21	1.06	0.79	0.73	0.77	0.83	0.77	0.94	0.90	0.91	0.86	0.88	0.84	0.93	1.17	1.21	1.19	1.33	1.30	1.40	1.48	1.29	1.22	
0.03	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.02	0.02	
1.01	1.14	1.44	1.36	1.45	1.09	1.36	1.57	1.72	1.81	1.78	1.69	1.75	1.58	1.56	1.80	1.61	1.72	1.74	1.71	1.31	1.17	1.31	1.22	1.25	1.20	1.17	1.06	1.15	
0.08	0.08	0.10	0.09	0.11	0.06	0.09	0.12	0.34	0.31	0.32	0.32	0.30	0.22	0.27	0.16	0.30	0.14	0.26	0.32	0.11	0.05	0.09	0.08	0.08	0.05	0.07	0.03	0.04	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	
0.48	0.59	0.67	0.74	0.75	0.77	0.76	0.72	0.26	0.26	0.27	0.27	0.26	0.28	0.29	0.54	0.26	0.55	0.35	0.33	0.54	0.62	0.65	0.67	0.69	0.73	0.61	0.65	0.64	
0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	
0.07	0.12	0.06	0.03	0.03	0.01	0.05	0.04	0.04	0.04	0.03	0.03	0.01	0.01	0.01	0.05	0.06	0.04	0.06	0.02	0.09	0.08	0.07	0.05	0.06	0.09	0.11	0.06	0.05	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
6.08	6.13	6.07	6.09	6.03	6.10	6.06	6.07	5.99	5.92	5.96	5.99	6.03	5.98	5.98	6.09	6.00	6.12	5.99	5.98	6.11	6.10	6.13	6.09	6.10	6.05	5.90	6.20	6.13	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.08	0.04	0.01	0.00	0.02	0.02	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	
6.08	6.13	6.07	6.09	6.03	6.10	6.06	6.07	6.00	6.00	6.00	6.00	6.03	6.00	6.00	6.09	6.00	6.12	6.00	6.00	6.11	6.10	6.13	6.09	6.10	6.05	6.00	6.20	6.13	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.31	0.23	0.23	0.31	0.18	0.33	0.25	0.19	0.41	0.33	0.40	0.45	0.32	0.39	0.46	0.12	0.42	0.18	0.34	0.26	0.37	0.49	0.32	0.24	0.26	0.19	0.24	0.38	0.41	
0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
0.14	0.07	0.10	0.07	0.12	0.10	0.12	0.10	0.06	0.12	0.05	0.03	0.12	0.08	0.07	0.														

[illegible]

TK201211200

Grt	Grt	Grt	Grt	Grt	Grt	Grt	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St
Tur matrix	Tur matrix	Tur matrix	Tur Grt inc	Tur Grt inc	Tur Grt inc	Tur Grt inc	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur Grt inc	Tur Grt inc	
core 94	core 95	core 96	core 52	rim 54	rim 57	rim 58	rim 40	rim 43	rim 45	rim 46	rim 48	rim 50	rim 53	rim 54	rim 58	rim 59	rim 60	rim 64	rim 66	rim 68	rim 70	core 38	core 41	core 51	core 55	core 61	rim 15	rim 17	
36.32	36.58	36.88	36.06	36.60	35.89	34.72	36.39	36.11	36.52	36.28	36.26	36.68	35.34	36.16	36.74	36.54	36.17	36.41	36.57	36.99	36.77	37.19	36.69	36.54	36.50	36.25	37.10	36.08	
1.03	0.44	0.47	0.76	0.57	0.99	0.88	0.50	0.64	0.49	0.57	0.62	0.74	0.60	0.43	0.61	0.52	0.28	0.36	0.55	0.68	0.44	0.39	0.79	0.55	0.66	0.34	0.60	0.35	
31.08	31.94	32.39	31.77	32.07	30.49	33.53	31.94	32.47	32.26	32.37	32.90	32.71	32.71	32.41	32.69	32.16	31.68	32.39	32.49	32.90	33.20	32.11	32.47	30.77	30.43	30.85	31.61	30.59	
0.00	0.02	0.00	0.02	0.03	0.04	0.00	0.09	0.06	0.04	0.05	0.07	0.11	0.10	0.08	0.01	0.00	0.04	0.04	0.08	0.12	0.00	0.08	0.03	0.05	0.24	0.01	0.02	0.04	
10.41	10.41	10.51	10.36	10.50	10.39	10.36	10.51	10.52	10.57	10.44	10.54	10.58	10.36	10.41	10.53	10.58	10.42	10.51	10.52	10.62	10.63	10.56	10.51	10.41	10.41	10.42	10.52	10.31	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	
10.25	10.78	9.98	13.12	10.45	10.78	11.08	6.68	6.60	6.74	6.38	6.10	6.43	6.21	6.27	6.52	6.84	7.70	6.84	6.04	6.08	6.98	4.43	8.73	6.94	7.09	8.49	7.96	8.09	
10.25	10.78	9.98	13.12	10.45	10.78	11.08	6.68	6.60	6.74	6.38	6.10	6.43	6.21	6.27	6.52	6.84	7.70	6.84	6.04	6.08	6.98	4.43	8.73	6.94	7.16	8.49	7.96	8.09	
