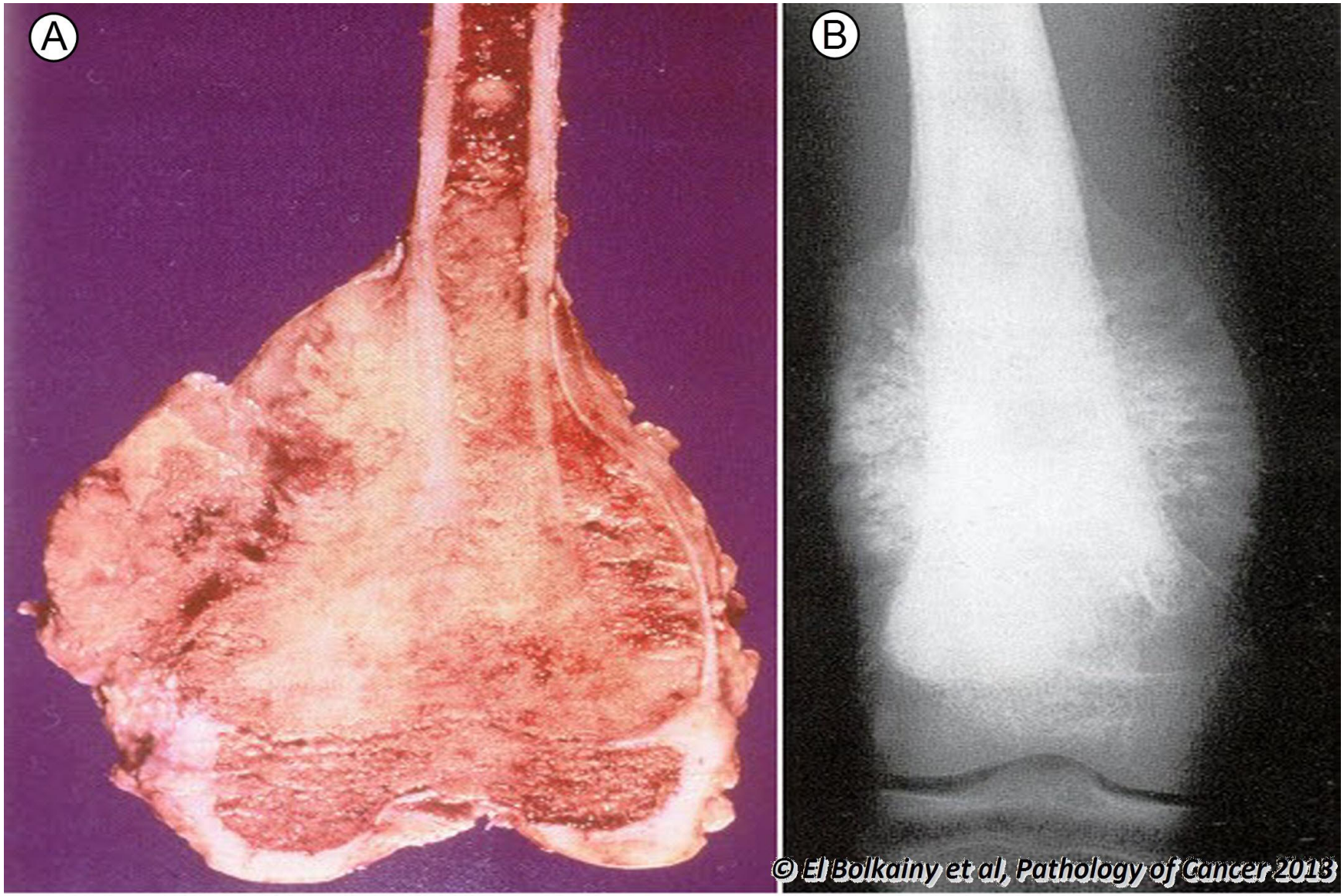
Chapter 20

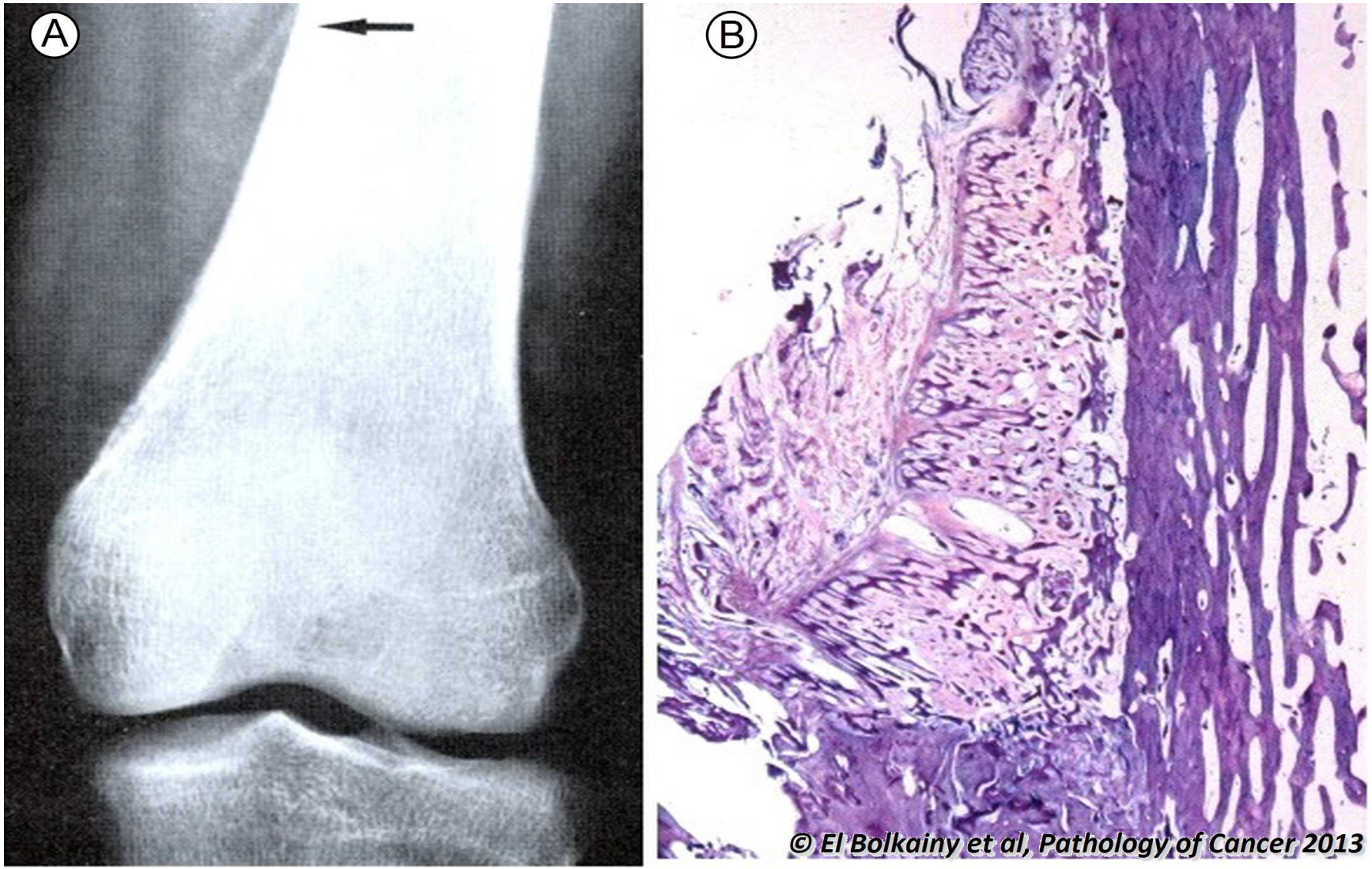
Malignant bone tumors

20.1 Osteosarcoma, central conventional type.



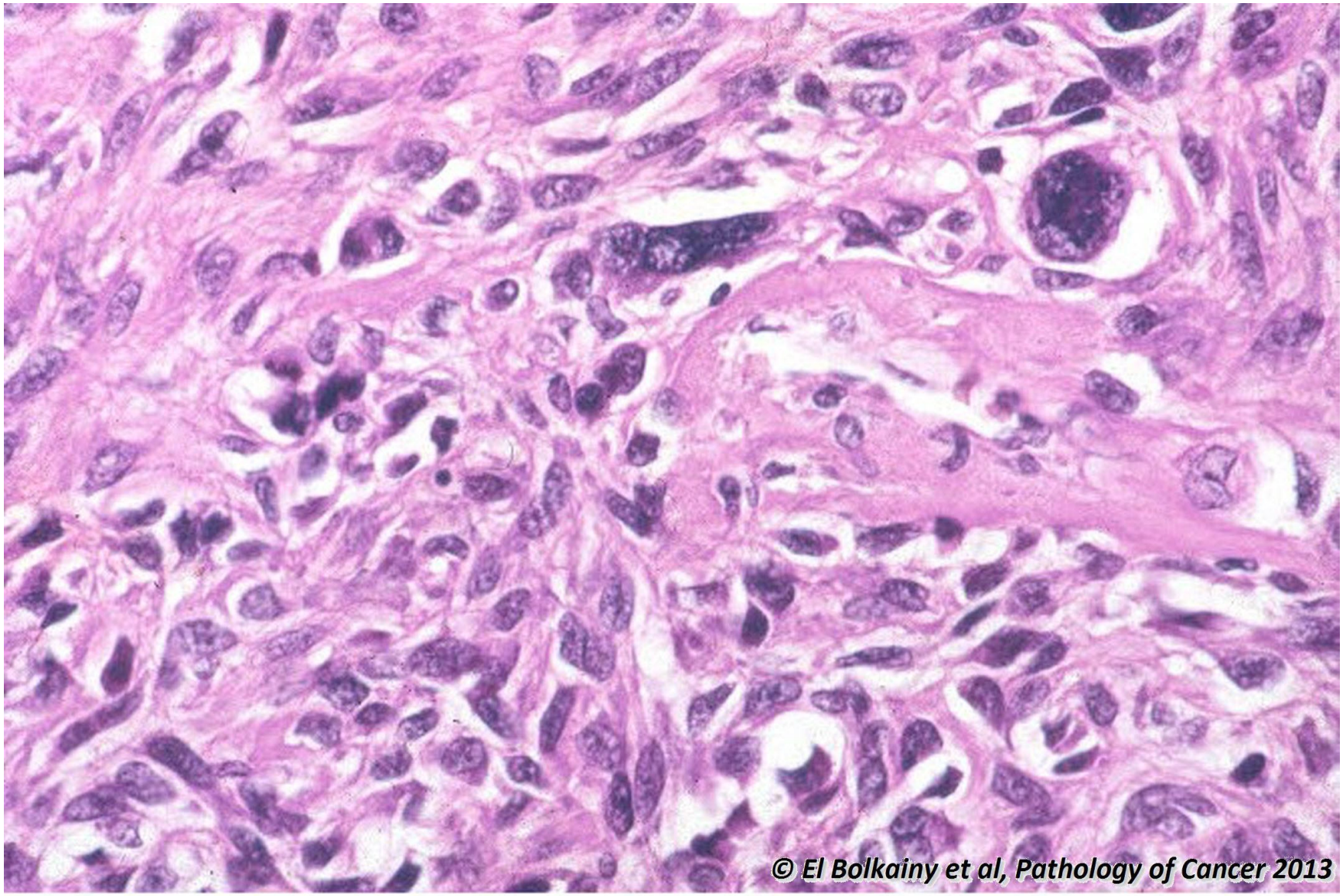
Picture 20-1 **Osteosarcoma, central conventional type. A** Gross, metaphyseal location and soft tissue invasion. **B** Radiography showing destructive lesion with subperiosteal bone formation (sun-ray appearance).

20.2 Osteosarcoma, Codman triangle.



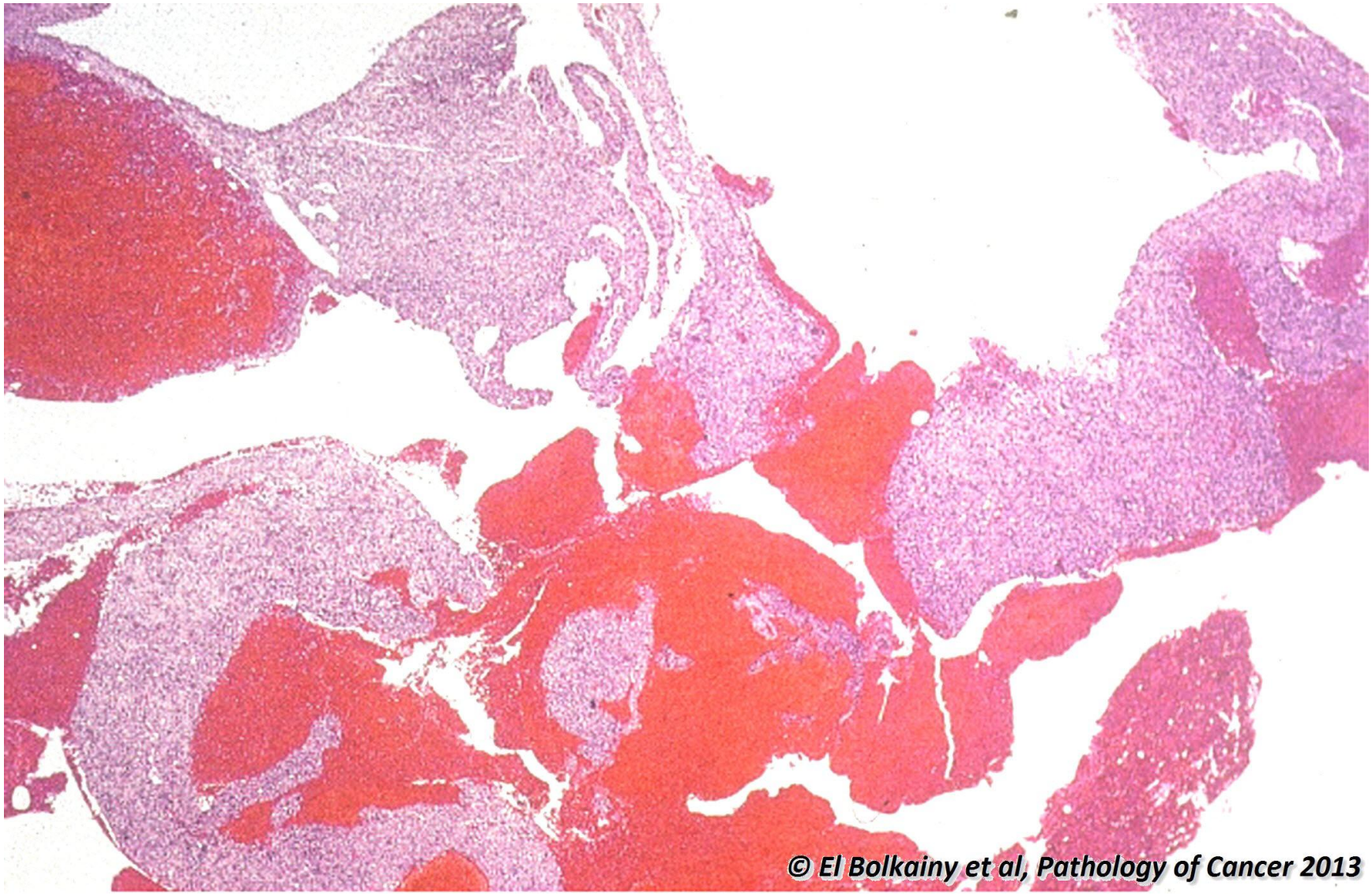
Picture 20-2 **Osteosarcoma, Codman triangle. A** Radiography, reactive bone deposition under periosteum at the upper end of tumor. **B** Histology, reactive bone formation is oriented at right angle to the periosteum which is raised by the tumor.

20.3 Osteosarcoma, histology.



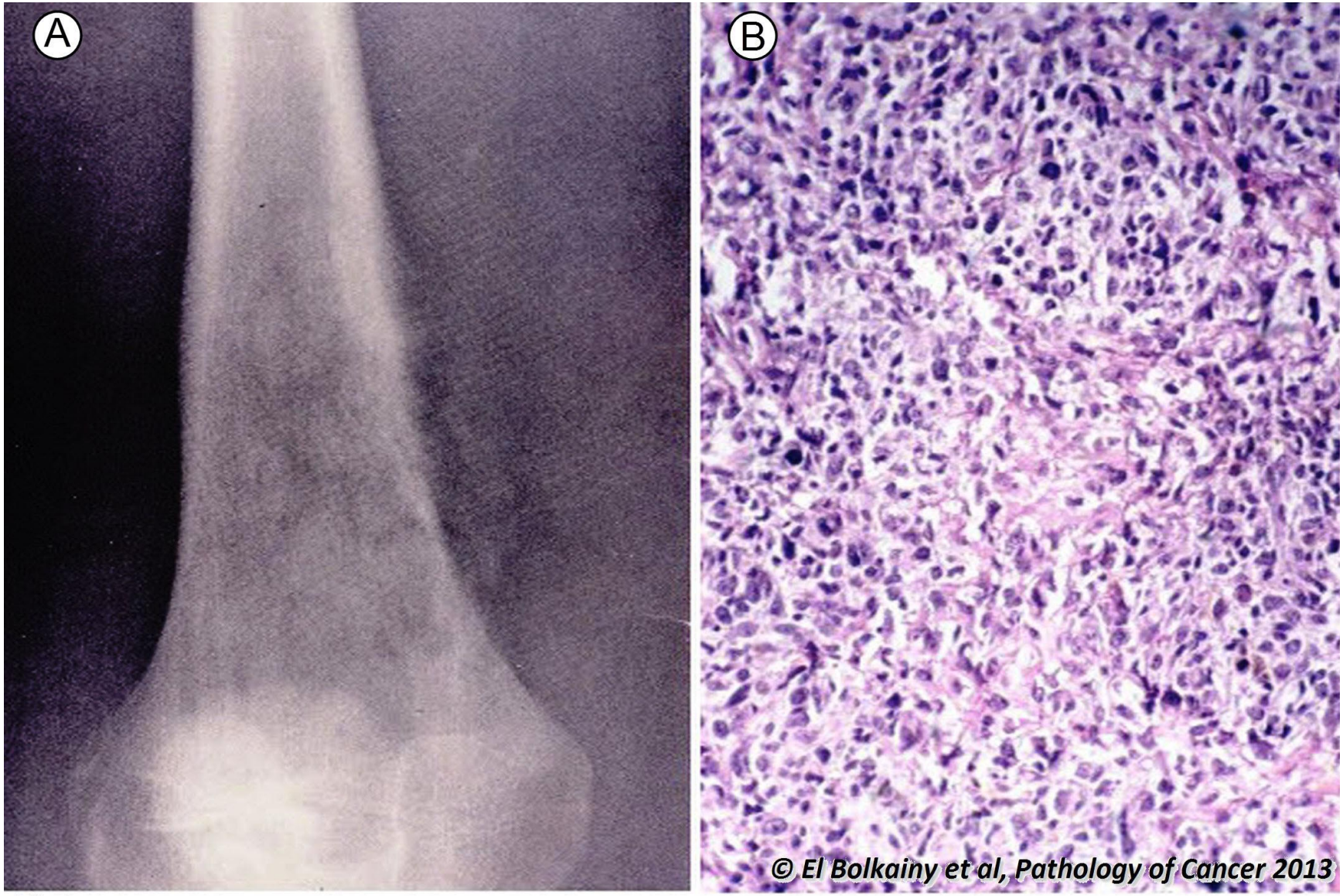
Picture 20-3 **Osteosarcoma, histology.** Stellate-shaped and spindle crowded osteoblasts, with bone formation in the stroma. Neoplastic osteoid is fine, eosinophilic, lacking lacunae and directly lined by malignant cells.

