X-Ray Crystallographic Study of Ribulose 1,5-Bisphosphate Carboxylase/Oxygenase from a Red Alga, *Galdieria Partita*, with High Specificity Factor

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Ribulose 1,5-bisphosphate carboxylase/ oxygenase (RuBisCO, EC 4.1.1.39) is the initial step enzyme in the Calvin-Benson cycle of photosynthesis. It catalyzes the addition of gaseous CO_2 to ribulose 1,5-bisphosphate (RuBP) and produces two molecules of 3-phosphoglycerate (3-PGA). However, this enzyme also catalyzes O_2 addition for RuBP as the primary reaction of photorespiration. The reaction yields one molecule each of 3-PGA and 2-phosphoglycolate from RuBP, which reduces the rate of photosynthesis. The oxygenation reaction impairs the photosynthetic efficiency by up to 60 %. Consequently, the enhancement of the carboxylation/oxygenation ratio is one of the most important factors for creating RuBisCOs with more useful properties for current global problems. Thus the improvement of carboxylation/oxygenation ratio by genetic engineering has been attempted to increase the productivity of crop plants. The carboxylation/oxygenation ratio is defined as CO_2/O_2 relative specificity factor (τ), V_cK_o/V_oK_c, where V_c and V_o are maximum velocity of carboxylation and oxygenation, respectively, and K_o and K_c are the Michaelis constants for O_2 and CO_2. While the τ value is 93 for higher plants spinach, *Galdieria* RuBisCO indicates the highest τ value of 238 among the RuBisCOs hitherto reported.

In this study we have performed the X-ray crystallographic study of *Galdieria* RuBisCO. Data collection was performed with the RIGAKU RAXIS-IV on beamline BL-41XU. We have changed many crystals because the crystals are fragile and sensitive to the X-ray. The first image of each crystal has quite clear spots of the diffractions up to at least 1.8 Å resolution, however the intensities were weakened in the next image. A merging of the data is now under examination.