0.10	0.04	0.08	0.16	0.16	0.25	0.41	0.02	0.06	0.07	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.05	0.10	0.04	0.12	0.08	0.04	0.07	0.00	0.02	0.00	0.00	0.00	
5.00	4.18	4.61	2.80	4.66	5.24	3.31	7.14	6.90	7.08	6.62	6.94	6.75	6.60	6.61	6.52	7.19	6.51	6.79	6.93	6.84	6.42	8.05	5.26	7.21	7.23	6.70	6.26	6.55	
0.47	0.16	0.09	0.23	0.51	0.76	0.35	1.45	1.21	1.38	0.98	1.12	1.06	1.00	1.07	0.94	1.20	1.25	1.14	0.91	1.10	1.07	0.15	0.81	0.87	1.12	0.80	1.03	1.06	
0.11	0.07	0.13	0.02	0.06	0.07	0.08	0.00	0.00	0.00	0.03	0.10	0.16	0.00	0.02	0.03	0.00	0.00	0.04	0.08	0.05	0.00	0.06	0.00	0.00	0.00	0.02	0.02	0.00	
2.03	2.11	1.82	2.01	1.76	2.07	1.96	1.64	1.81	1.52	1.60	1.79	1.73	1.69	1.63	1.71	1.70	1.74	1.63	1.78	1.89	1.72	2.25	1.54	1.95	1.90	1.98	1.98	1.85	
0.04	0.07	0.02	0.00	0.03	0.02	0.03	0.02	0.02	0.02	0.03	0.01	0.03	0.03	0.03	0.05	0.00	0.04	0.04	0.04	0.03	0.03	0.02	0.00	0.02	0.03	0.00	0.03	0.00	
0.16	0.15	0.09	0.17	0.20	0.22	0.18	0.09	0.06	0.12	0.06	0.05	0.12	0.02	0.07	0.11	0.09	0.17	0.07	0.11	0.05	0.20	0.02	0.12	0.12	0.08	0.05	0.14	0.00	
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.51	3.52	3.58	3.49	3.53	3.47	3.49	3.58	3.60	3.59	3.57	3.61	3.59	3.56	3.55	3.58	3.60	3.51	3.59	3.59	3.61	3.64	3.55	3.61	3.53	3.53	3.56	3.60	3.49	
100.50	100.46	100.64	100.97	101.11	100.69	100.37	100.07	100.03	100.40	98.98	100.09	100.71	98.23	98.75	100.04	100.41	99.58	99.84	99.75	101.07	101.06	99.11	100.50	99.06	99.32	99.51	100.78	98.53	
0.07	0.06	0.04	0.07	0.08	0.09	0.08	0.04	0.02	0.05	0.03	0.02	0.05	0.01	0.03	0.05	0.04	0.07	0.03	0.03	0.05	0.02	0.08	0.01	0.05	0.05	0.03	0.02	0.06	
100.43	100.40	100.60	100.90	101.03	100.59	100.29	100.03	100.01	100.35	98.96	100.08	100.65	98.22	98.71	100.00	100.37	99.50	99.81	99.72	101.03	101.04	99.02	100.49	99.01	99.27	99.48	100.76	98.47	
6.07	6.11	6.10	6.05	6.05	6.01	5.82	6.02	5.97	6.01	6.04	5.98	6.02	5.93	6.04	6.06	6.01	6.03	6.02	6.04	6.05	6.01	6.12	6.06	6.10	6.10	6.04	6.13	6.08	
0.13	0.06	0.06	0.10	0.07	0.12	0.11	0.06	0.08	0.06	0.04	0.08	0.09	0.08	0.05	0.08	0.06	0.04	0.04	0.07	0.08	0.05	0.05	0.10	0.07	0.08	0.04	0.07	0.04	
6.12	6.28	6.31	6.28	6.25	6.01	6.63	6.22	6.32	6.25	6.35	6.39	6.33	6.47	6.38	6.36	6.23	6.23	6.31	6.33	6.34	6.40	6.23	6.33	6.05	5.99	6.06	6.15	6.08	
0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01	0.03	0.00	0.00	0.00	0.00	0.00	
1.43	1.51	1.38	1.84	1.45	1.51	1.55	0.92	0.91	0.93	0.89	0.84	0.88	0.87	0.88	0.90	0.94	1.07	0.95	0.83	0.83	0.95	0.61	1.21	0.97	1.00	1.18	1.10	1.14	
0.01	0.01	0.01	0.02	0.02	0.04	0.06	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	
1.24	1.04	1.14	0.70	1.15	1.31	0.83	1.76	1.70	1.74	1.64	1.71	1.65	1.65	1.64	1.60	1.76	1.62	1.67	1.71	1.67	1.56	1.97	1.30	1.79	1.80	1.66	1.54	1.65	
0.08	0.03	0.02	0.04	0.09	0.14	0.06	0.26	0.21	0.24	0.17	0.20	0.19	0.18	0.19	0.17	0.21	0.22	0.20	0.16	0.19	0.19	0.03	0.14	0.16	0.20	0.14	0.18	0.19	
0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0.66	0.68	0.58	0.65	0.56	0.67	0.64	0.53	0.58	0.49	0.52	0.57	0.55	0.55	0.53	0.55	0.54	0.56	0.52	0.57	0.60	0.55	0.72	0.49	0.63	0.61	0.64	0.63	0.60	
0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	
0.08	0.08	0.05	0.09	0.10	0.12	0.10	0.05	0.03	0.06	0.03	0.02	0.06	0.01	0.04	0.06	0.05	0.09	0.04	0.04	0.05	0.02	0.10	0.01	0.06	0.06	0.04	0.03	0.07	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	
