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Pore volume in soil aggregates has functions of water retention, fine root penetration and microbial habitation in soil. How pore system developed with soil aggregation in rice soil is still poorly understood. Using a chronosequence of rice soils derived from salt marsh from East China, undisturbed topsoil samples were collected using soil core sampler and large water stable macroaggregates in size of 1-2mm in diameter were separated with wet-sieving following Six (2000). Porosity, pore shape, pore network and pore size groups of the obtained soil aggregate fractions were examined quantified by the synchrotron radiation micro-computed tomography (SR-mCT). Compared to the original salt marsh, total porosity of the large macroaggregates was increased by 7.4%, 8.1%, 9.2% and 12.2% in rice soils cultivated respectively for 50, 100, 300 and 700 years. Meanwhile, proportion of elongated pores in these macroaggregates was 39% in the rice soil cultivated for 50 years but increased to 88% in the soil cultivated for 700 years. Moreover, the proportion of connected pores was 16.6 % only in the soil cultivated for 50 years but increased to 29.9%, 47.3% and 85.5% in the soil cultivated respectively for 100, 300 and 700 years. With regard to pore size distribution, the pores respectively in size categories of ultra-micro-pores (0-5 mm), micro-pores (5-30 mm) and meso-pores(30-80 mm) were observed randomly distributed but macro-pores (>80 mm) undetected in the rice soil cultivated for 50 years. Whereas, in the rice soil cultivated for 700 years, the macro-pores (≥ 80 mm in size) accounted for 88.10% of total pores. These pore structure changes could be well reflected in the simulated 3-D images of the studied large macroaggregate samples using SR-mCT tomography. Overall, with the enhancement of soil aggregation, both porosity, pore shape and connectivity were all increased following soil organic matter accumulation (SOM) with prolonged rice cultivation. How these changes could impact on storage and functioning of SOM-water-microbes within the aggregates deserve further studies.

Keywords: rice soil; macroaggregates; pore structure; aggregation; soil development