20.4 Osteosarcoma, telangiectatic type, histology.



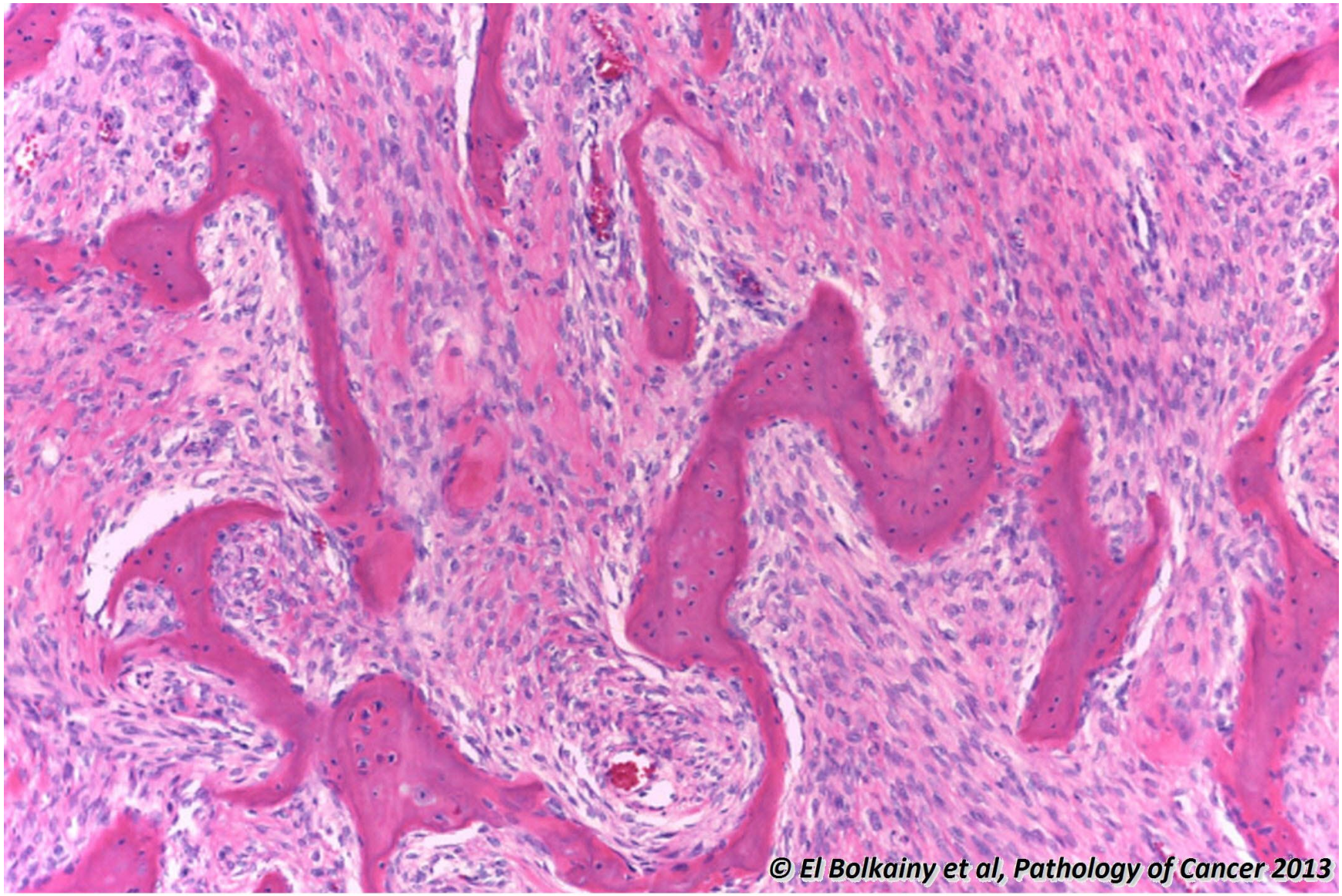
Picture 20-4 **Osteosarcoma, telangiectatic type, histology.** Large irregular vascular spaces filled with blood, directly lined by malignant cells. This should not be confused with aneurysmal bone cyst which is rich in multinucleated giant cells and lacks cellular anaplasia.

20.5 Osteosarcoma, small cell type (osteolytic type).



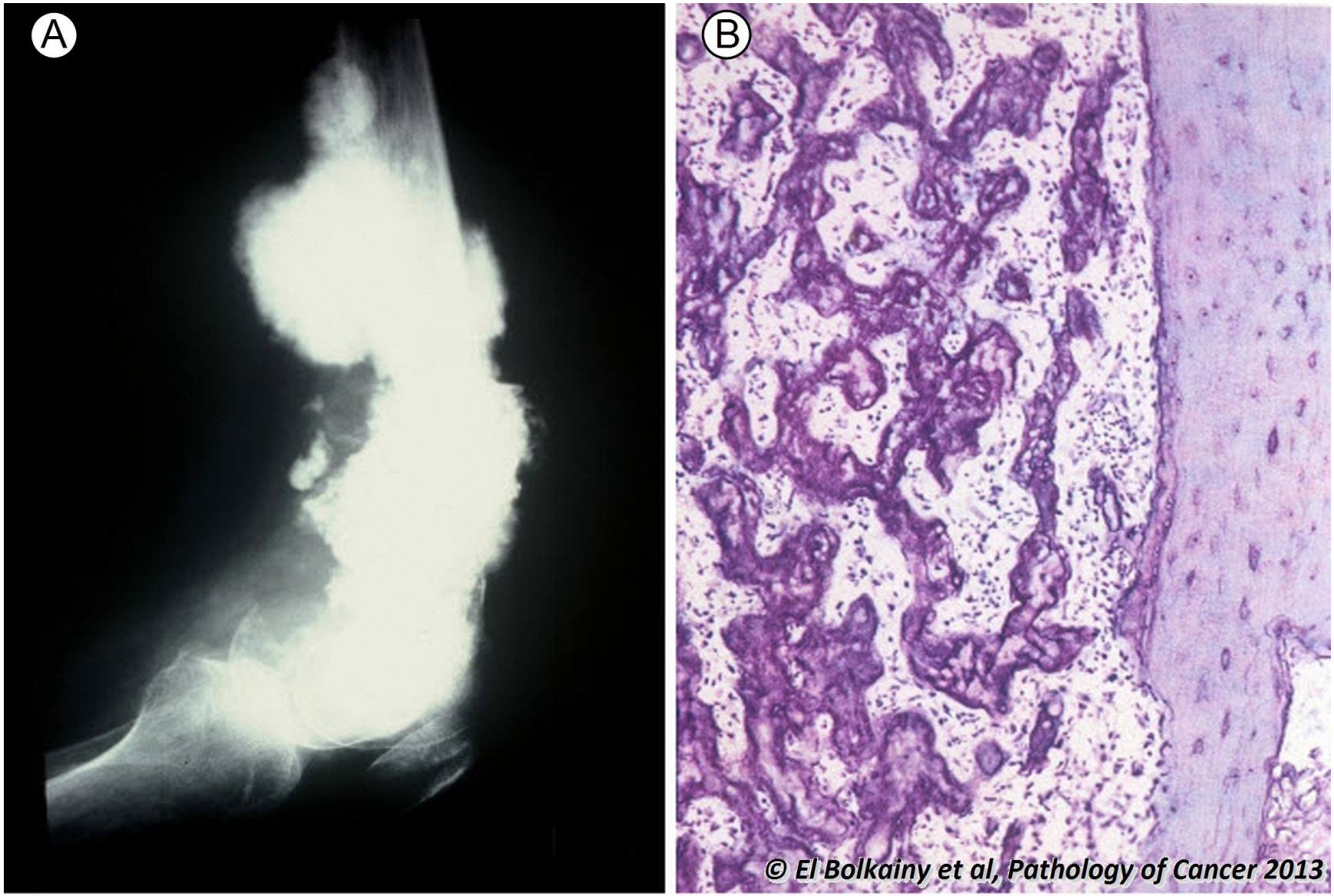
Picture 20-5 **Osteosarcoma, small cell type (osteolytic type). A** Radiography, note the hypodense metaphyseal lesion eroding cortical bone. **B** Histology, the sarcoma cells with minimal osteoid in the stroma. The small round cell size may simulate lymphoma or Ewing sarcoma, but immunostains will help (LCA, CD99).

20.6 Osteosarcoma, fibroblastic type.



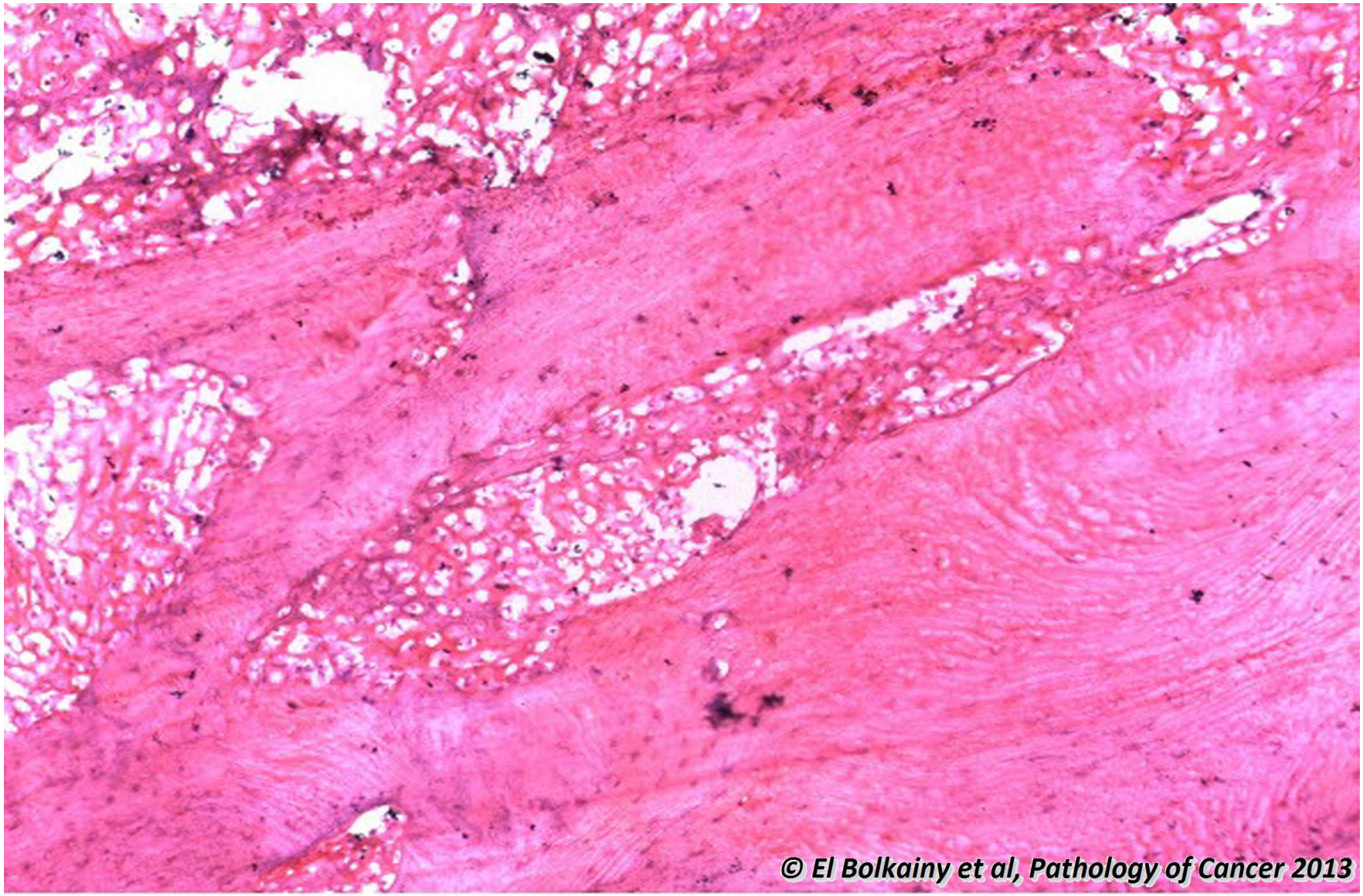
Picture 20-6 **Osteosarcoma, fibroblastic type.** Spindle shaped cells with collagen in the stroma infiltrating marrow spaces. Neoplastic osteoid may still be observed by careful study of tumor section. The larger bony trabeculae represent normal bone.

20.7 Osteosarcoma of femur, sclerosing type.



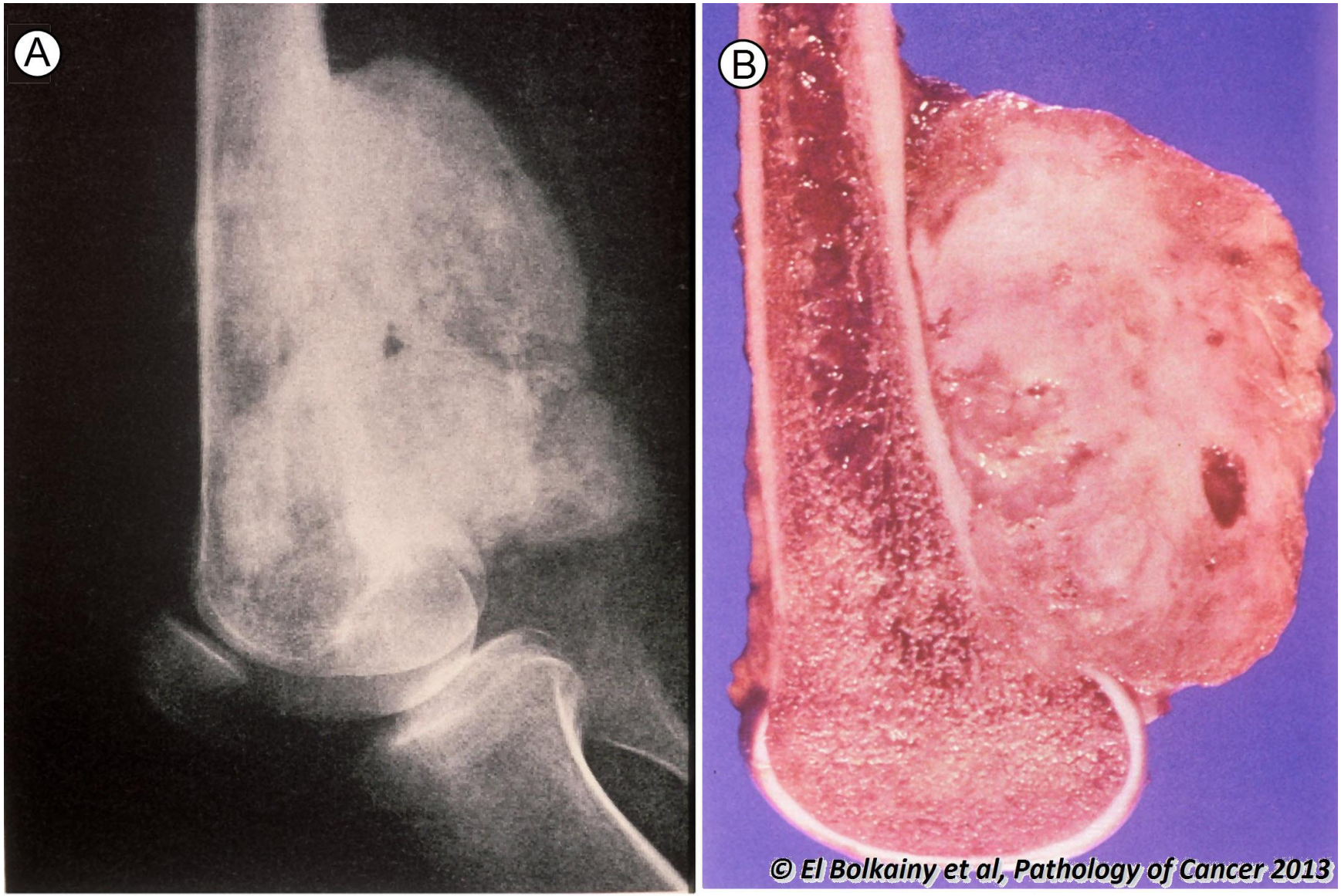
Picture 20-7 **Osteosarcoma of femur, sclerosing type. A** Radiography, a very dense extensive tumor of distal femur. **B** Histology, shows abundant osteoid in the tumor. Normal bone with lacunae to the Rt. for comparison.

20.8 Osteosarcoma, sclerosing type, histology.



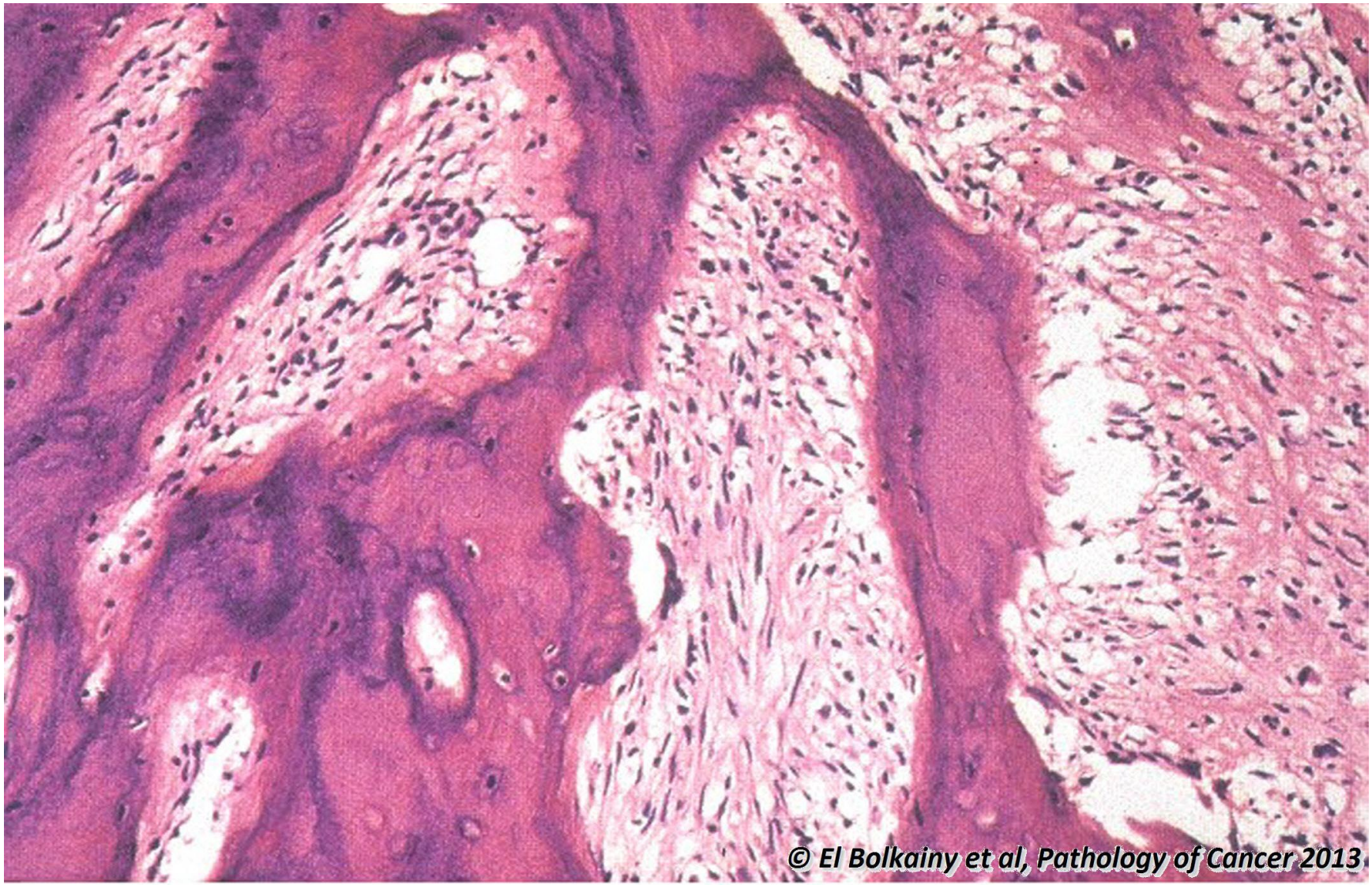
Picture 20-8 **Osteosarcoma, sclerosing type, histology.** The sarcoma with abundant osteoid formation and network appearance permeating marrow spaces inbetween dense normal bone trabeculae, with obvious lamellae and lacunae.