6.07	6.11	6.10	6.05	6.05	6.01	5.82	6.02	5.97	6.01	6.04	5.98	6.02	5.93	6.04	6.06	6.01	6.03	6.02	6.04	6.05	6.01	6.12	6.06	6.10	6.10	6.04	6.13	6.08	
0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.03	0.00	0.00	0.02	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.07	6.11	6.10	6.05	6.05	6.01	6.00	6.02	6.00	6.01	6.04	6.00	6.02	6.00	6.04	6.06	6.01	6.03	6.02	6.04	6.05	6.01	6.12	6.06	6.10	6.10	6.04	6.13	6.08	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.12	0.28	0.31	0.28	0.25	0.01	0.45	0.22	0.29	0.25	0.35	0.37	0.33	0.39	0.38	0.36	0.23	0.23	0.31	0.33	0.34	0.40	0.23	0.33	0.05	0.00	0.06	0.15	0.08	
0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.02	0.00	0.01	0.00	0.01	0.03	0.00	0.00	0.00	
0.13	0.06	0.06	0.10	0.07	0.12	0.11	0.06	0.08	0.06	0.07	0.08	0.09	0.08	0.05	0.08	0.06	0.04	0.04	0.07	0.08	0.05	0.05	0.10	0.07	0.08	0.04	0.07	0.04	
1.43	1.51	1.38	1.84																										

TK2013112109B

St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	St	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc
rim	rim	rim	rim	rim	rim	rim	core	core	core	core	core	core	core	core	core	core	core	core	rim	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc	Grt inc
19	20	22	27	28	31	36	16	18	21	25	26	29	32	35	37	98-34	98-35	98-36	98-37	98-38	98-39	98-40	98-41	98-42	98-6	98-7	98-16	98-17	
36.23	36.77	36.58	36.09	35.64	36.22	36.10	36.44	36.61	35.51	36.36	34.98	36.04	36.19	36.68	36.45	35.47	36.33	36.73	36.84	35.54	36.48	36.00	35.95	35.81	36.17	35.84	36.08	34.75	
0.60	0.36	0.62	0.69	0.63	0.27	0.44	0.34	0.66	1.06	0.57	1.16	1.05	0.53	0.50	0.42	0.41	0.64	0.68	0.00	0.75	0.66	0.80	0.73	0.42	0.59	0.55	0.46	0.74	
31.60	31.28	31.41	30.21	29.81	30.74	30.57	32.34	33.11	31.29	30.58	31.95	28.59	30.44	30.52	30.66	34.66	30.64	31.00	32.46	32.77	30.77	30.13	31.01	32.06	31.01	31.12	31.31	31.16	
0.09	0.05	0.07	0.05	0.03	0.10	0.06	0.08	0.04	0.04	0.09	0.00	0.10	0.10	0.08	0.05	0.00	0.09	0.08	0.00	0.00	0.04	0.00	0.07	0.07	0.02	0.02	0.04	0.02	
10.57	10.38	10.43	10.34	10.24	10.32	10.41	10.41	10.48	10.18	10.32	10.10	10.17	10.39	10.38	10.32	10.44	10.42	10.48	10.45	10.40	10.51	10.39	10.43	10.47	10.44	10.39	10.38	10.27	
0.00	0.00	0.00	0.11	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
8.74	7.93	7.95	8.11	9.08	8.02	9.05	8.45	8.69	11.30	8.29	12.95	9.60	8.97	10.37	10.14	13.78	10.71	10.98	10.34	12.22	11.00	10.49	10.33	9.46	10.85	10.33	10.42	13.84	
8.74	7.93	7.95	8.21	9.34	8.02	9.05	8.45	8.69	11.30	8.29	12.95	11.28	8.97	10.37	10.14	13.78	10.71	10.98	10.34	12.22	11.02	10.49	10.33	9.46	10.85	10.33	10.42	13.84	
0.00	0.00	0.07	0.04	0.02	0.08	0.04	0.08	0.04	0.04	0.07	0.13	0.00	0.01	0.03	0.06	0.06	0.00	0.10	0.15	0.20	0.13	0.00	0.06	0.04	0.00	0.14	0.01	0.05	
6.66	6.01	6.19	6.76	6.23	6.44	6.54	5.25	4.67	3.46	6.15	1.80	5.17	6.44	5.26	5.08	1.26	5.38	4.89	4.25	3.11	5.45	5.64	5.50	5.68	5.29	5.35	5.06	3.32	
1.18	0.70	0.67	0.87	0.88	0.90	0.90	0.55	0.52	0.34	0.63	0.89	0.24	0.74	0.37	0.30	0.20	1.12	0.34	0.24	0.28	1.23	1.77	1.55	1.64	0.77	1.44	0.80	1.51	
0.00	0.00	0.00	0.12	0.00	0.02	0.07	0.08	0.00	0.00	0.04	0.02	0.00	0.11	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.14	0.00	0.00	
1.90	2.11	2.01	2.16	2.12	2.04	2.10	1.81	1.64	2.12	2.10	1.77	2.42	2.11	2.19	2.23	1.89	1.57	2.02	1.65	2.00	1.68	1.37	1.23	1.15	1.71	1.48	1.68	1.52	
0.04	0.02	0.02	0.02	0.01	0.01	0.03	0.00	0.01	0.06	0.03	0.05	0.03	0.00	0.03	0.02	0.05	0.05	0.02	0.03	0.03	0.01	0.02	0.04	0.04	0.02	0.03	0.01	0.04	
