# Fabrication and histological evaluation of porous carbonate apatite blocks using disodium hydrogen phosphate crystals as a porogen and phosphatization accelerator

ペリー, ピネイロ, フレイタス

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氏　　名　：ペリー　ピネイロ　フレイタス
Pery Pinheiro Freitas

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（リン酸水素二ナトリウム結晶を気孔形成材およびリン酸化促進材として用いた炭酸アパタイト多孔体の創製と生体反応評価）

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## 論 文 内 容 の 要 旨

The porous architecture of artificial bones plays a pivotal role in bone ingrowth. Although salt leaching methods produce predictable porous architectures, their application in the low-temperature fabrication of ceramics remains a challenge. Carbonate apatite ($CO_3Ap$) blocks with three ranges of pore sizes: 100–200, 200–400, and 400–600 μm, were fabricated from $CaCO_3$ blocks with embedded $Na_2HPO_4$ crystals as a porogen and accelerator for $CaCO_3$-to-$CO_3Ap$ conversion. $CaCO_3$ blocks were obtained from $Ca(OH)_2$ compacts with $Na_2HPO_4$ by $CO_2$ flow at 100% humidity. When carbonated under 100% water humidity, the dissolution of $Na_2HPO_4$ and the formation of hydroxyapatite were observed. Using 90% methanol and 10% water were beneficial in avoiding the $Na_2HPO_4$ consumption and generating the metastable $CaCO_3$ vaterite, which was rapidly converted into $CO_3Ap$ in a $Na_2HPO_4$ solution in 7 days. For the histological evaluation, the $CO_3Ap$ blocks were implanted in rabbit femur defects. Four weeks after implantation, new bone was formed at the edges of the blocks. After 12 weeks, new bone was observed in the central areas of the material. Notably, $CO_3Ap$ blocks with pore sizes of 100–200 μm were the most effective, exhibiting approximately 23% new bone area. This study sheds new light on the fabrication of tailored porous blocks and provides a useful guide for designing artificial bones.