20.9 Parosteal osteosarcoma.



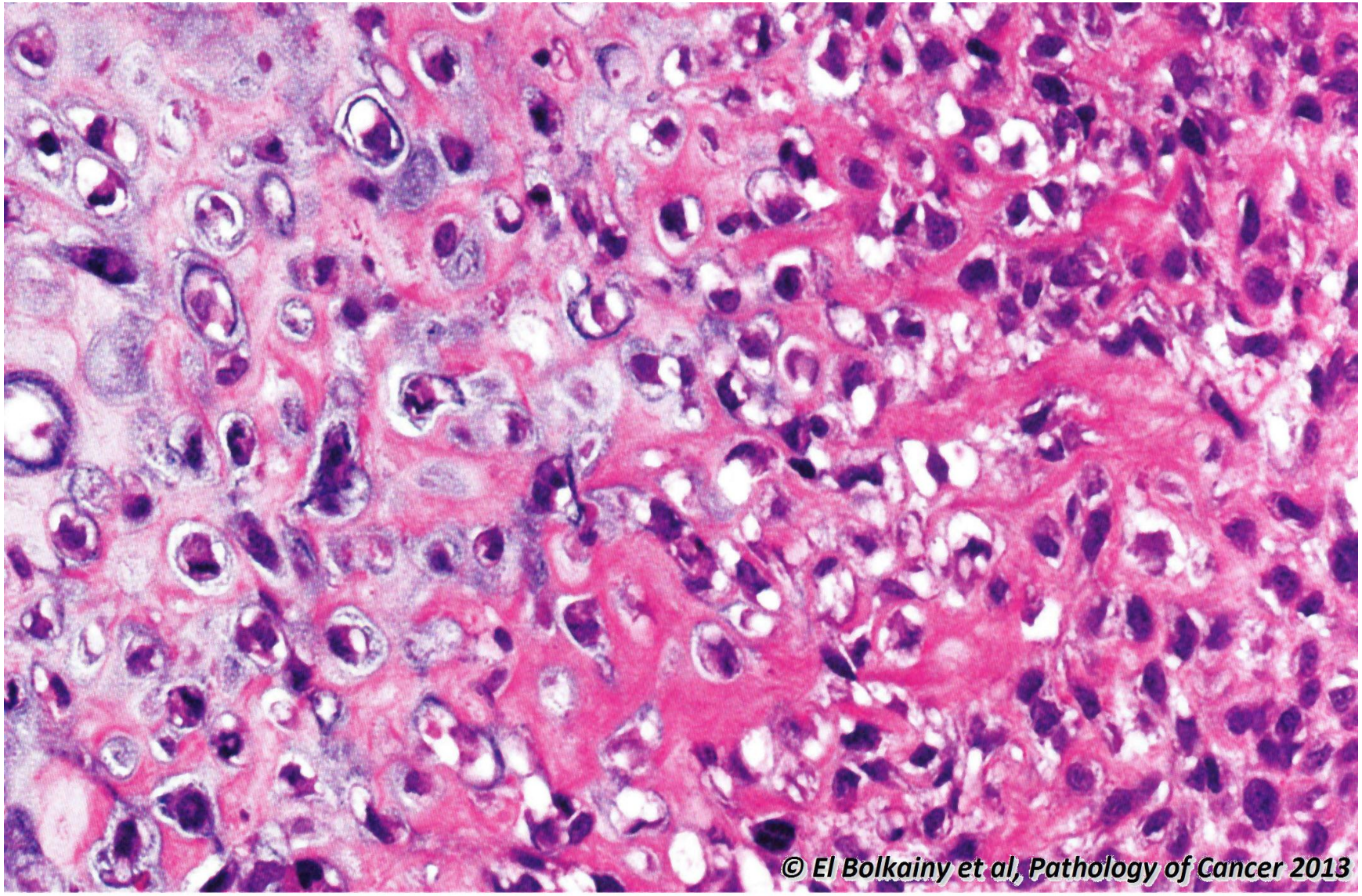
Picture 20-9 **Parosteal osteosarcoma. A** Radiography, this low grade surface osteosarcoma is most common at lower end of femur, posteriorly opposite the metaphysis. **B** Grossly, the tumor does not invade the medullary cavity.

20.10 Parosteal osteosarcoma, histology.



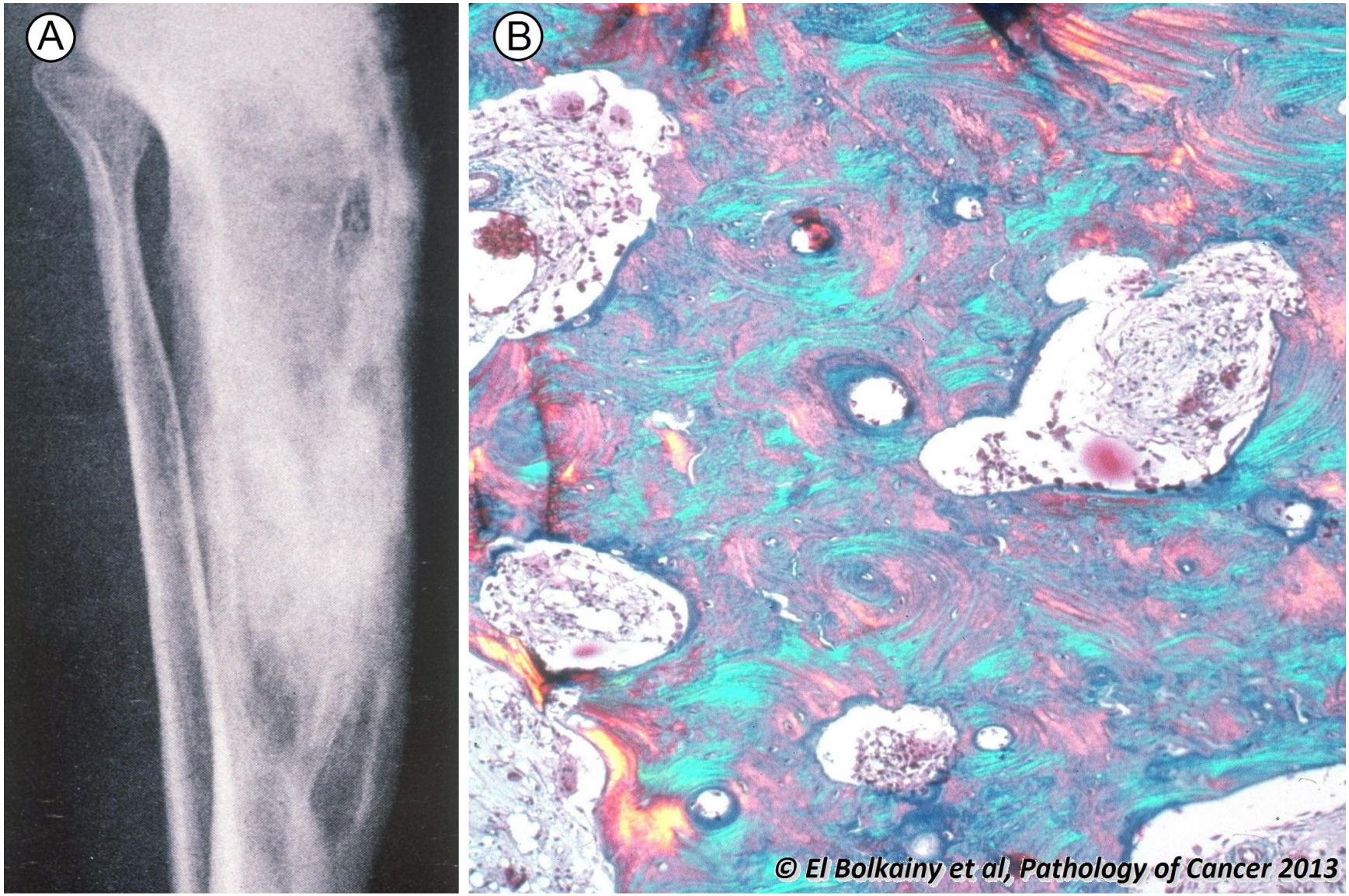
Picture 20-10 **Parosteal osteosarcoma, histology.** This tumor type is usually a low grade and fibrogenic. High-grade surface osteosarcomas are rarely encountered.

20.11 Periosteal osteosarcoma (juxtacortical), histology.



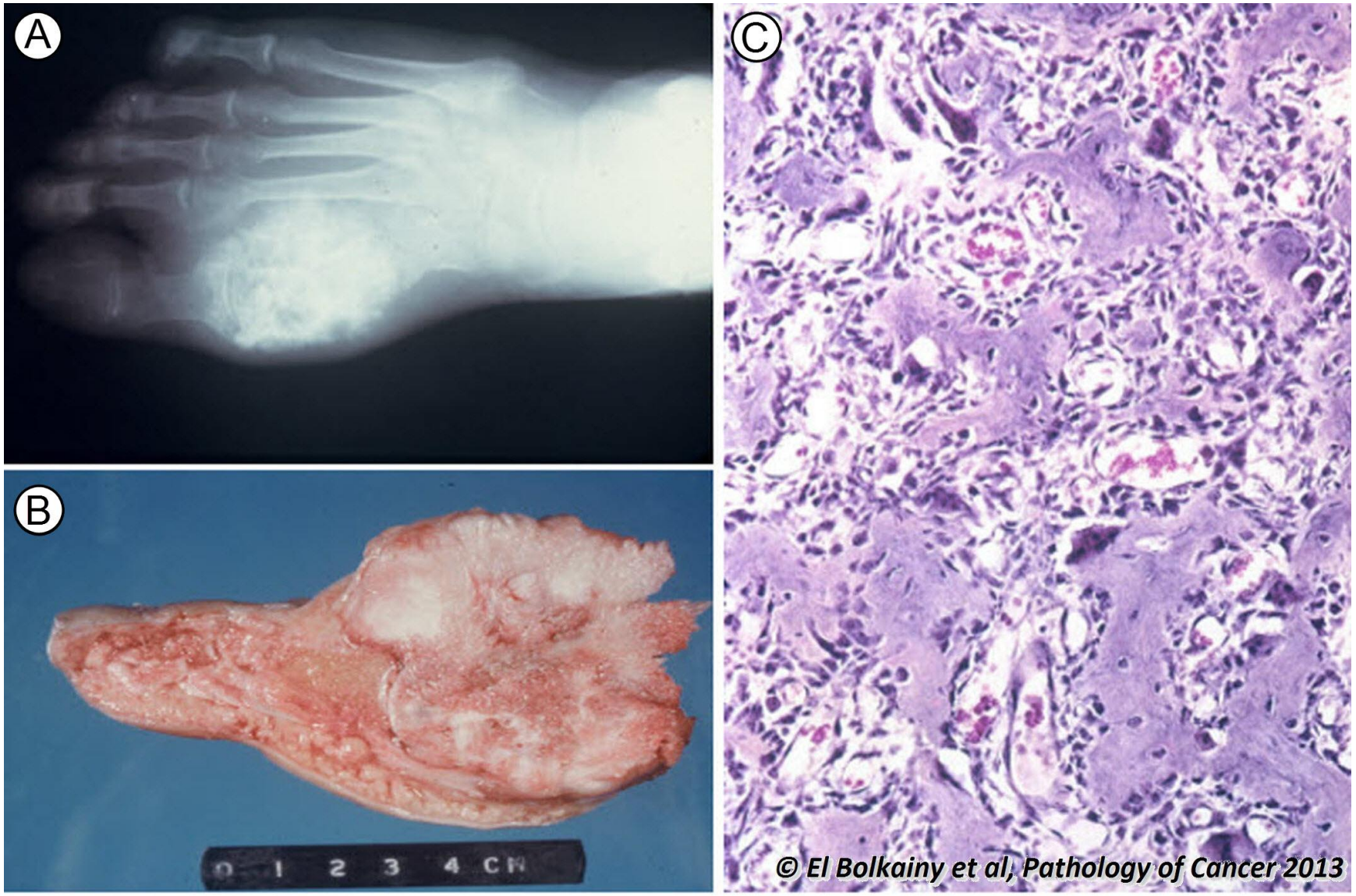
Picture 20-11 **Periosteal osteosarcoma (juxtacortical), histology.** This rare surface osteosarcoma is of intermediate grade, commonly located at diaphysis and shows chondrogenic differentiation.

20.12 Osteosarcoma on top of Paget disease.



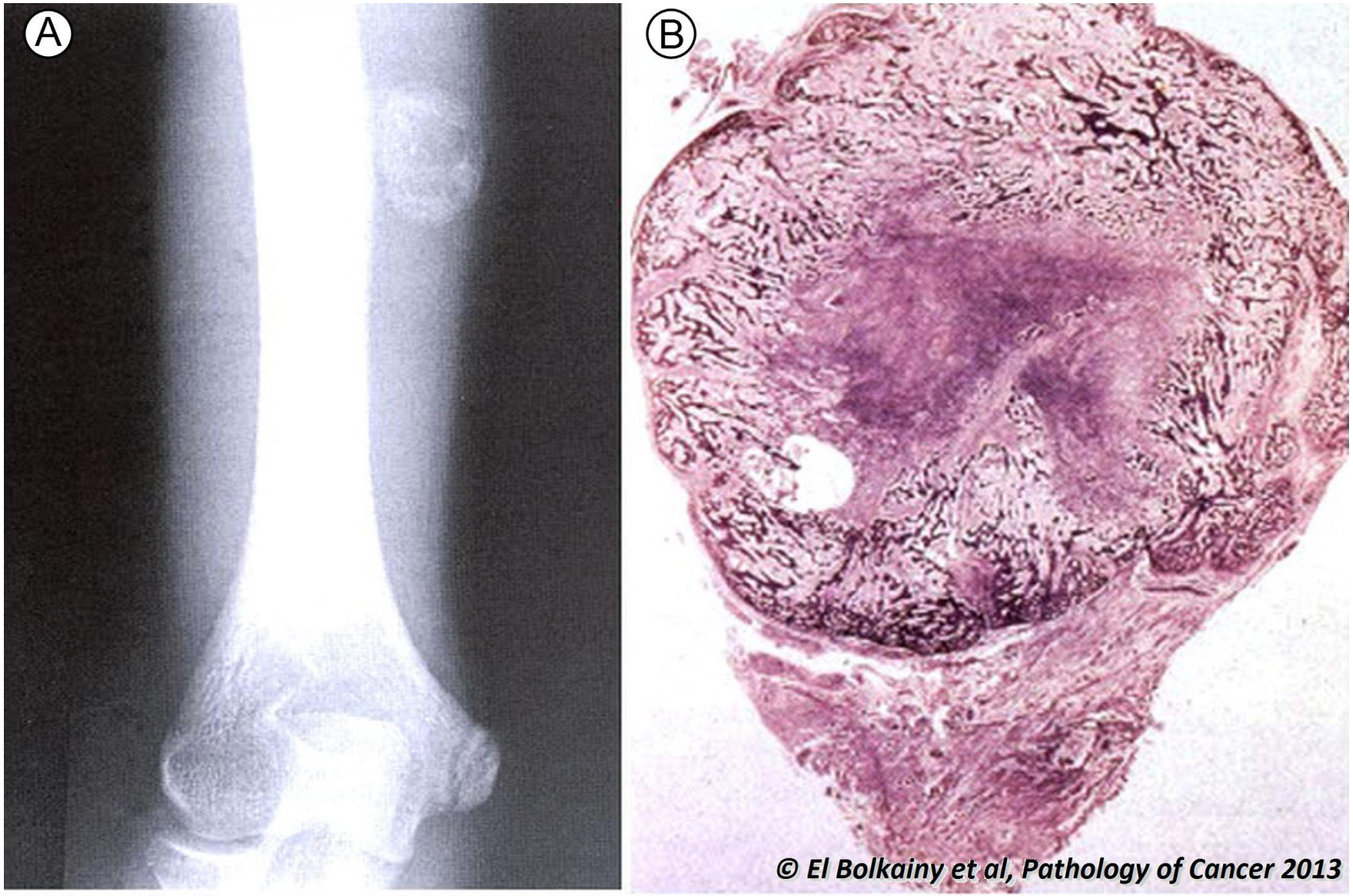
Picture 20-12 **Osteosarcoma on top of Paget disease. A** Radiography showing a destructive tumor of upper tibia (metadiaphyseal). **B** Histology with polarized light, note the mosaic appearance of bone lamellae characteristic of Paget disease. This subtype is observed in adults and elderly patients.

20.13 Aggressive osteoblastoma of metatarsal bone.



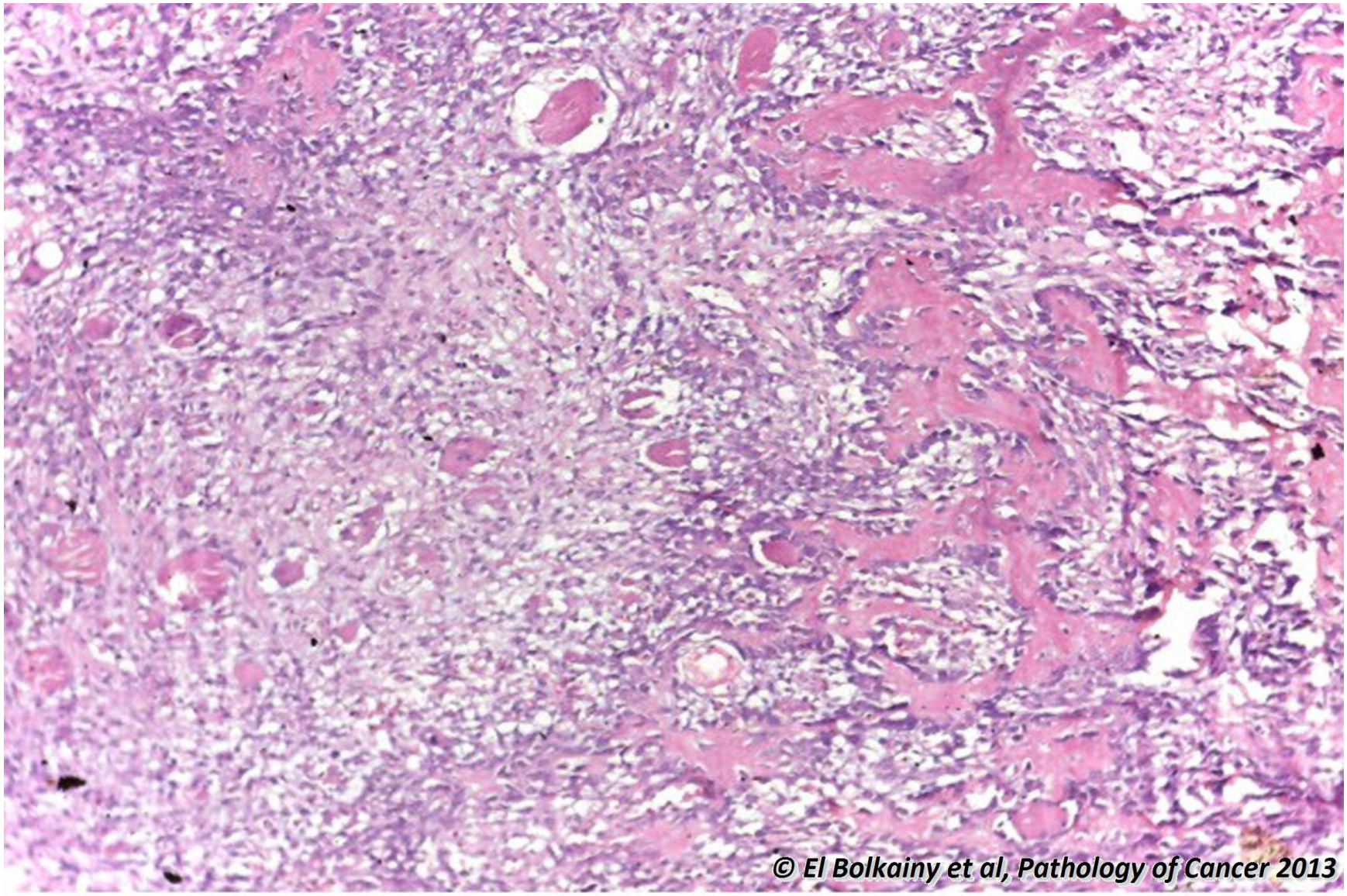
Picture 20-13 **Aggressive osteoblastoma of metatarsal bone. A** Radiography**. B** Gross features (size > 2 cm). **C** Histology, irregular osteoid rimmed by active osteoblasts in a fibrovascular stroma.