0.13	0.09	0.13	0.04	0.06	0.10	0.08	0.03	0.05	0.00	0.05	0.00	0.00	0.19	0.04	0.00	0.00	0.04	0.02	0.00	0.00	0.12	0.05	0.09	0.04	0.08	0.03	0.01	0.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	
3.58	3.54	3.54	3.54	3.50	3.51	3.55	3.58	3.59	3.51	3.53	3.48	3.51	3.49	3.56	3.56	3.60	3.57	3.60	3.59	3.62	3.52	3.57	3.57	3.58	3.54	3.57	3.54	3.54	
101.32	99.22	99.68	99.15	98.51	98.79	99.91	99.43	100.09	98.91	98.79	99.27	98.61	99.72	100.06	99.26	101.82	100.56	100.94	100.00	100.90	101.61	100.68	100.52	100.50	100.49	100.43	99.83	100.75	
0.05	0.04	0.05	0.02	0.03	0.04	0.03	0.01	0.02	0.00	0.02	0.00	0.00	0.08	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.05	0.02	0.04	0.02	0.03	0.01	0.00	0.00	
101.27	99.19	99.62	99.13	98.49	98.75	99.88	99.42	100.08	98.91	98.77	99.27	98.61	99.63	100.04	99.26	101.82	100.54	100.93	100.00	100.90	101.61	100.63	100.50	100.46	100.47	100.40	99.82	100.75	
5.96	6.16	6.09	6.07	6.05	6.10	6.03	6.08	6.07	6.06	6.12	6.02	6.16	6.06	6.14	6.14	5.91	6.06	6.09	6.13	5.94	6.03	6.02	5.99	5.94	6.02	5.99	6.04	5.88	
0.07	0.05	0.08	0.09	0.08	0.03	0.05	0.04	0.08	0.14	0.07	0.15	0.14	0.07	0.06	0.05	0.05	0.08	0.08	0.00	0.09	0.08	0.10	0.09	0.05	0.07	0.07	0.06	0.09	
6.12	6.18	6.17	5.99	5.96	6.10	6.02	6.48	6.47	6.36	6.07	6.48	5.76	6.00	6.02	6.09	6.80	6.02	6.06	6.36	6.45	6.00	5.94	6.09	6.27	6.08	6.14	6.16	6.22	
0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.00	
1.20	1.11	1.11	1.15	1.33	1.13	1.26	1.18	1.21	1.61	1.17	1.86	1.61	1.25	1.45	1.43	1.92	1.49	1.52	1.44	1.71	1.52	1.53	1.44	1.31	1.51	1.45	1.46	1.96	
0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.00	0.00	0.00	0.01	0.01	0.00	0.01	0.02	0.03	0.02	0.00	0.01	0.01	0.00	0.02	0.00	0.01	
1.63	1.50	1.54	1.69	1.58	1.62	1.63	1.31	1.15	0.88	1.54	0.46	1.32	1.61	1.31	1.27	0.31	1.34	1.21	1.05	0.78	1.34	1.41	1.37	1.41	1.31	1.33	1.26	0.84	
0.21	0.13	0.12	0.16	0.16	0.16	0.16	0.10	0.09	0.06	0.11	0.16	0.04	0.13	0.07	0.05	0.04	0.20	0.06	0.04	0.05	0.22	0.32	0.28	0.29	0.14	0.26	0.14	0.27	
0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	
0.61	0.68	0.65	0.70	0.70	0.67	0.68	0.59	0.53	0.70	0.69	0.59	0.80	0.68	0.71	0.73	0.61	0.51	0.65	0.53	0.65	0.54	0.44	0.40	0.37	0.55	0.48	0.54	0.50	
0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.01	
0.07	0.05	0.07	0.02	0.03	0.05	0.04	0.01	0.02	0.00	0.03	0.00	0.00	0.10	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.06	0.02	0.05	0.02	0.04	0.02	0.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
5.96	6.16	6.09	6.07	6.05	6.10	6.03	6.08	6.07	6.06	6.12	6.02	6.16	6.06	6.14	6.14	5.91	6.06	6.09	6.13	5.94	6.03	6.02	5.99	5.94	6.02	5.99	6.04	5.88	
0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.06	0.00	0.00	0.01	0.06	0.00	0.01	0.00	0.12	
6.00	6.16	6.09	6.07	6.05	6.10	6.03	6.08	6.07	6.06	6.12	6.02	6.16	6.06	6.14	6.14	6.00	6.06	6.09	6.13	6.00	6.03	6.02	6.00	6.00	6.02	6.00	6.04	6.00	
6.00	6.00	6.00	5.99	5.96	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.76	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.94	6.00	6.00	6.00	6.00	6.00	6.00	
0.00	0.00	0.00	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.08	0.18	0.17	0.00	0.00	0.10	0.02	0.36	0.47	0.30	0.07	0.48	0.00	0.00	0.02	0.09	0.71	0.02	0.06	0.36	0.39	0.00	0.00	0.08	0.22	0.08	0.13	0.18	0.10	
0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.01	0.00	0.	

Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky	Su/Ky
Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur	Tur
Grt inc	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix
core	core	core	core	core	core	core	core	core	core	core	mantle	mantle	mantle	inner mantle	outer mantle	inner mantle	outer mantle	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix	matrix
9B-18	9B-11	9B-25	9B-33	9B-43	9B-44	9B-48	9B-55	9B-56	9B-59	9B-23	9B-24	9B-45	9B-47	9B-49	9B-12	9B-13	9B-9	9B-10	9B-31	9B-29	9B-28	9B-8	9B-14	9B-26	9B-27	9B-30	9B-32	9B-50		
36.14	34.03	36.50	35.89	35.22	36.08	36.74	36.14	36.28	36.23	35.58	35.98	36.00	36.42	36.24	35.91	36.09	36.34	36.78	35.63	35.83	35.94	36.25	35.12	35.30	36.44	36.44	36.50	36.54		
0.24	0.96	0.52	0.44	1.05	0.69	0.44	0.63	0.30	0.38	0.83	0.27	0.45	0.64	1.14	0.49	0.72	0.54	0.36	0.24	0.82	0.82	0.61	0.89	0.56	0.14	0.37	0.94	0.86		
31.69	34.30	30.02	31.82	31.27	31.46	31.12	32.43	31.72	31.71	31.63	31.48	32.53	31.64	29.77	30.67	32.42	31.74	32.15	30.81	31.61	32.08	32.54	31.58	31.47	32.51	32.52	32.05	32.36		
0.00	0.02	0.02	0.01	0.00	0.02	0.00	0.03	0.00	0.00	0.09	0.02	0.03	0.87	0.01	0.02	0.08	0.02	0.04	0.02	0.03	0.03	0.06	0.01	0.03	0.00	0.00	0.00	0.00		
10.39	10.17	10.38	10.40	10.42	10.45	10.34	10.50	10.43	10.46	10.43	10.28	10.38	10.38	10.32	10.32	10.47	10.49	10.46	10.38	10.47	10.56	10.52	10.33	10.29	10.53	10.41	10.51	10.60		
0.00	0.00	0.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
10.51	12.97	10.51	8.15	10.78	10.49	11.30	7.49	10.53	10.65	9.02	9.51	8.38	5.85	10.51	10.05	7.24	10.40	10.24	10.80	10.20	8.57	7.52	8.60	8.84	7.54	6.35	7.25	7.94		
10.51	12.97	11.04	8.15	10.78	10.49	11.30	7.49	10.53	10.65	9.02	9.51	8.38	5.85	11.17	10.05	7.24	10.40	10.24	10.80	10.20	8.57	7.52	8.60	8.84	7.54	6.35	7.25	7.94		
0.10	0.07	0.00	0.02	0.00	0.00	0.00	0.06	0.00	0.05	0.07	0.00	0.13	0.03	0.05	0.04	0.00	0.06	0.01	0.04	0.01	0.09	0.01	0.00	0.01	0.00	0.00	0.00	0.00		
4.79	1.13	5.40	6.18	5.41	5.18	4.06	6.37	4.94	5.01	5.93	4.99	5.21	6.56	5.04	5.49	6.29	5.11	4.54	5.60	5.43	6.45	6.24	6.03	5.76	6.54	6.37	6.51	6.39		
0.96	0.40	0.65	1.43	1.29	1.12	0.13	1.10	0.81	0.86	1.46	0.85	1.10	0.58	0.65	1.83	1.24	1.35	0.33	1.69	1.76	1.08	1.04	1.43	1.35	1.39	1.15	1.23	1.33		
0.02	0.02	0.03	0.00	0.00	0.00	0.04	0.00	0.00	0.02	0.00	0.10	0.00	0.00	0.09	0.02	0.00	0.07	0.00	0.00	0.04	0.02	0.06	0.00	0.07	0.00	0.00	0.16	0.05		
1.50	1.88	2.02	1.22	1.50	1.41	2.08	1.68	1.63	1.50	1.67	1.51	1.12	2.15	1.97	1.20	1.44	1.35	1.75	1.27	1.10	1.79	1.55	1.76	1.66	1.28	1.24	1.62	1.43		
0.02	0.05	0.03	0.06	0.04	0.04	0.03	0.02	0.00	0.07	0.04	0.06	0.03	0.03	0.03	0.04	0.07	0.05	0.02	0.02	0.04	0.02	0.03	0.06	0.07	0.02	0.06	0.03	0.06		
0.01	0.00	0.03	0.05	0.05	0.05	0.00	0.07	0.09	0.04	0.05	0.05	0.07	0.42	0.04	0.04	0.08	0.06	0.00	0.07	0.11	0.03	0.02	0.05	0.08	0.07	0.13	0.04	0.07		
0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01		
3.58	3.51	3.56	3.56	3.57	3.58	3.56	3.59	3.56	3.59	3.57	3.52	3.54	3.38	3.54	3.54	3.57	3.58	3.61	3.54	3.56	3.63	3.61	3.54	3.51	3.60	3.53	3.60	3.62		
99.94	99.51	100.20	99.24	100.59	100.56	99.84	100.10	100.28	100.54	100.36	98.63	98.95	98.95	100.05	99.65	99.70	101.17	100.28	100.11	101.01	101.02	100.14	99.40	99.00	100.06	98.56	100.44	101.25		
0.00	0.00	0.01	0.02	0.02	0.02	0.00	0.03	0.04	0.02	0.02	0.02	0.03	0.17	0.02	0.02	0.03	0.03	0.00	0.03	0.05	0.01	0.01	0.02	0.03	0.03	0.05	0.02	0.03		
99.93	99.51	100.18	99.22	100.57	100.54	99.84	100.07	100.25	100.53	100.34	98.61	98.92	98.77	100.04	99.63	99.67	101.14	100.28	100.08	100.96	101.01	100.13	99.37	98.97	100.03	98.50	100.43	101.22		