20.14 Myositis ossificans.



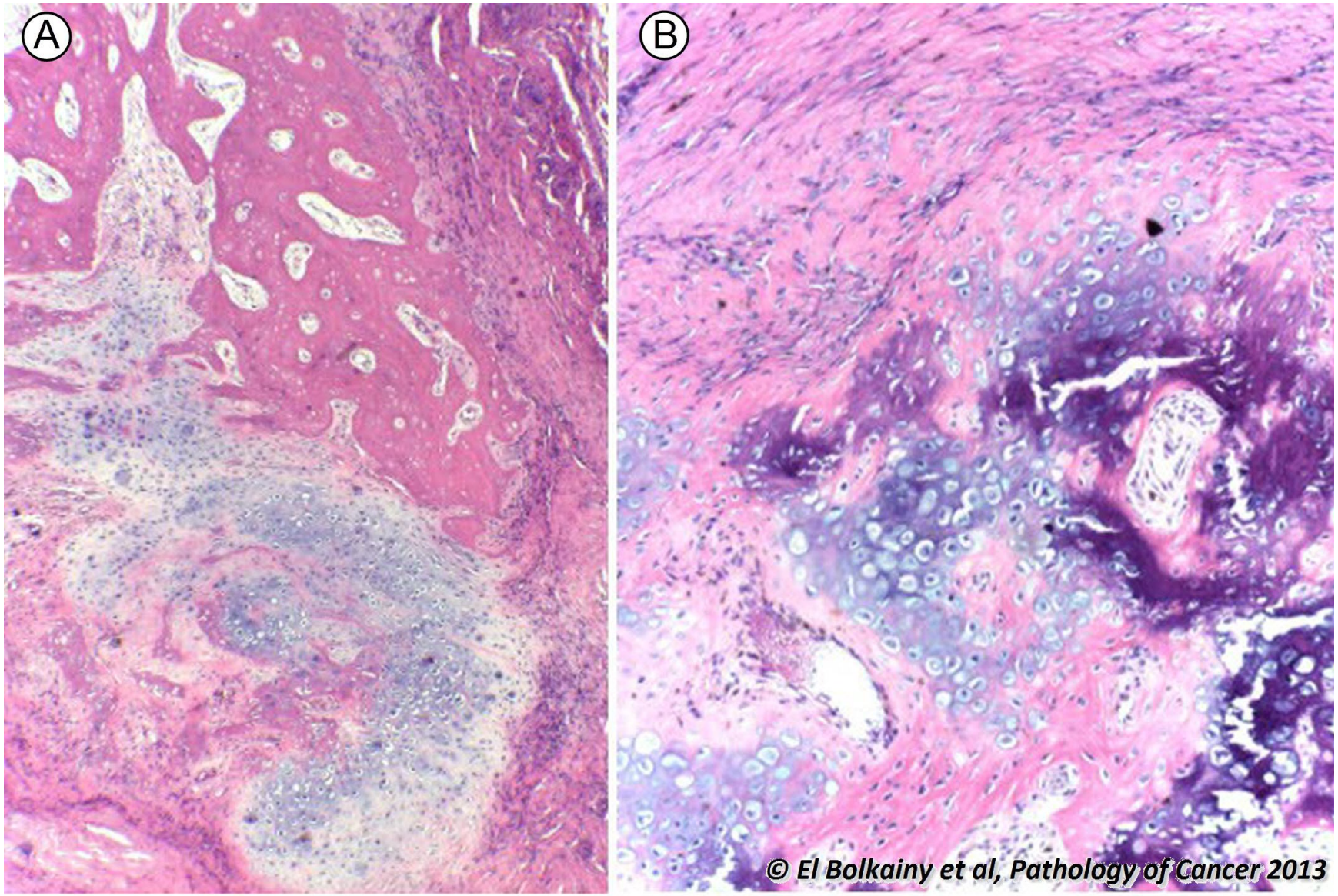
Picture 20-14 **Myositis ossificans. A** Radiography, a circumscribed bony mass lesion in soft tissue close to but separate from bone. **B** Histology, characteristic zonation phenomenon with bone maturation at the periphery of the lesion. The center shows a mixture of osteoid , cartilage and muscle fibers.

20.15 Myositis ossificans, histology of maturation phenomenon.



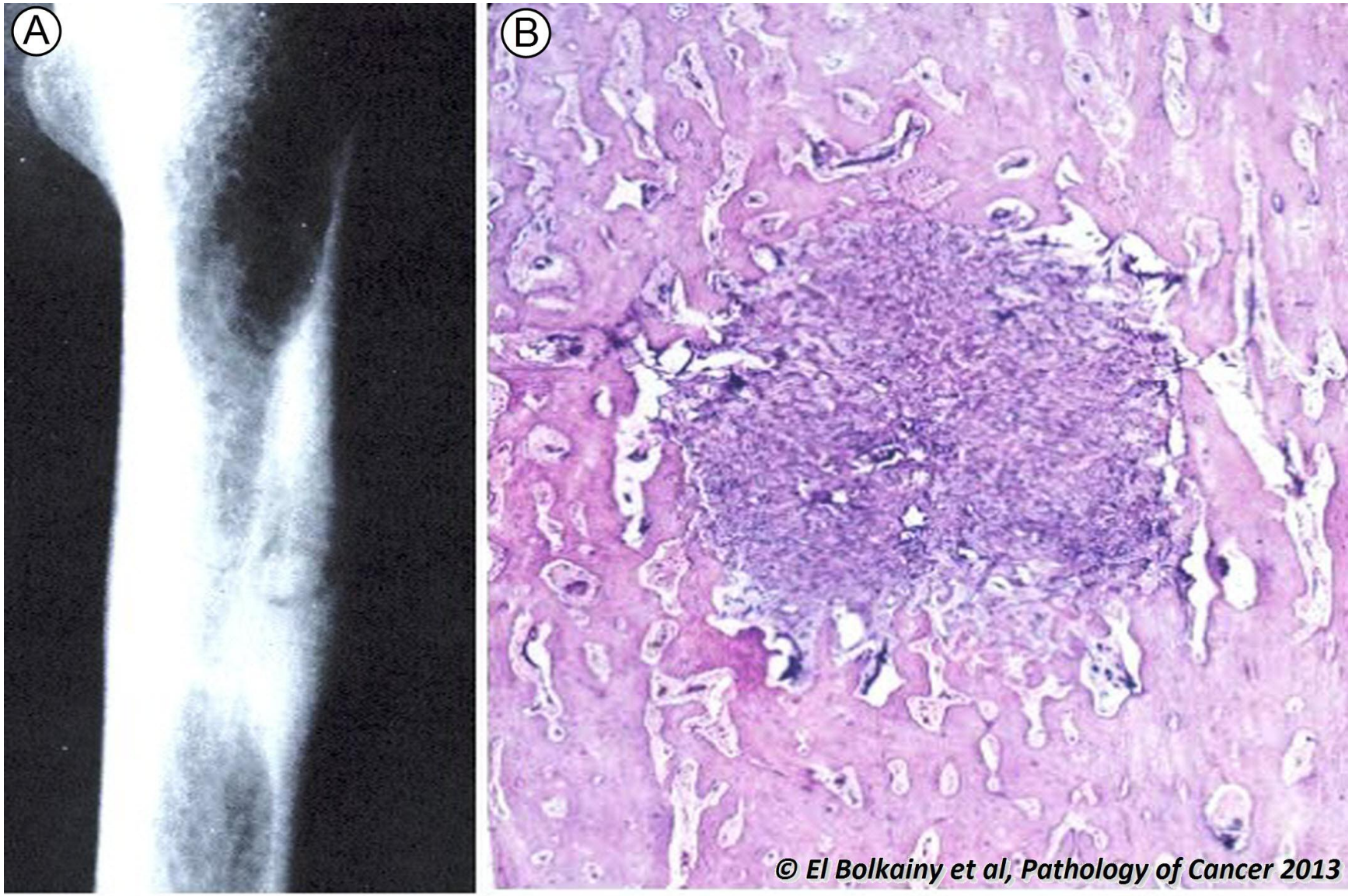
Picture 20-15 **Myositis ossificans, histology of maturation phenomenon.** The center of the lesion (Lt.) shows immature bone, whereas, the periphery (Rt.) is more mature with obvious normal osteoblastic rimming.

20.16 Callus of ununited fracture, histology.



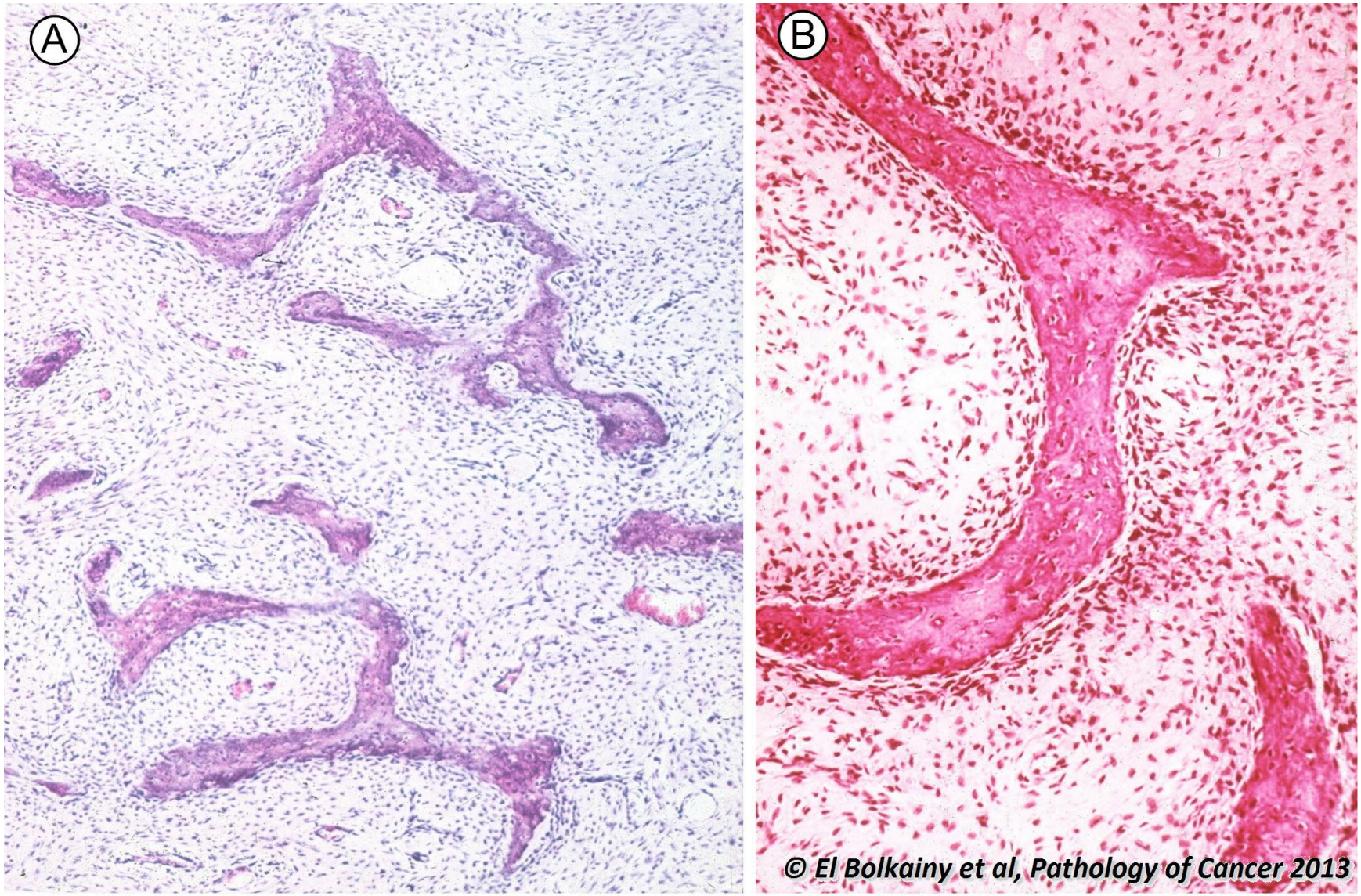
Picture 20-16 **Callus of ununited fracture, histology.** Similar to myositis, showing areas of cartilage, reactive osteoid with osteoblastic rimming and fibrous tissue.

20.17 Osteoid osteoma of femur.



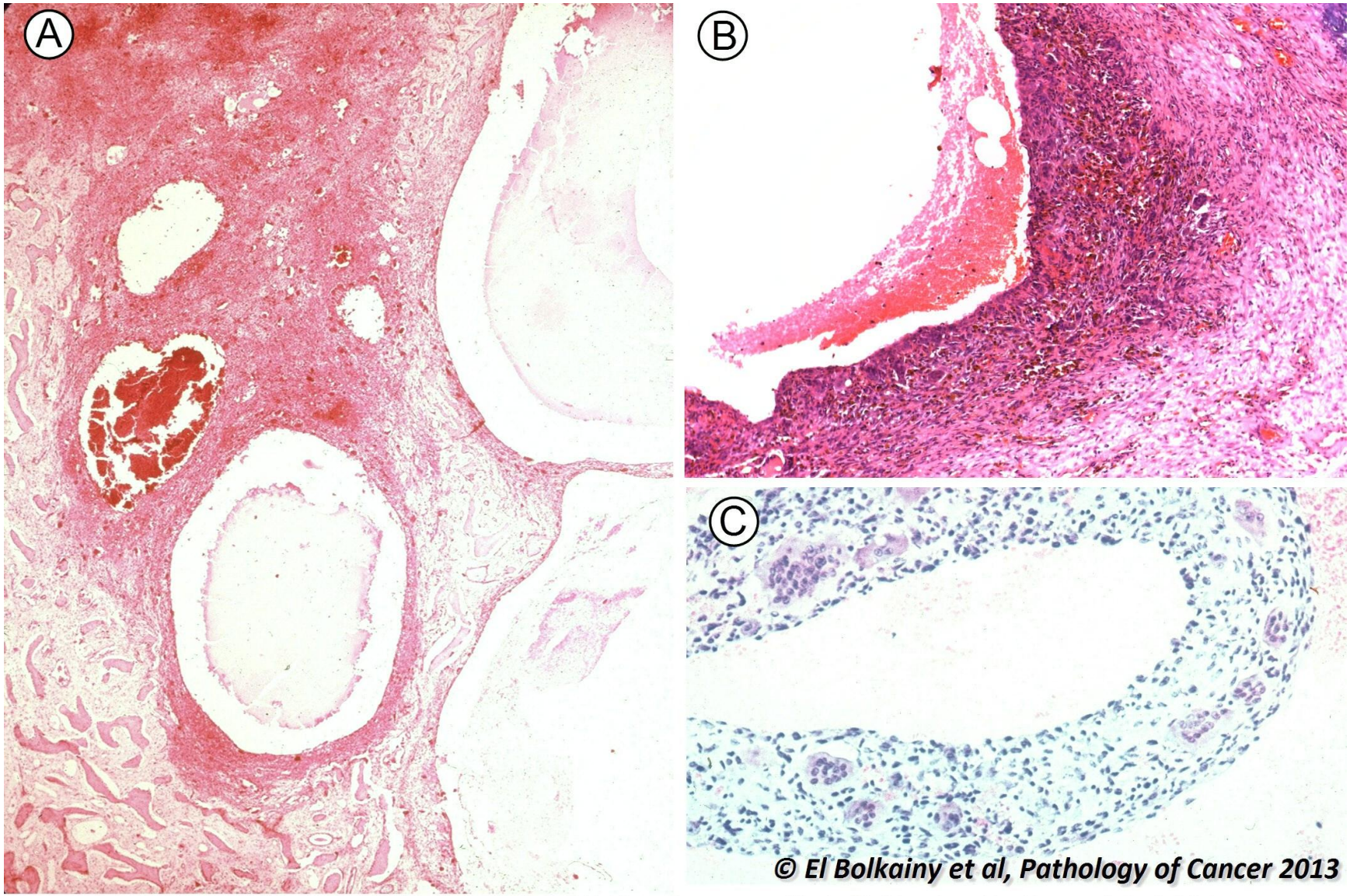
Picture 20-17 **Osteoid osteoma of femur. A** Radiography, note the cortical location and central dense nidus. **B** Histology, the nidus is composed of osteoid tissue with osteoblastic rimming, surrounded by dense sclerotic bone. The tumor is small in size (< 2 cm).

20.18 Fibrous and osteofibrous dysplasia, histology.



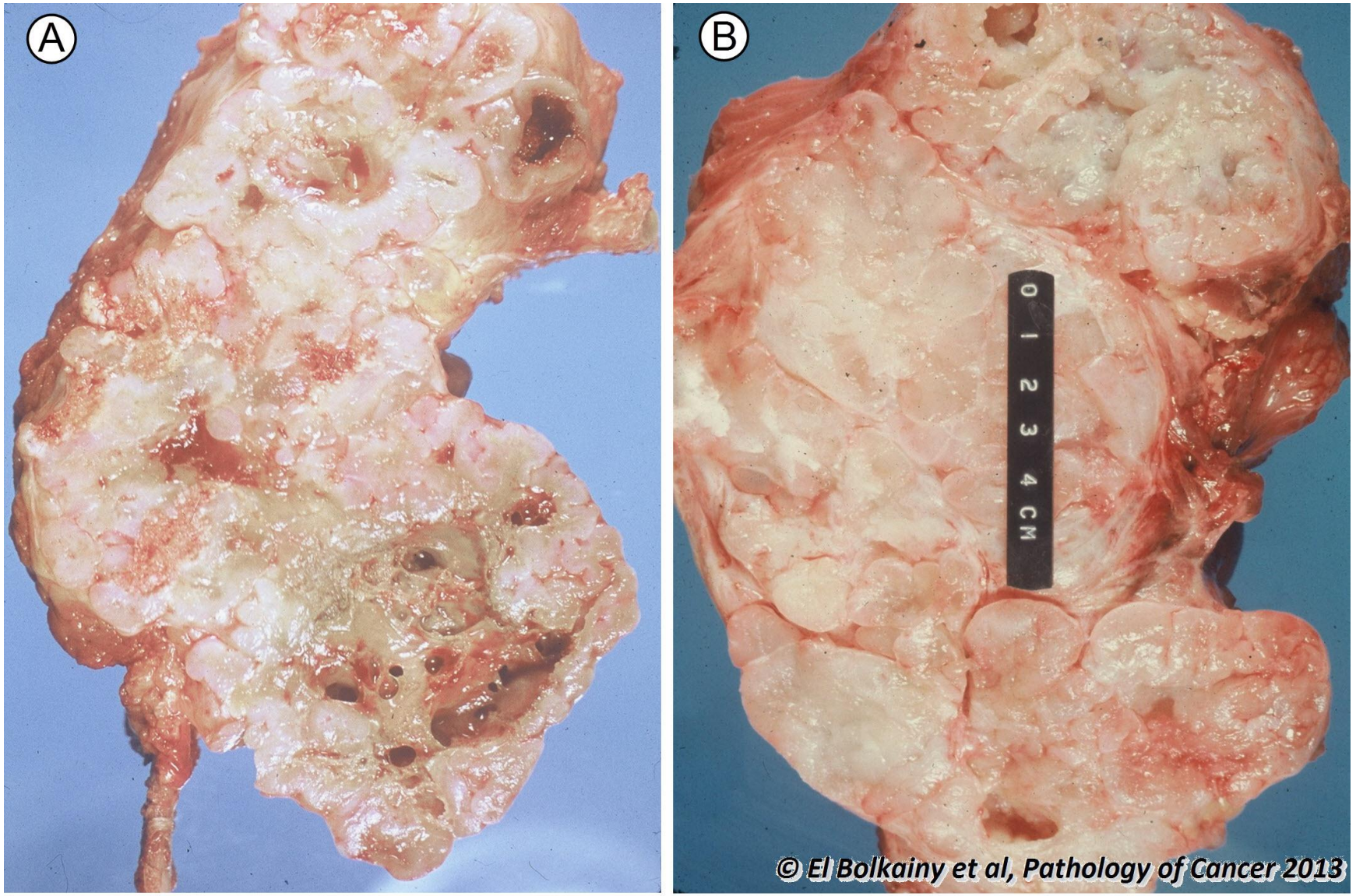
Picture 20-18 **A Fibrous dysplasia, histology.** It affects medullary bone, thin curvilinear and branching bone trabeculae (chinese letters), lacking osteoblastic rimming, associated bland fibroblastic stroma. **B Osteofibrous dysplasia, histology.** This osteofibrous lesion affects cortical bone and usually shows osteoblastic rimming. Young patients are affected.