6.04	5.81	6.11	6.00	5.87	6.00	6.17	5.98	6.04	6.02	5.93	6.08	6.03	6.10	6.10	6.05	5.99	6.02	6.11	5.97	5.95	5.91	5.99	5.91	5.96	6.01	6.08	6.03	5.99		
0.03	0.12	0.06	0.06	0.13	0.09	0.06	0.08	0.04	0.05	0.10	0.03	0.06	0.10	0.14	0.06	0.09	0.07	0.04	0.03	0.10	0.10	0.08	0.11	0.07	0.02	0.05	0.12	0.11		
6.25	6.91	5.93	6.27	6.15	6.17	6.16	6.32	6.23	6.21	6.21	6.27	6.42	6.25	5.91	6.09	6.34	6.20	6.29	6.08	6.18	6.22	6.04	6.26	6.26	6.32	6.40	6.24	6.25		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00		
1.47	1.85	1.55	1.14	1.50	1.46	1.59	1.04	1.47	1.48	1.26	1.34	1.17	0.82	1.57	1.42	1.00	1.44	1.42	1.51	1.42	1.18	1.04	1.21	1.25	1.04	0.89	1.00	1.09		
0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.01	0.00	0.02	0.00	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00		
1.19	0.29	1.35	1.54	1.34	1.28	1.02	1.57	1.23	1.24	1.47	1.26	1.30	1.64	1.27	1.38	1.56	1.26	1.12	1.40	1.34	1.58	1.54	1.51	1.45	1.61	1.58	1.60	1.56		
0.17	0.07	0.12	0.26	0.23	0.20	0.02	0.19	0.14	0.15	0.26	0.15	0.20	0.10	0.12	0.33	0.22	0.24	0.06	0.30	0.31	0.19	0.18	0.26	0.24	0.25	0.21	0.22	0.23		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00		
0.49	0.62	0.65	0.40	0.49	0.45	0.68	0.54	0.52	0.48	0.54	0.50	0.36	0.70	0.64	0.39	0.46	0.43	0.56	0.41	0.35	0.57	0.50	0.57	0.54	0.41	0.40	0.52	0.45		
0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.01	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01		
0.00	0.00	0.02	0.03	0.02	0.03	0.00	0.04	0.05	0.02	0.03	0.03	0.04	0.22	0.02	0.02	0.04	0.03	0.00	0.04	0.06	0.02	0.01	0.03	0.04	0.04	0.07	0.02	0.04		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00		
6.04	5.81	6.11	6.00	5.87	6.00	6.17	5.98	6.04	6.02	5.93	6.08	6.03	6.10	6.10	6.05	5.99	6.02	6.11	5.97	5.95	5.91	5.99	5.91	5.96	6.01	6.08	6.03	5.99		
0.00	0.19	0.00	0.00	0.13	0.00	0.00	0.02	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.03	0.05	0.09	0.01	0.09	0.04	0.00	0.00	0.00	0.01		
6.04	6.00	6.11	6.00	6.00	6.00	6.17	6.00	6.04	6.02	6.00	6.08	6.03	6.10	6.10	6.05	6.00	6.02	6.11	6.00	6.00	6.00	6.00	6.00	6.00	6.01	6.08	6.03	6.00		
6.00	6.00	5.93	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.91	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00		
0.25	0.72	0.00	0.26	0.02	0.17	0.16	0.30	0.23	0.21	0.14	0.27	0.42	0.25	0.00	0.09	0.34	0.20	0.29	0.05	0.13	0.13	0.33	0.17	0.23	0.32	0.40	0.24	0.24		
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.12	0.00	0.00	0.01	0.00	0.00	0.00	0.00										

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St/Ky	St/Ky	St/Ky	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt	Grt
Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix	Tur matrix
rim	rim	rim	core	core	core	core	core	core	core	core	core	core	core	core	inner mantle	inner mantle	outer mantle	inner mantle	outer mantle	inner mantle	outer mantle	mantle	mantle	mantle	mantle	inner mantle	inner mantle	outer mantle	604-83
9B-57	9B-58	9B-60	604-50	604-51	604-59	604-61	604-63	604-69	604-74	604-79	604-85	604-88	604-93	604-96	604-52	604-53	604-54	604-56	604-57	604-64	604-66	604-68	604-71	604-73	604-75	604-77	604-80	604-82	604-83
36.55	37.19	36.12	35.29	35.43	35.84	36.68	35.87	36.28	36.23	36.15	35.82	36.04	36.10	40.31	36.44	36.47	36.18	36.21	36.63	37.24	36.58	36.69	36.38	35.95	36.51	36.27	36.77	36.11	
0.45	1.16	0.56	0.20	0.72	0.20	0.41	1.03	0.69	1.26	0.84	0.43	0.01	0.80	0.28	1.38	0.90	1.29	1.11	1.23	0.95	0.52	0.33	1.23	0.92	0.60	0.66	0.84	0.55	