20.19 Aneurysmal bone cyst, histology.



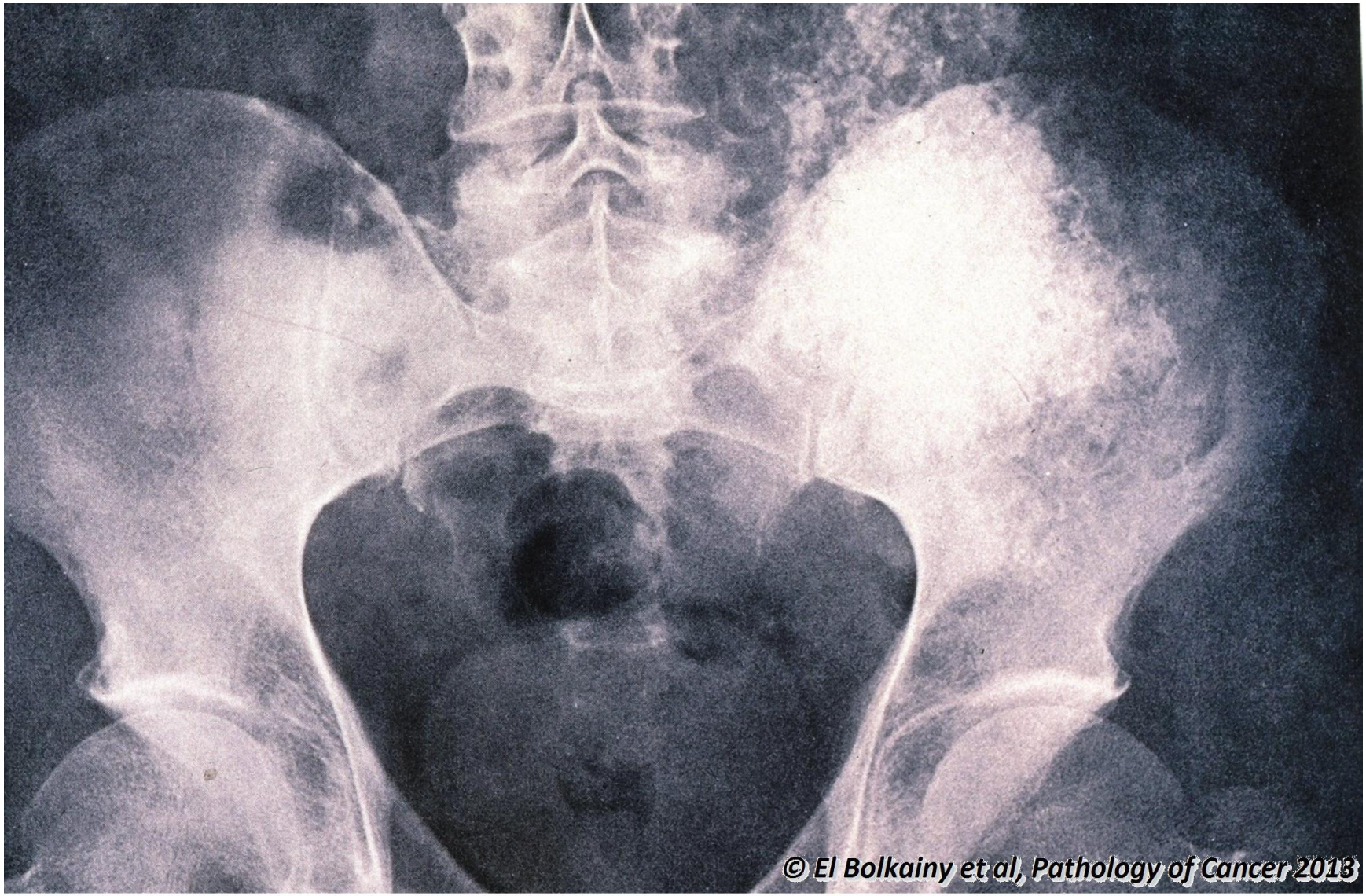
Picture 20-19 **Aneurysmal bone cyst, histology. A** and **B** Vascular spaces filled with blood and lacking endothelial lining. **C** Cyst wall is fibrotic with scattered multinucleated giant cells. This benign expansile lesion (contrary to sarcomas) does not invade soft tissue.

20.20 Chondrosarcoma of ribs, gross features.



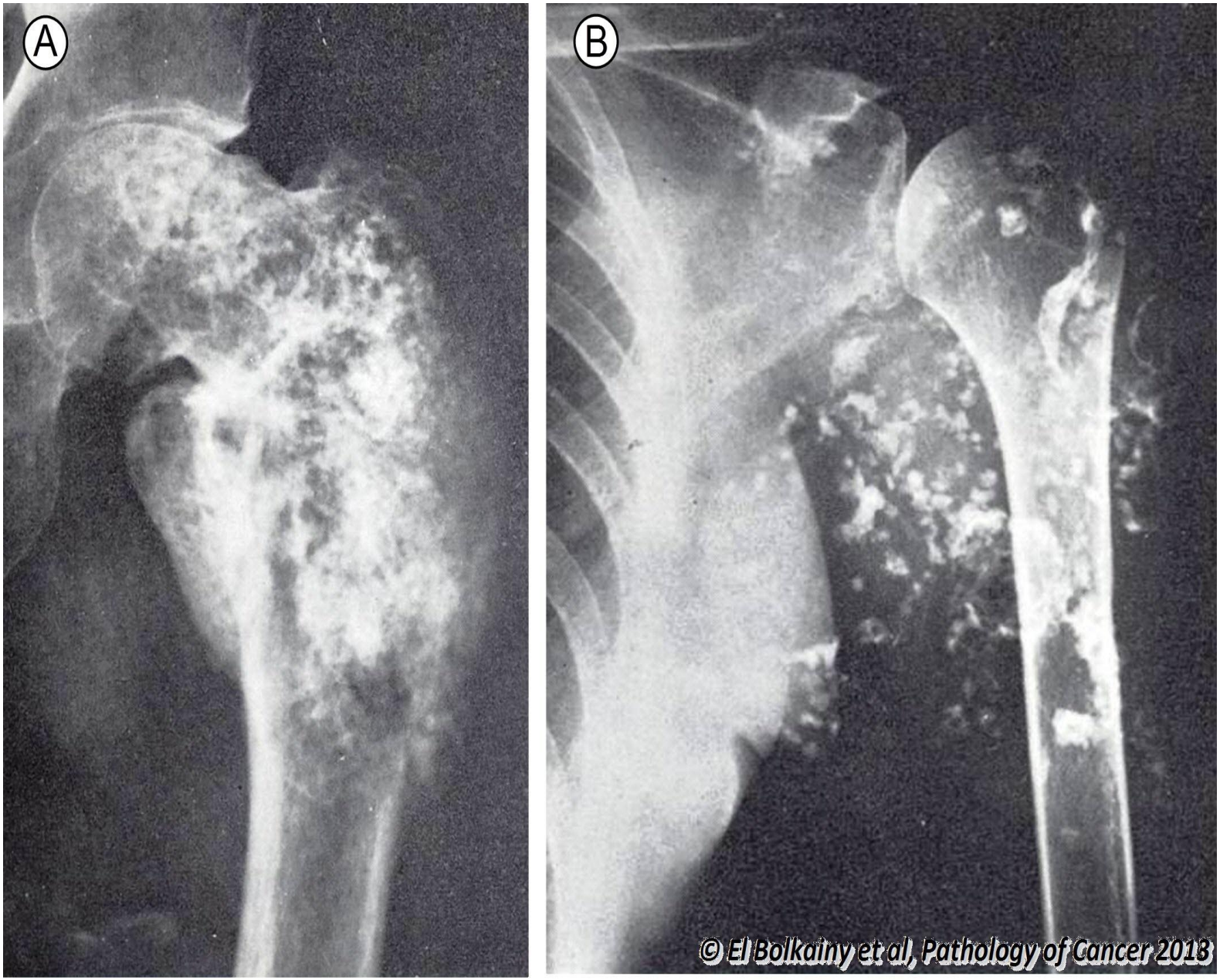
Picture 20-20 **Chondrosarcoma of ribs, gross features.** A large multinodular mass of cartilage arising from a rib and invading soft tissue. Note the gray-blue color, focal hemorrhage and cystic change.

20.21 Chondrosarcoma of pelvis, radiography.



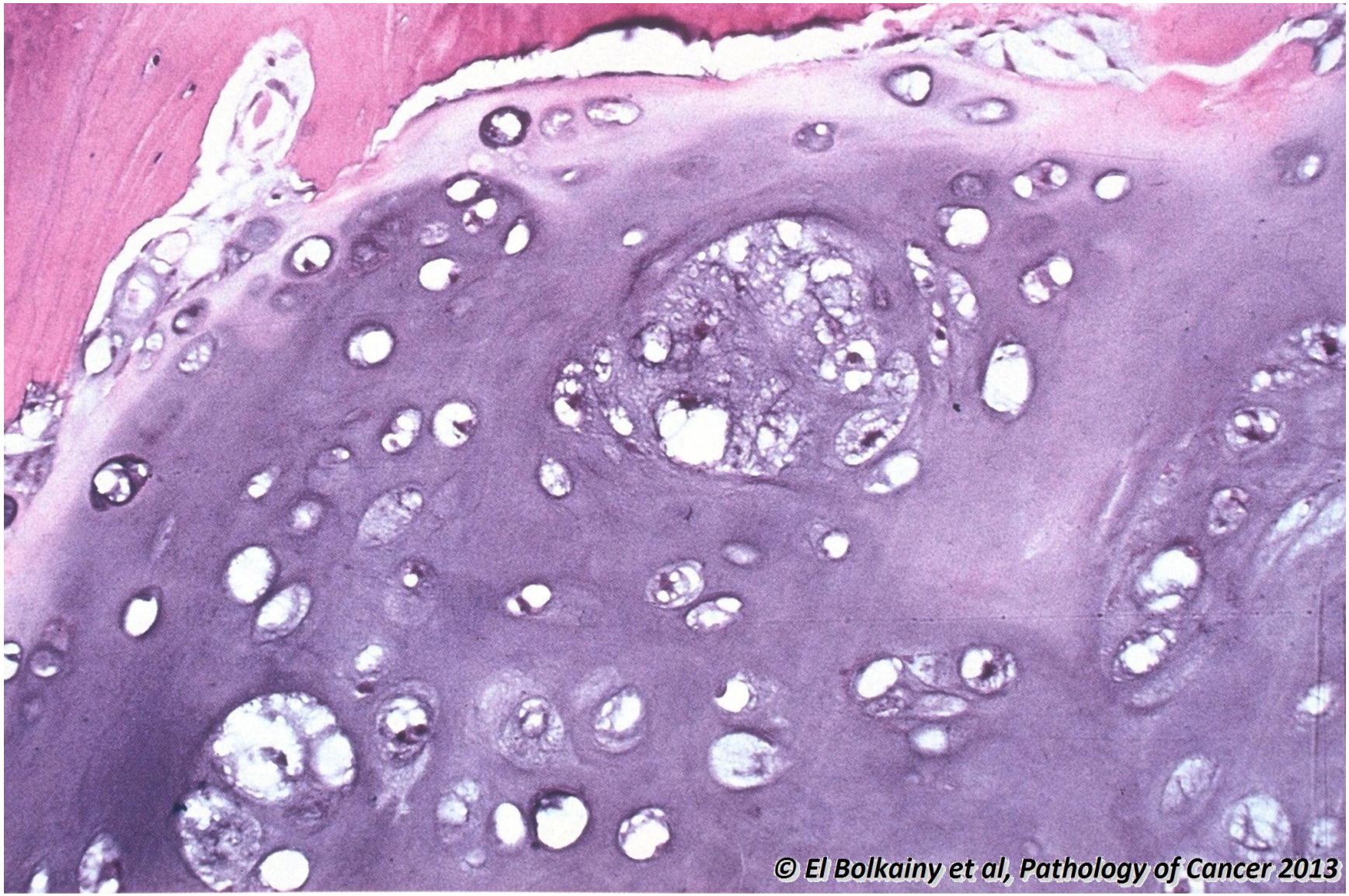
Picture 20-21 **Chondrosarcoma of pelvis, radiography.** A large tumor mass of iliac bone with characteristic mottled calcification.

20.22 Chondrosarcoma of upper femur, radiography.



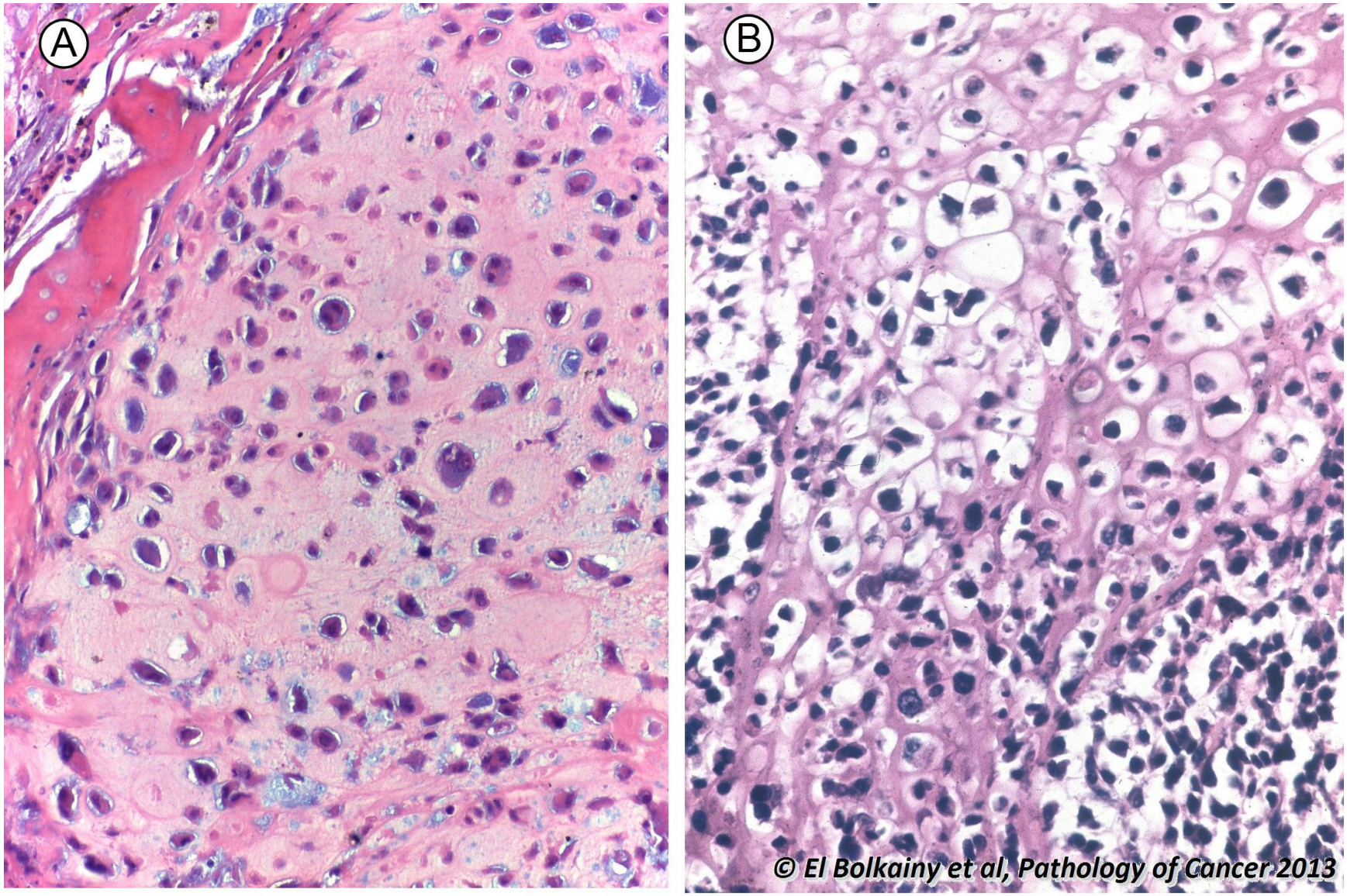
Picture 20-22 **Chondrosarcoma of upper femur, radiography**. The tumor arises centrally, invades soft tissue and shows characteristic mottled calcification.