32.75	33.03	32.45	33.41	31.73	33.60	33.53	33.26	33.68	33.33	32.57	32.58	34.94	32.91	29.92	31.19	32.02	30.59	31.07	30.97	31.92	33.01	32.79	31.38	31.62	31.83	30.79	32.61	32.62	
0.01	0.04	0.08	0.00	0.00	0.00	0.03	0.02	0.01	0.03	0.04	0.00	0.00	0.00	0.00	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.03	0.01	0.00	0.05	0.00	0.03	0.03	
10.53	10.72	10.49	10.25	10.24	10.36	10.52	10.45	10.49	10.51	10.30	10.24	10.39	10.38	10.46	10.41	10.45	10.34	10.40	10.41	10.55	10.45	10.49	10.45	10.38	10.29	10.31	10.46	10.36	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
7.69	7.41	7.72	13.31	15.05	13.15	7.40	12.04	6.01	6.43	7.31	14.47	8.77	10.40	9.22	11.02	11.13	10.93	11.38	10.82	11.29	10.56	11.31	11.60	11.55	10.19	10.86	10.83	10.51	
7.69	7.41	7.72	13.31	15.05	13.15	7.40	12.04	6.01	6.43	7.31	14.47	8.77	10.40	10.25	11.02	11.13	10.93	11.38	10.82	11.29	10.56	11.31	11.60	11.55	10.19	10.86	10.83	10.51	
0.00	0.00	0.04	0.14	0.05	0.01	0.00	0.11	0.11	0.06	0.00	0.08	0.14	0.04	0.07	0.00	0.06	0.09	0.02	0.01	0.04	0.05	0.01	0.00	0.03	0.07	0.00	0.00	0.10	
5.99	6.25	6.20	1.63	1.58	1.90	5.40	2.78	6.00	5.94	5.12	1.09	3.38	3.62	3.95	4.28	4.01	4.60	4.40	4.53	4.04	3.64	3.69	4.15	4.04	3.81	4.59	3.61	3.74	
1.35	1.25	1.25	0.28	0.42	0.33	0.34	0.31	0.60	1.00	0.48	0.23	0.42	0.17	0.11	0.41	0.26	0.42	0.50	0.40	0.28	0.24	0.21	0.42	0.52	0.12	0.40	0.11	0.33	
0.00	0.01	0.08	0.02	0.11	0.03	0.05	0.00	0.00	0.01	0.05	0.02	0.00	0.05	0.04	0.00	0.03	0.03	0.02	0.00	0.07	0.03	0.07	0.04	0.00	0.03	0.03	0.00	0.07	
1.22	1.26	1.51	1.80	2.10	1.69	1.94	1.88	1.93	1.65	1.65	2.00	1.59	1.94	1.82	1.93	1.98	1.98	1.99	1.95	2.05	1.67	1.84	2.16	2.00	1.79	2.05	1.72	1.71	
0.07	0.03	0.06	0.03	0.03	0.05	0.10	0.05	0.06	0.07	0.04	0.09	0.02	0.06	0.03	0.03	0.03	0.05	0.06	0.02	0.03	0.05	0.04	0.03	0.01	0.04	0.03	0.04	0.04	
0.09	0.08	0.11	0.22	0.36	0.04	0.29	0.31	0.31	0.17	0.08	0.07	0.12	0.38	0.06	0.13	0.12	0.14	0.13	0.20	0.05	0.11	0.07	0.14	0.14	0.08	0.15	0.07	0.11	
0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
3.59	3.66	3.57	3.43	3.36	3.55	3.49	3.46	3.47	3.54	3.51	3.50	3.52	3.40	3.58	3.53	3.55	3.50	3.52	3.50	3.61	3.55	3.59	3.54	3.52	3.51	3.48	3.57	3.52	
100.28	102.09	100.22	100.00	101.16	100.76	100.16	101.55	99.63	100.22	98.15	100.61	99.35	100.25	100.88	100.75	101.00	100.13	100.80	100.68	102.13	100.45	101.15	101.53	100.67	98.92	99.62	100.68	99.80	
0.04	0.03	0.05	0.09	0.15	0.02	0.12	0.13	0.13	0.07	0.03	0.03	0.05	0.16	0.02	0.05	0.05	0.06	0.05	0.08	0.02	0.04	0.03	0.06	0.06	0.03	0.06	0.03	0.04	
100.24	102.06	100.18	99.91	101.01	100.75	100.04	101.42	99.50	100.15	98.11	100.58	99.30	100.09	100.86	100.70	100.95	100.07	100.75	100.60	102.11	100.40	101.12	101.47	100.61	98.89	99.56	100.65	99.75	
6.03	6.03	5.98	5.98	6.02	6.01	6.06	5.97	6.01	5.99	6.10	6.08	6.03	6.04	6.70	6.09	6.06	6.08	6.05	6.11	6.13	6.09	6.08	6.05	6.02	6.17	6.11	6.11	6.06	
0.06	0.14	0.07	0.03	0.09	0.03	0.05	0.13	0.09	0.16	0.11	0.06	0.00	0.10	0.04	0.17	0.11	0.16	0.14	0.15	0.12	0.06	0.04	0.15	0.12	0.08	0.08	0.10	0.07	
6.37	6.31	6.33	6.68	6.35	6.64	6.53	6.52	6.58	6.49	6.47	6.52	6.89	6.49	5.86	6.14	6.27	6.06	6.12	6.09	6.20	6.47	6.40	6.15	6.24	6.34	6.12	6.38	6.45	
0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	
1.06	1.00	1.07	1.89	2.14	1.84	1.02	1.67	0.83	0.89	1.03	2.05	1.23	1.46	1.42	1.54	1.55	1.54	1.59	1.51	1.55	1.47	1.57	1.61	1.62	1.44	1.53	1.50	1.47	
0.00	0.00	0.01	0.02	0.01	0.00	0.00	0.02	0.02	0.01	0.00	0.01	0.02	0.01	0.01	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.01	