20.23 Chondrosarcoma grade 1, histology.



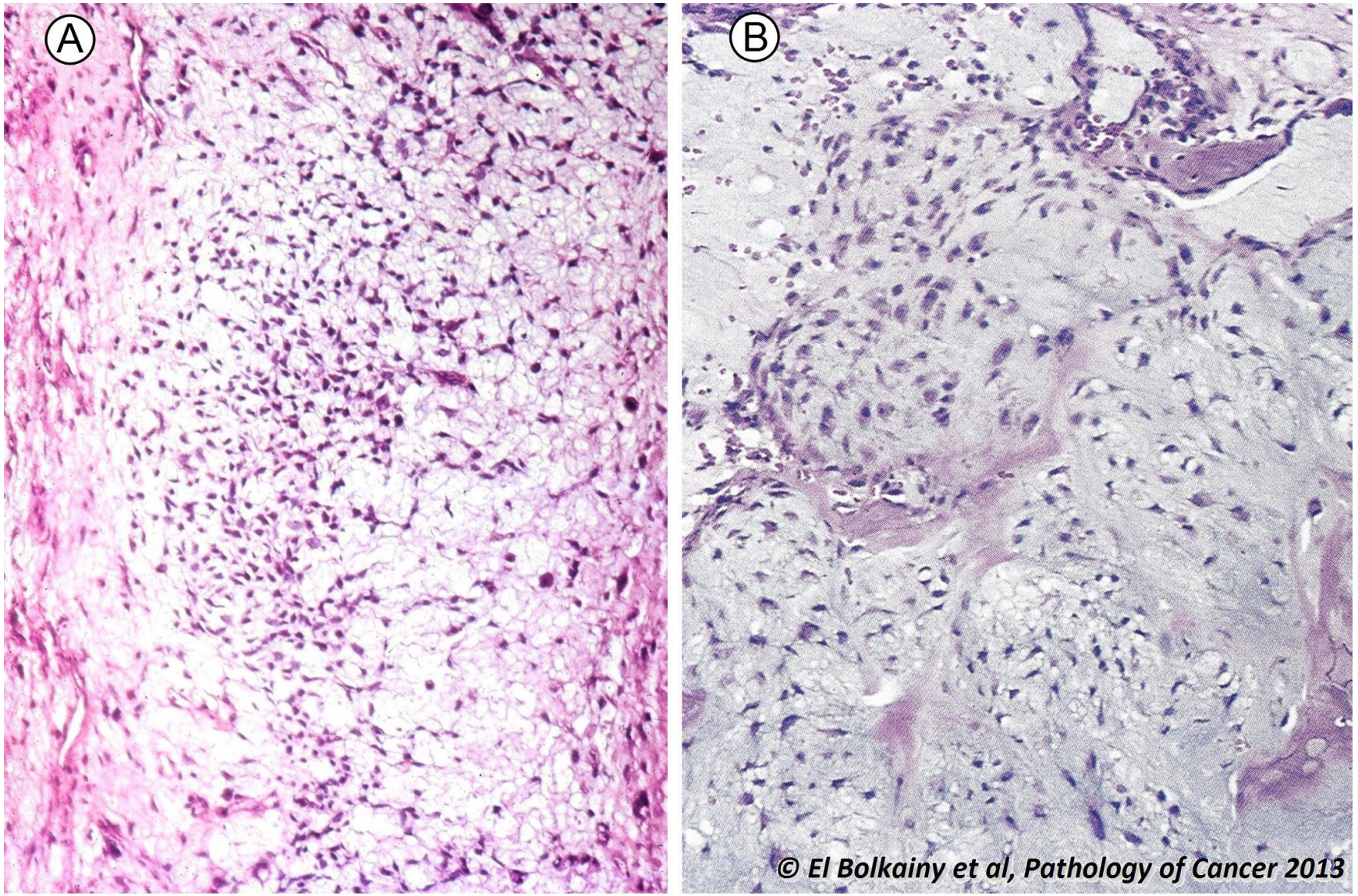
Picture 20-23 **Chondrosarcoma grade 1, histology.** There is minimal anaplasia, low cellularity and lacunae contain single chondrocytes. This simulates a benign chondroma, but cartilagenous tumors > 5 cm in diameter are considered malignant.

20.24 Chondrosarcoma grade 2, histology.



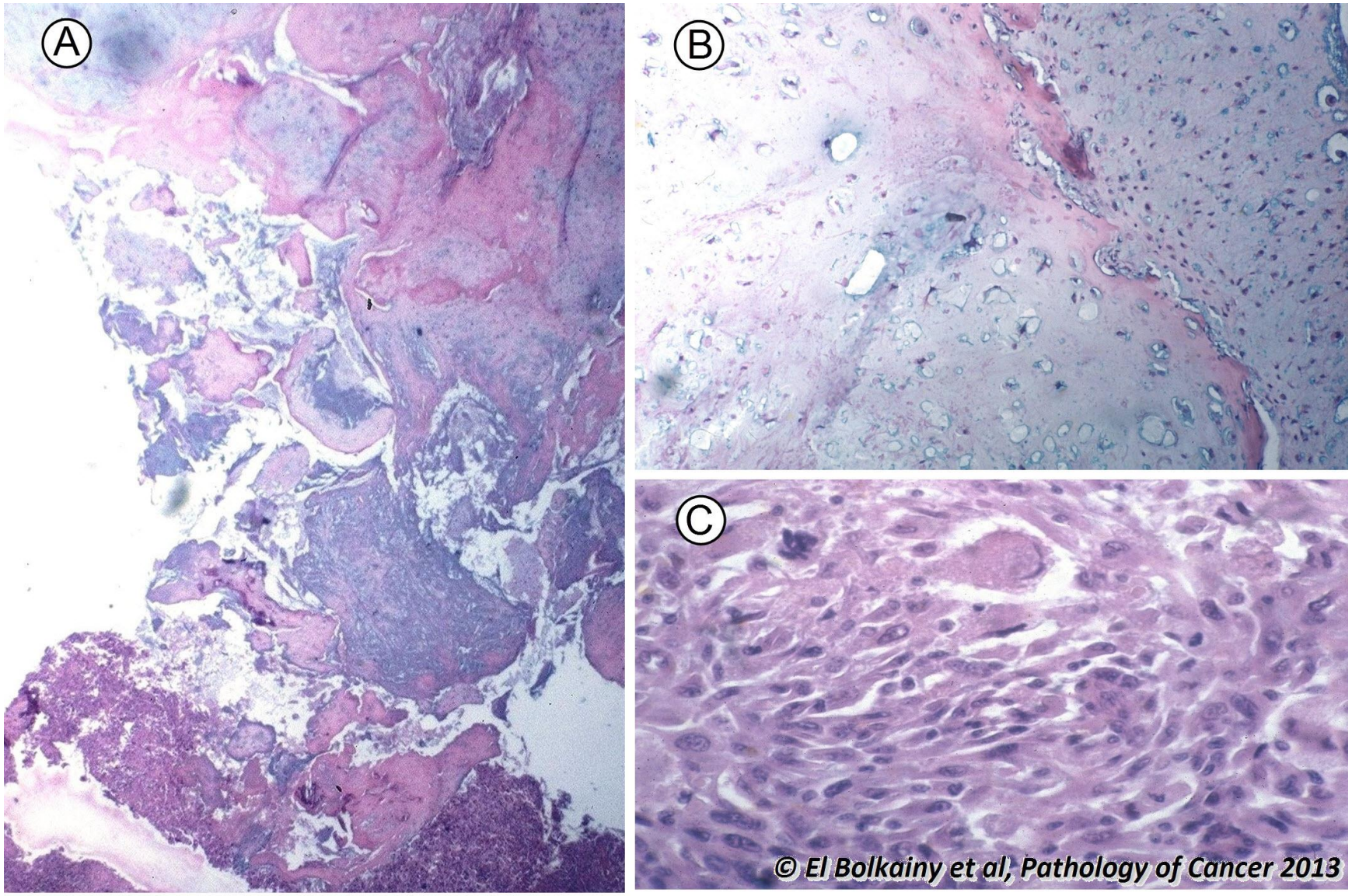
Picture 20-24 **Chondrosarcoma grade 2, histology.** There is moderate hypercellularity, moderate anaplasia with variation in cell size and lacunae may contain multiple cells. There is also of orderly pattern in the matrix.

20.25 Chondrosarcoma grade 3, histology.



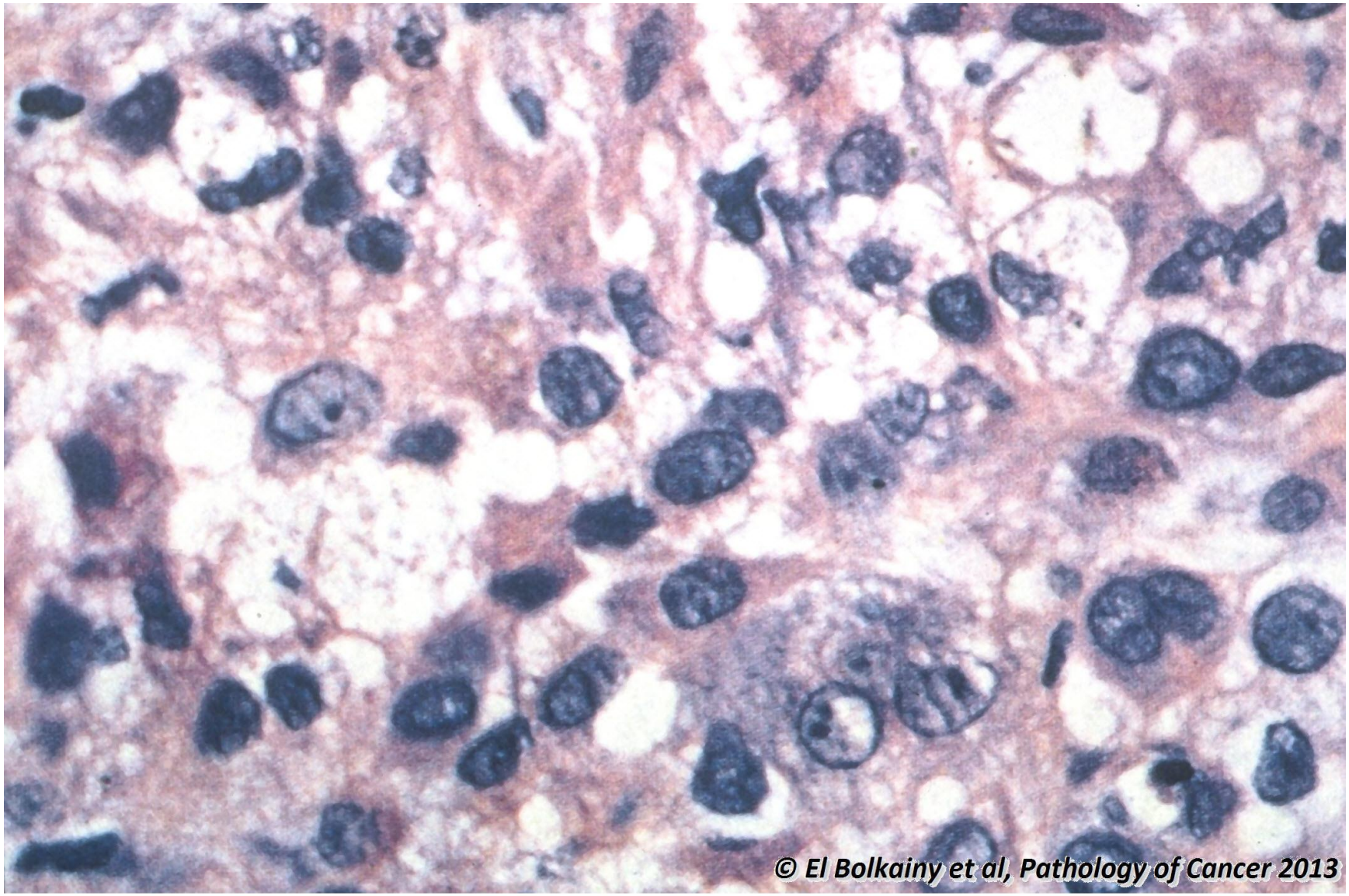
Picture 20-25 **Chondrosarcoma grade 3, histology.** There is marked cellularity and crowded pattern. A change of rounded shape to spindle or stellate shape in myxoid stroma, best seen at the peripheral growing margin of the tumor.

20.26 Dedifferentiated chondrosarcoma, histology.



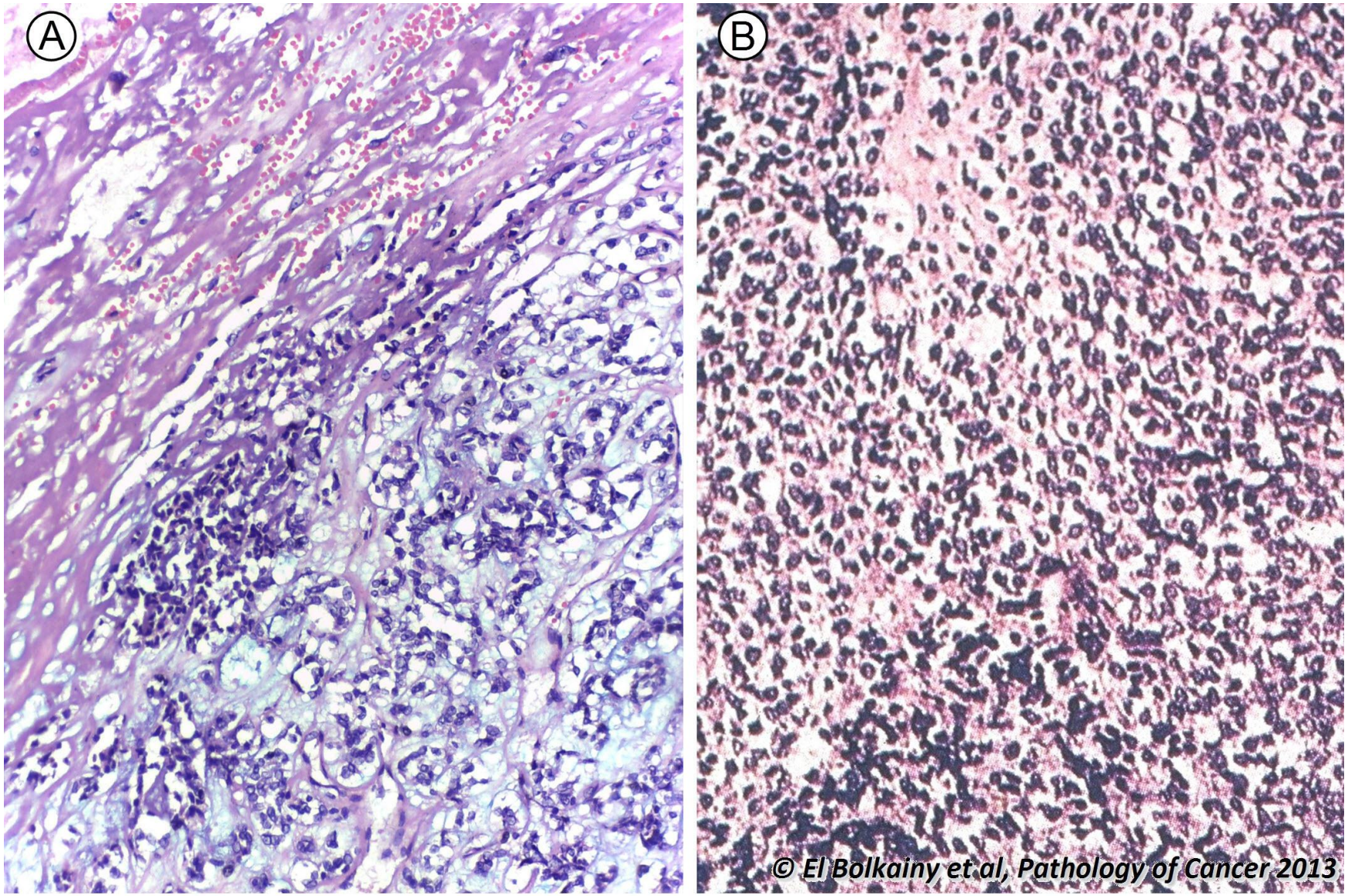
Picture 20-26 **Dedifferentiated chondrosarcom, histology.** This denotes focal progression of a low-grade chondrosarcoma to high- grade sarcoma. **A** The two tumors occupy geographic areas in proximity with abrupt transition. **B** Original grade 1 chondrosarcoma. **C** Dedifferentiated tumor, a malignant fibrous histiocytoma (undifferentiated pleomorphic sarcoma).

20.27 Chondrosarcoma, clear cell type, histology.



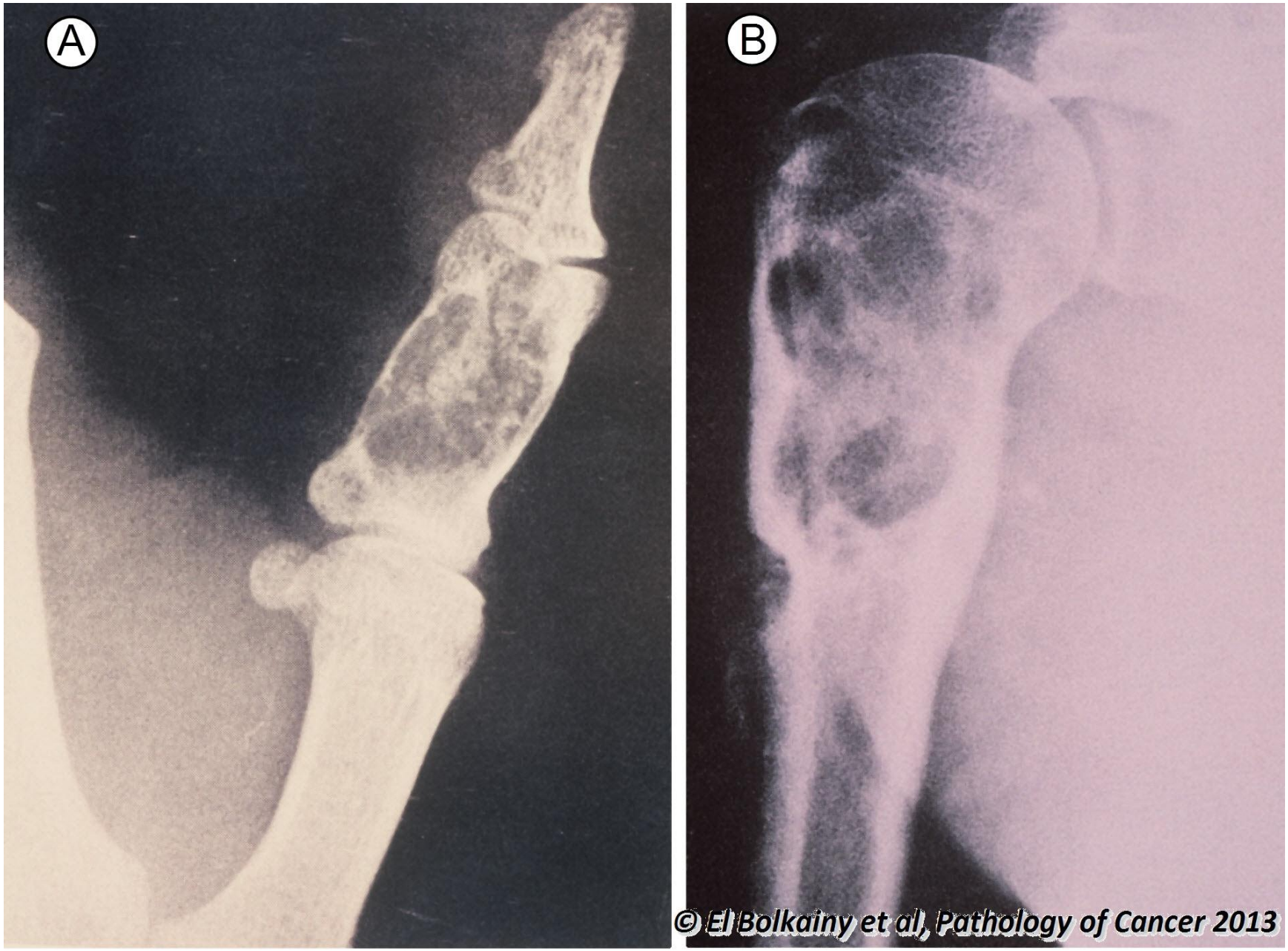
Picture 20-27 **Chondrosarcoma, clear cell type, histology.** This rare variant shows malignant chondroblasts with clear cytoplasm, central nuclei and prominent nucleoli. It may rarely shows osteoid and giant cells in the stroma.

20.28 Mesenchymal chondrosarcoma, histology.



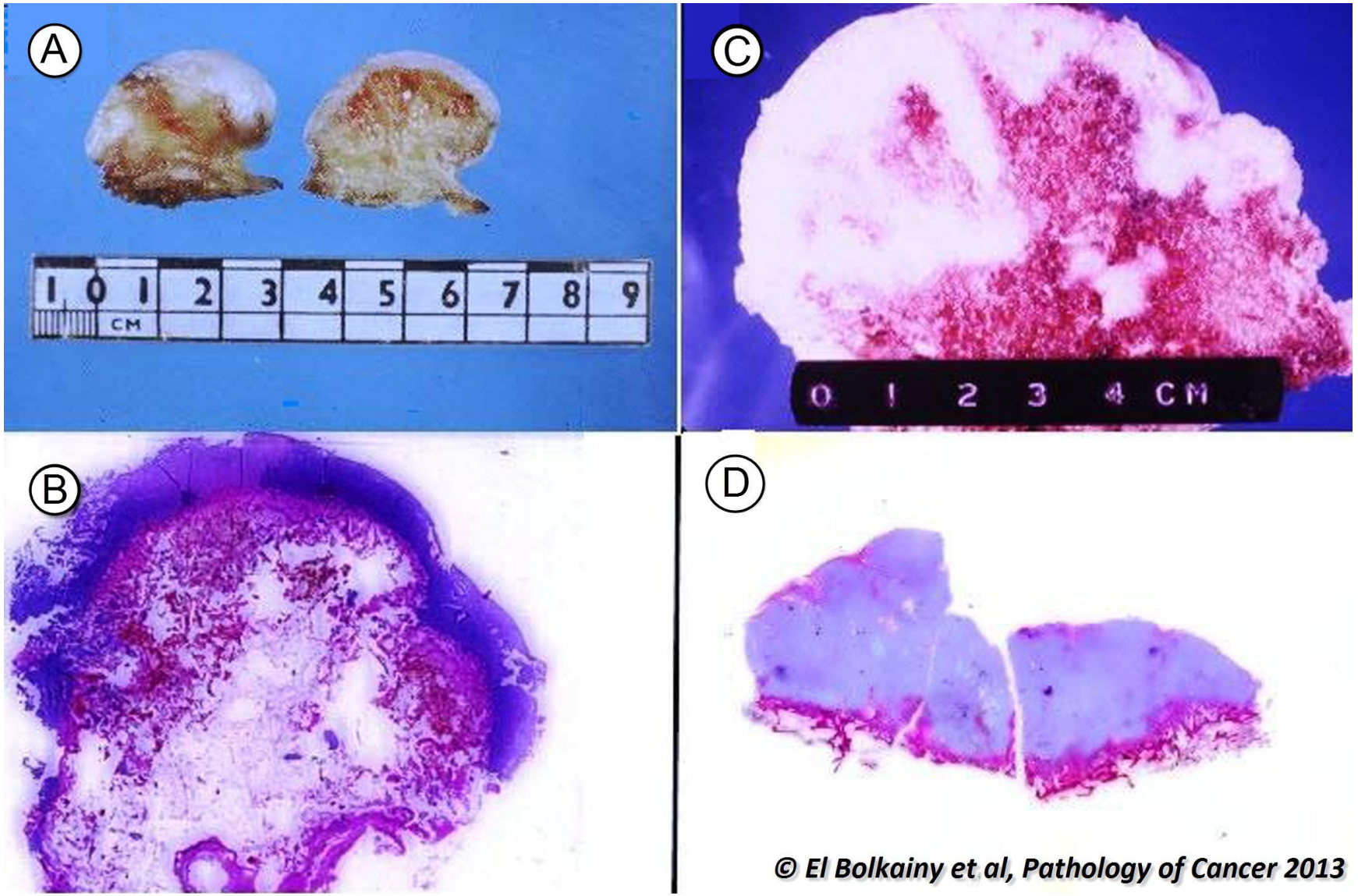
Picture 20-28 **Mesenchymal chondrosarcoma, histology.** A rare biphasic sarcoma composed of **A** a cartilagenous component, as well as, **B** a hypercellular round cell component with vascular stroma.

20.29 Enchondroma of thumb, radiography.



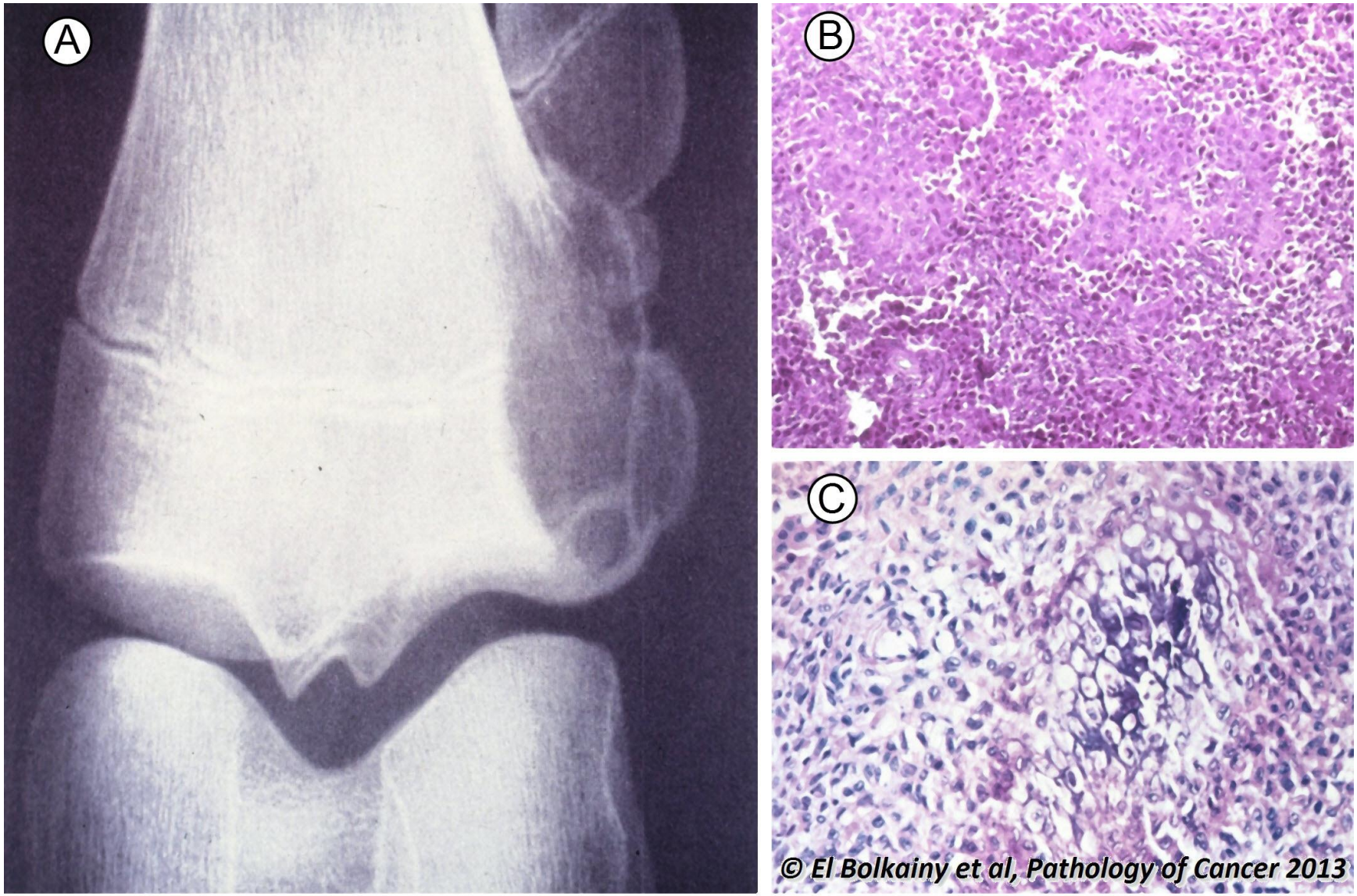
Picture 20-29 **Enchondroma of thumb, radiography. A** Enchondroma of middle phalanx of thumb, an intact cortical bone assures its benign nature. **B** Cartilagenous tumor of upper humeral metaphysis. A large size (> 5 cm) and erosion of cortical bone should raise suspicion of malignancy.

20.30 Osteochondroma.



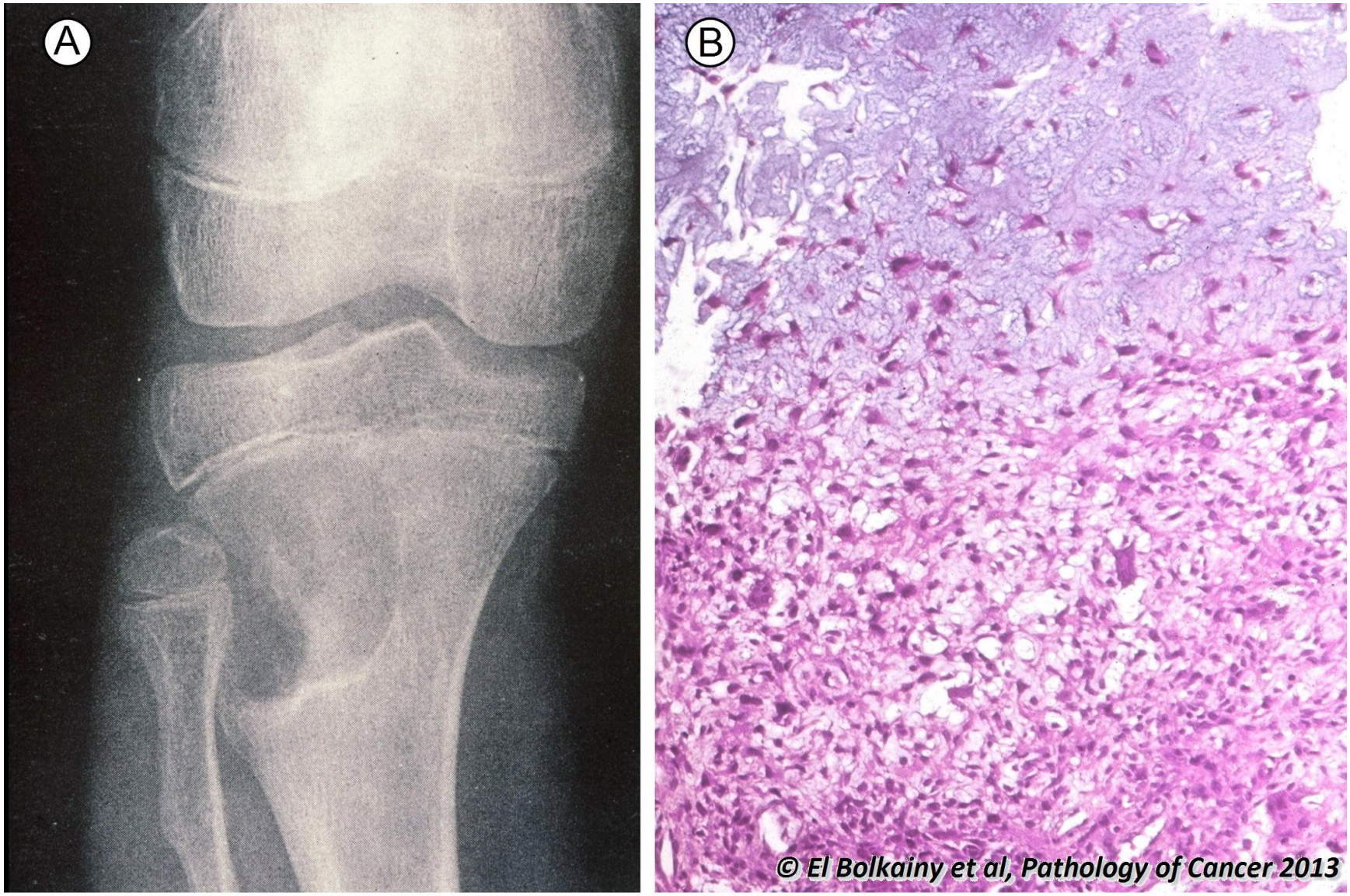
Picture 20-30 **Osteochondroma. A** and **B** A benign osteochondroma has a thin uniform catilagenous cap (usually < 1 cm). **C** and **D** Invasion of cancellous bone by cartilage or focal thickening of cartilagenous cap (1-3 cm) should raise suspicion of malignant change.

20.31 Chondroblastoma.



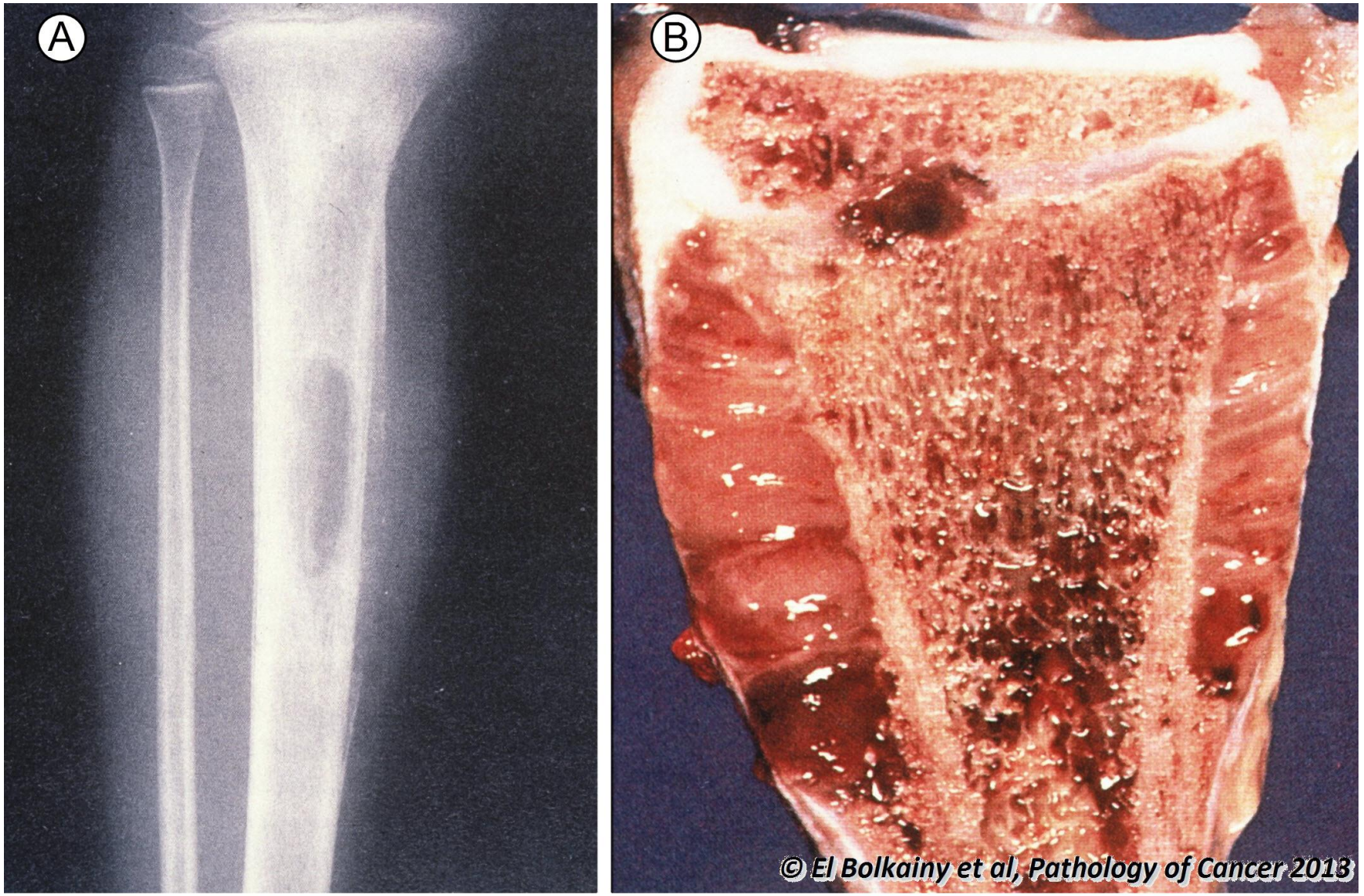
Picture 20-31 **Chondroblastoma. A** Radiography. This benign tumor is typically epiphyseal in location. **B** Histology, hypercellular round chondroblasts, with minimal focal chondroid matrix, osteoclast- like giant cells and **C** chicken wire calcification in the stroma.

20.32 Chondromyxoid fibroma.



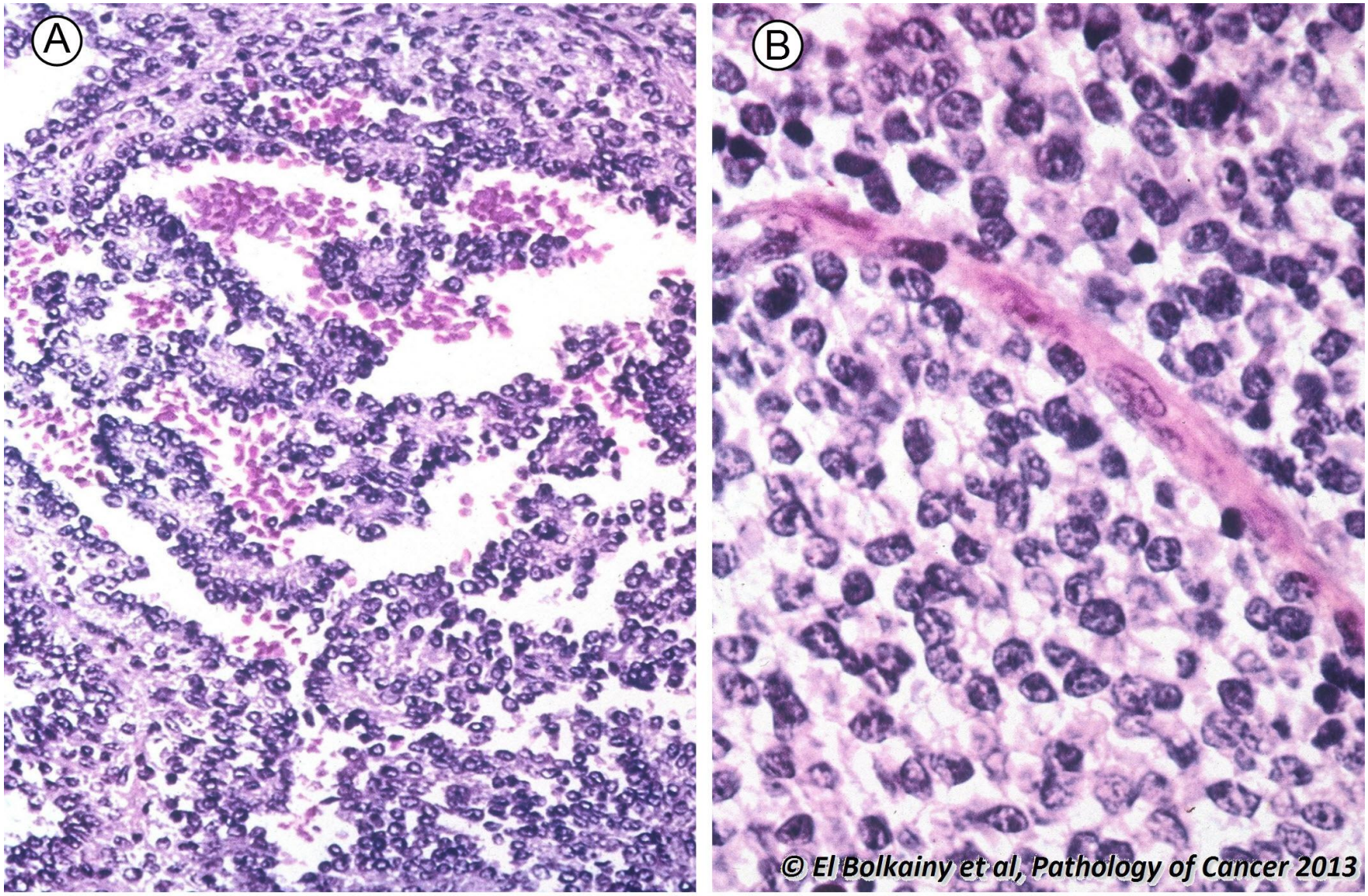
Picture 20-32 **Chondromyxoid fibroma. A** Radiography, metaphyseal location is characteristic, with well-defined margin. **B** Histology, spindle and stellate cells with lobular pattern in myxoid stroma, few osteoclast-like giant cells.