1.47	1.51	1.53	0.41	0.40	1.33	0.69	1.48	1.46	1.29	0.28	0.84	0.90	0.98	1.06	0.99	1.15	1.09	1.13	0.99	0.90	0.91	1.03	1.01	0.96	1.15	0.89	0.93	0.93	
0.24	0.22	0.22	0.05	0.08	0.06	0.06	0.05	0.11	0.18	0.09	0.04	0.08	0.03	0.02	0.07	0.05	0.08	0.09	0.07	0.05	0.04	0.04	0.08	0.09	0.02	0.07	0.02	0.06	
0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
0.39	0.40	0.48	0.59	0.69	0.55	0.62	0.61	0.62	0.53	0.54	0.66	0.51	0.63	0.58	0.62	0.64	0.64	0.64	0.63	0.65	0.54	0.59	0.69	0.65	0.59	0.67	0.55	0.56	
0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.02	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.01	
0.05	0.04	0.06	0.12	0.19	0.02	0.15	0.16	0.16	0.09	0.04	0.04	0.06	0.20	0.03	0.07	0.06	0.07	0.07	0.10	0.03	0.06	0.04	0.07	0.07	0.04	0.08	0.04	0.06	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
6.03	6.03	5.98	5.98	6.02	6.01	6.06	5.97	6.01	5.99	6.10	6.08	6.03	6.04	6.70	6.09	6.06	6.08	6.05	6.11	6.13	6.09	6.08	6.05	6.02	6.17	6.11	6.11	6.06	
0.00	0.00	0.02	0.02	0.00	0.00	0.00	0.03	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.03	6.03	6.00	6.00	6.02	6.01	6.06	6.00	6.01	6.00	6.10	6.08	6.03	6.04	6.70	6.09	6.06	6.08	6.05	6.11	6.13	6.09	6.08	6.05	6.02	6.17	6.11	6.11	6.06	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	5.86	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00	
0.37	0.31	0.32	0.66	0.35	0.64	0.53	0.49	0.58	0.48	0.47	0.52	0.89	0.49	0.00	0.14	0.27	0.06	0.12	0.09	0.20	0.47	0.40	0.15	0.24	0.34	0.12	0.38	0.45	
0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.																						

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Grt	Grt	FmI	FmI	FmI
Tur	Tur	Tur	Tur	Tur
Grt inc	Grt inc	matrix	matrix	matrix
		rim	rim	core
604-109	604-111	201A-127	201A-126	201A-128
36.62	36.10	36.26	35.98	36.34
0.92	0.66	1.08	1.61	0.70
32.48	32.75	32.44	31.85	31.93
0.00	0.02	0.10	0.26	0.07
10.50	10.36	10.50	10.46	10.46
0.00	0.00	0.00	0.00	0.00
10.33	9.85	8.11	7.97	8.49
10.33	9.85	8.11	7.97	8.49
0.15	0.06	0.13	0.00	0.00
4.21	3.95	5.58	5.84	5.79
0.55	0.44	0.72	0.71	0.80
0.11	0.00	0.00	0.00	0.04
1.73	1.75	2.04	2.06	2.12
0.02	0.07	0.05	0.06	0.05
0.08	0.07	0.08	0.03	0.04
0.00	0.00	0.00	0.00	0.01
3.58	3.54	3.58	3.59	3.58
101.28	99.62	100.67	100.42	100.42
0.04	0.03	0.03	0.02	0.02
101.24	99.59	100.64	100.41	100.40
6.06	6.06	6.00	5.98	6.04
0.11	0.08	0.13	0.20	0.09
6.34	6.48	6.33	6.24	6.25
0.00	0.00	0.01	0.03	0.01
1.43	1.38	1.12	1.11	1.18
0.02	0.01	0.02	0.00	0.00
1.04	0.99	1.38	1.45	1.43
0.10	0.08	0.13	0.13	0.14
0.01	0.00	0.00	0.00	0.00
0.55	0.57	0.66	0.66	0.68
0.00	0.02	0.01	0.01	0.01
0.04	0.04	0.04	0.02	0.02
0.00	0.00	0.00	0.00	0.00
3.00	3.00	3.00	3.00	3.00
6.06	6.06	6.00	5.98	6.04
0.00	0.00	0.00	0.02	0.00
<i>6.06</i>	<i>6.06</i>	<i>6.00</i>	<i>6.00</i>	<i>6.04</i>
6.00	6.00	6.00	6.00	6.00
0.00	0.00	0.00	0.00	0.00
<i>6.00</i>	<i>6.00</i>	<i>6.00</i>	<i>6.00</i>	<i>6.00</i>
0.34	0.48	0.33	0.21	0.25
0.00	0.00	0.01	0.03	0.01
0.11	0.08	0.13	0.20	0.09
1.43	1.38	1.12	1.11	1.18
1.04	0.99	1.38	1.45	1.43
0.02	0.01	0.02	0.00	0.00
<i>2.94</i>	<i>2.94</i>	<i>3.00</i>	<i>3.00</i>	<i>2.96</i>
0.10	0.08	0.13	0.13	0.14
0.55	0.57	0.66	0.66	0.68
0.00	0.02	0.01	0.01	0.01
0.01	0.00	0.00	0.00	0.00
0.34	0.33	0.20	0.20	0.16
<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>	<i>1.00</i>
0.04	0.04	0.04	0.02	0.02
0.00	0.00	0.00	0.00	0.00
3.96	3.96	3.96	3.98	3.98
<i>4.00</i>	<i>4.00</i>	<i>4.00</i>	<i>4.00</i>	<i>4.00</i>
0.42	0.42	0.55	0.57	0.55
0.42	0.42	0.55	0.57	0.55
0.15	0.12	0.16	0.16	0.17