20.33 Ewing sarcoma of tibia.



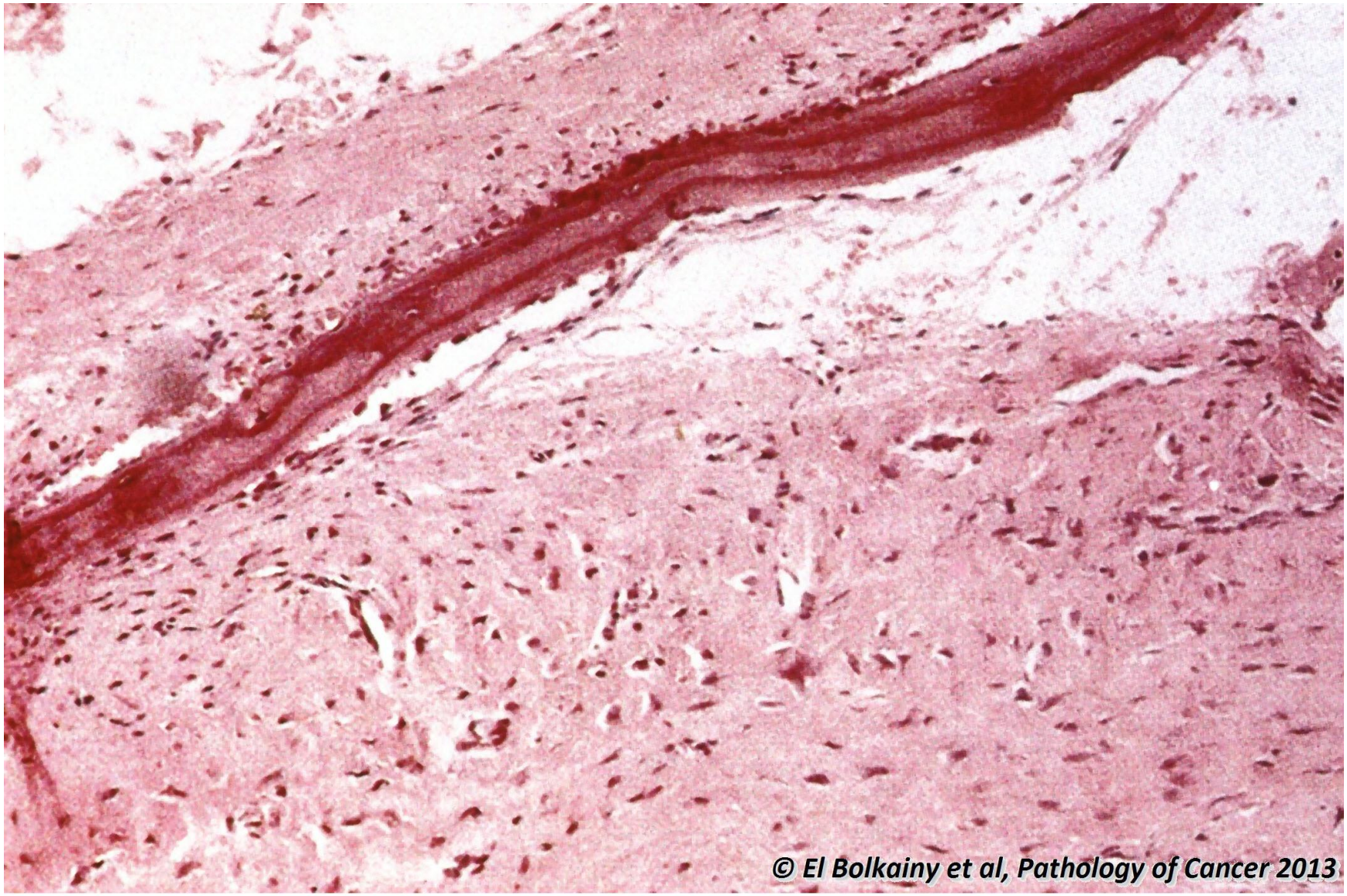
Picture 20-33 **Ewing sarcoma of tibia. A** Radiography, commonly affects the shaft with onion skin pattern of subperiosteal reaction. Soft tissue mass is more prominent than the bony changes. **B** Gross features, marked soft tissue spread with hemorrhage and necrosis.

20.34 Ewing sarcoma, histology.



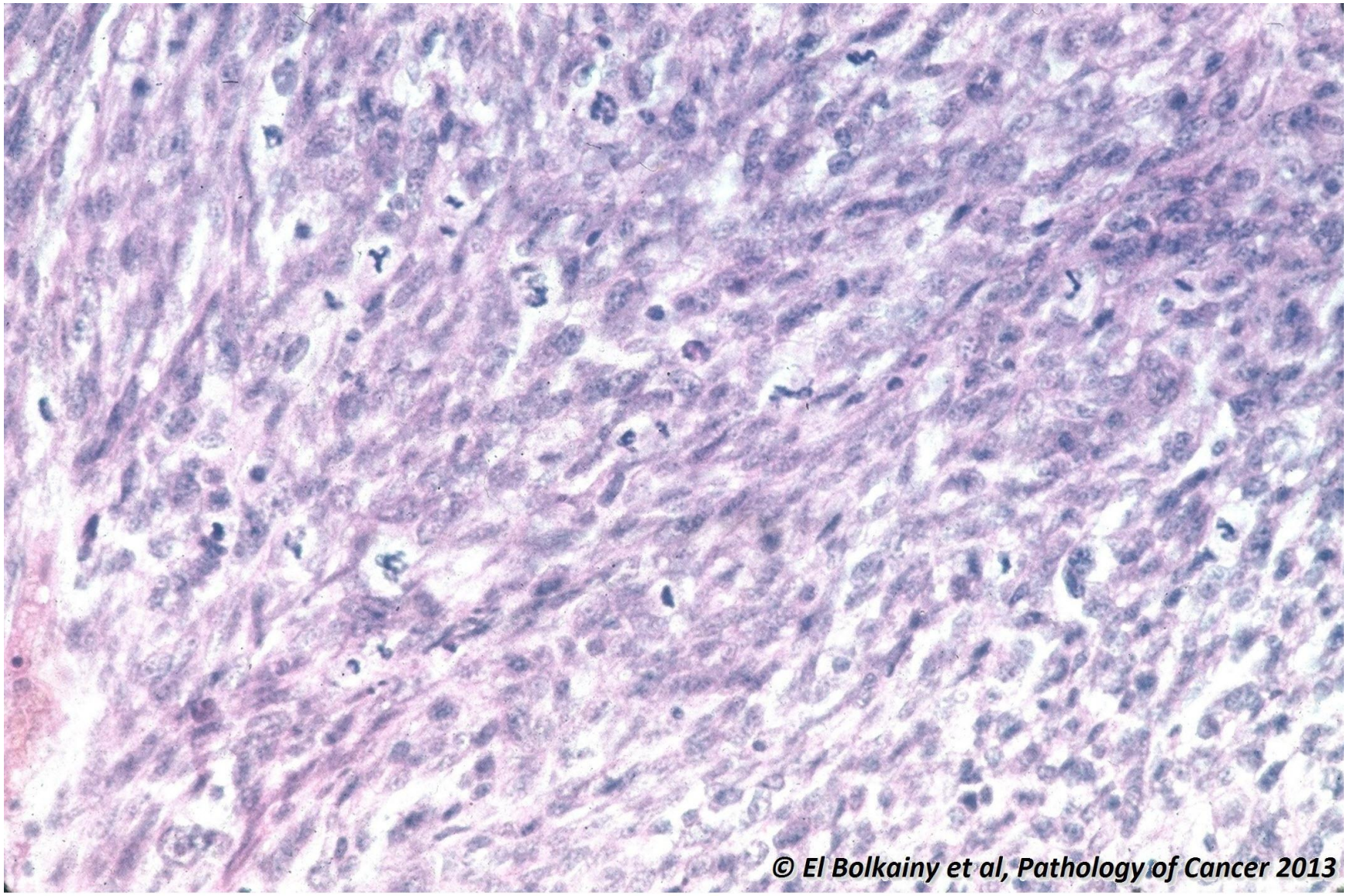
Picture 20-34 **Ewing sarcoma, histology.** This is a monophasic, hypercellular, round cell tumor, with marked necrosis especially in tumor areas away from blood supply. Confirmatory immunostains: CD99+ and FLI-1+.

20.35 Desmoplastic fibroma, histology.



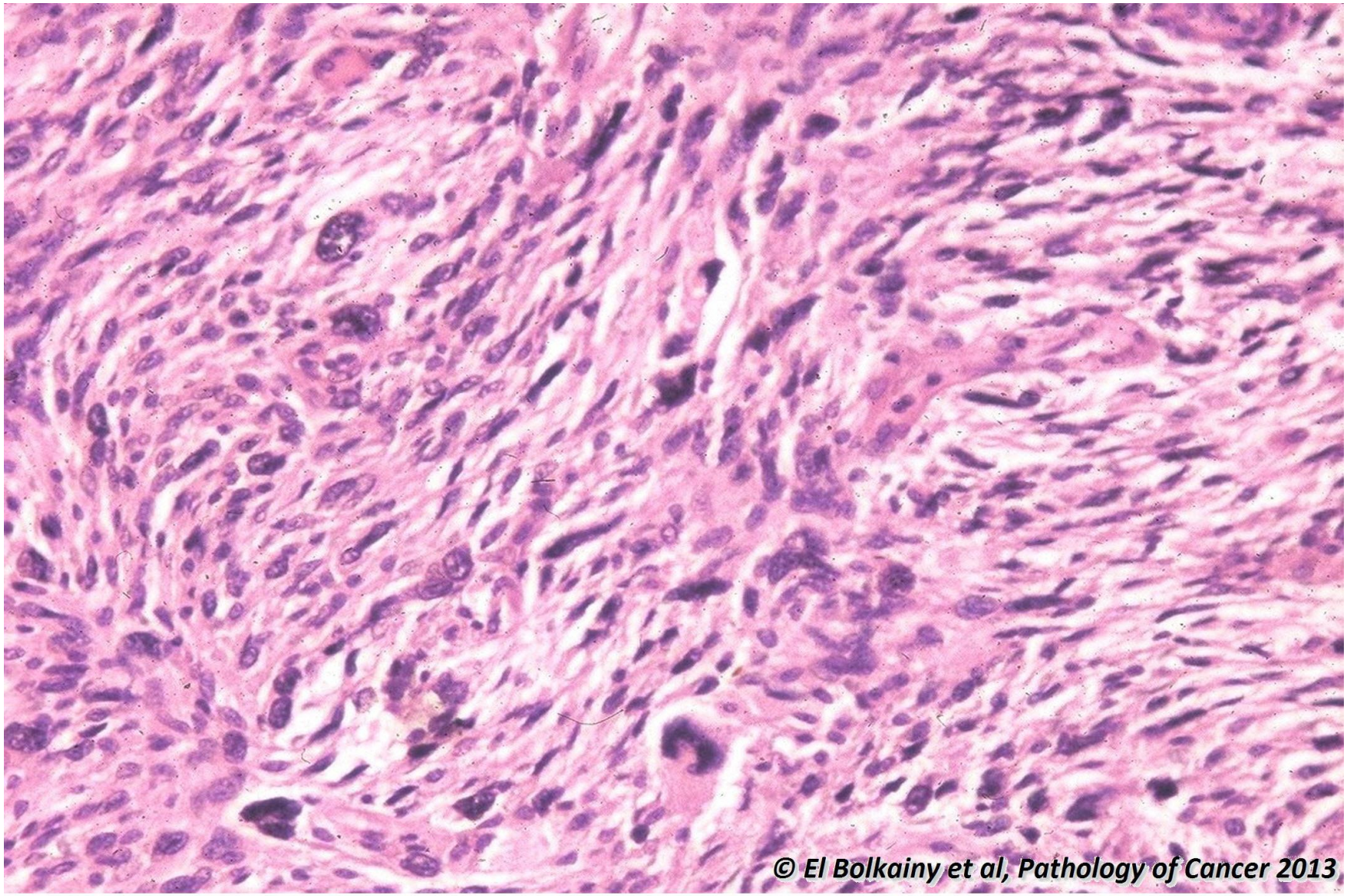
Picture 20-35 **Desmoplastic fibroma, histology.** This borderline locally recurrent fibromatosis is composed of hypocellular fibroblasts with abundant collagen (amount of collagen is more than fibroblasts). Radiologically it differs from non-ossifying fibroma by its central location and invasive property.

20.36 Fibrosarcoma, histology.



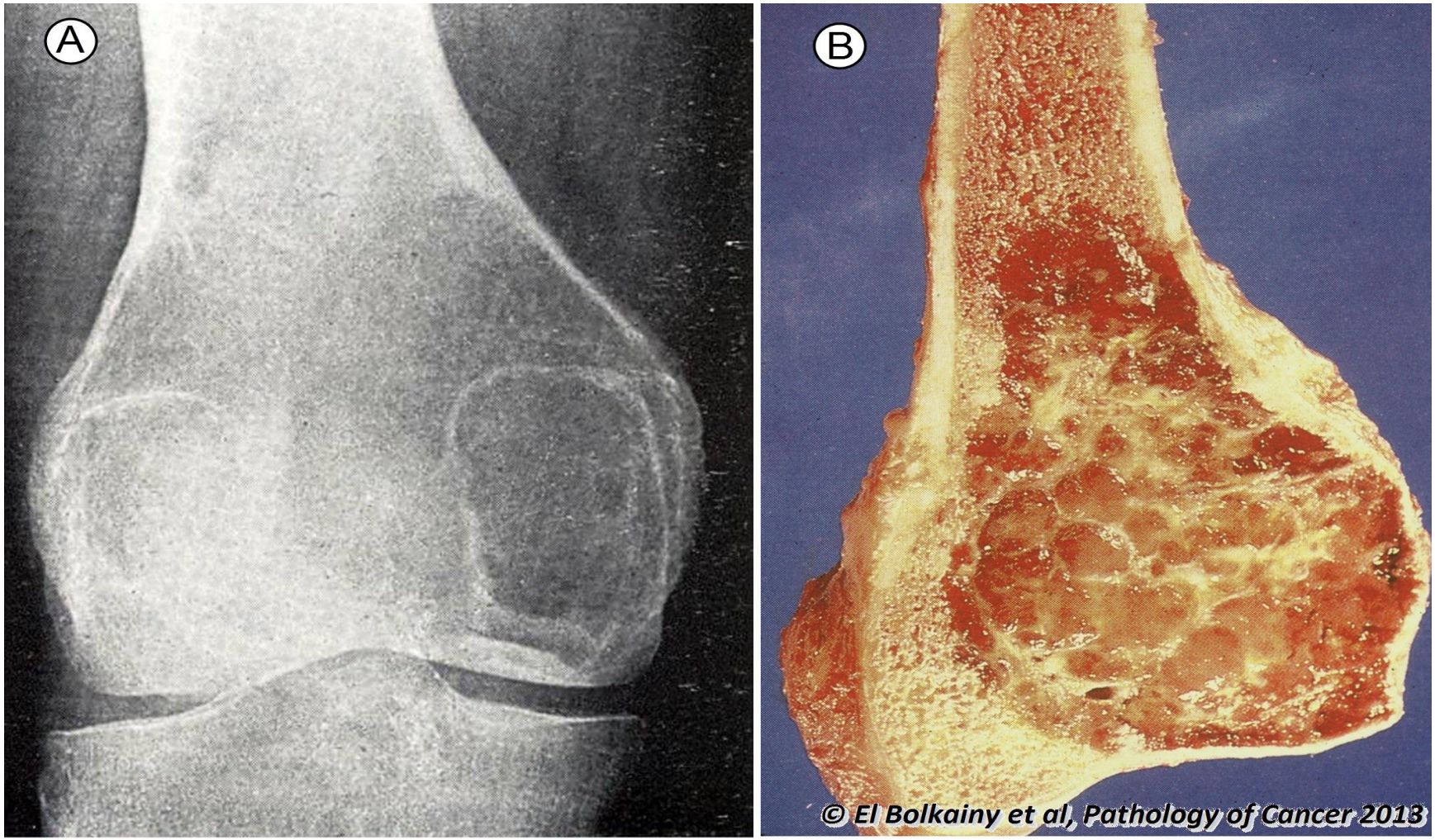
Picture 20-36 **Fibrosarcoma, histology.** Hypercellular spindle cell sarcoma lacking giant cells and bone formation in the stroma. The amount of spindle cells are more than stromal collagen. Mitosis and Herring-bone pattern are evident.

20.37 Malignant fibrous histiocytoma, histology.



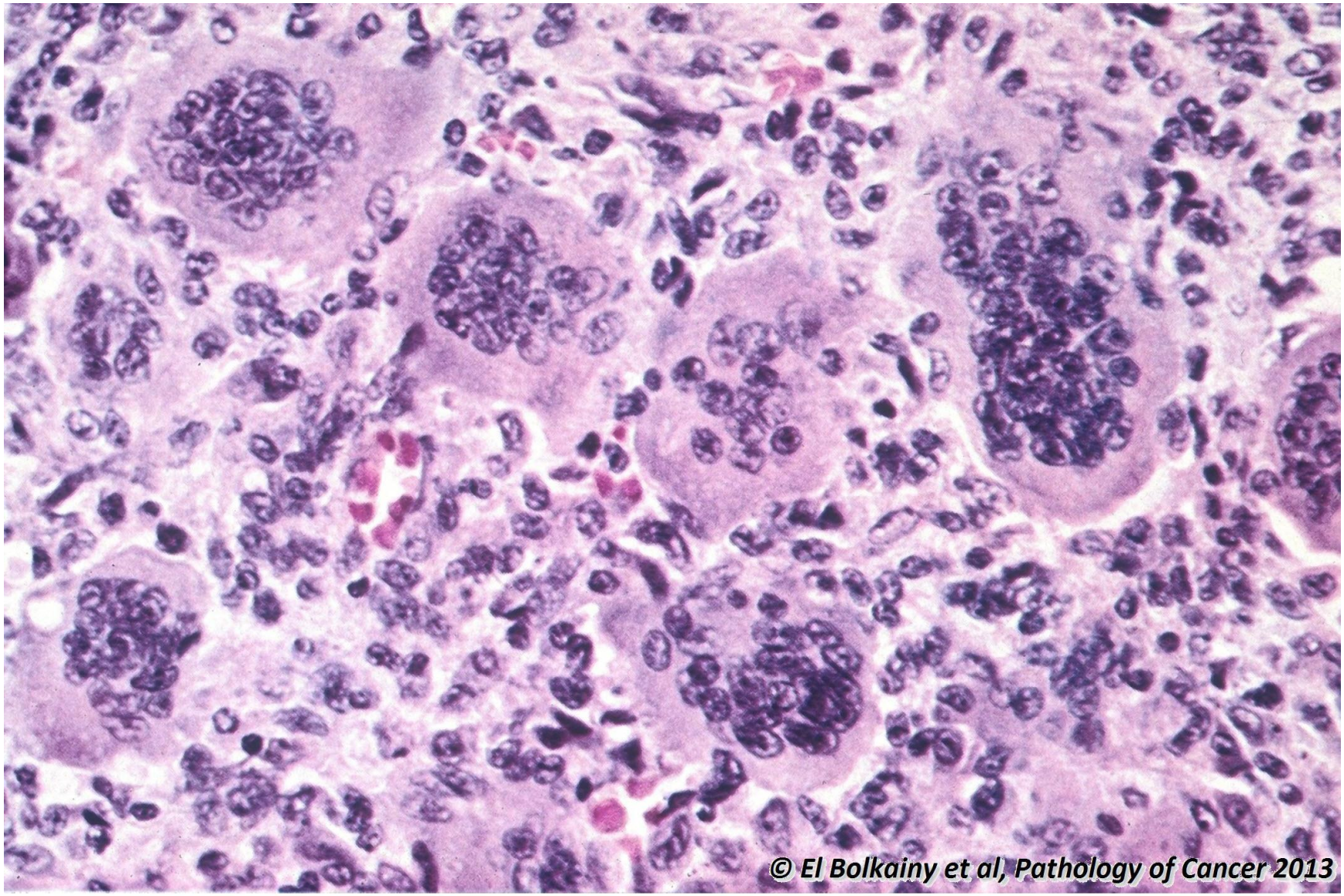
Picture 20-37 **Malignant fibrous histiocytoma, histology.** The fibroblasts with a characteristic storiform multinucleated giant cells are present.

20.38 Giant cell tumor of distal end of femur.



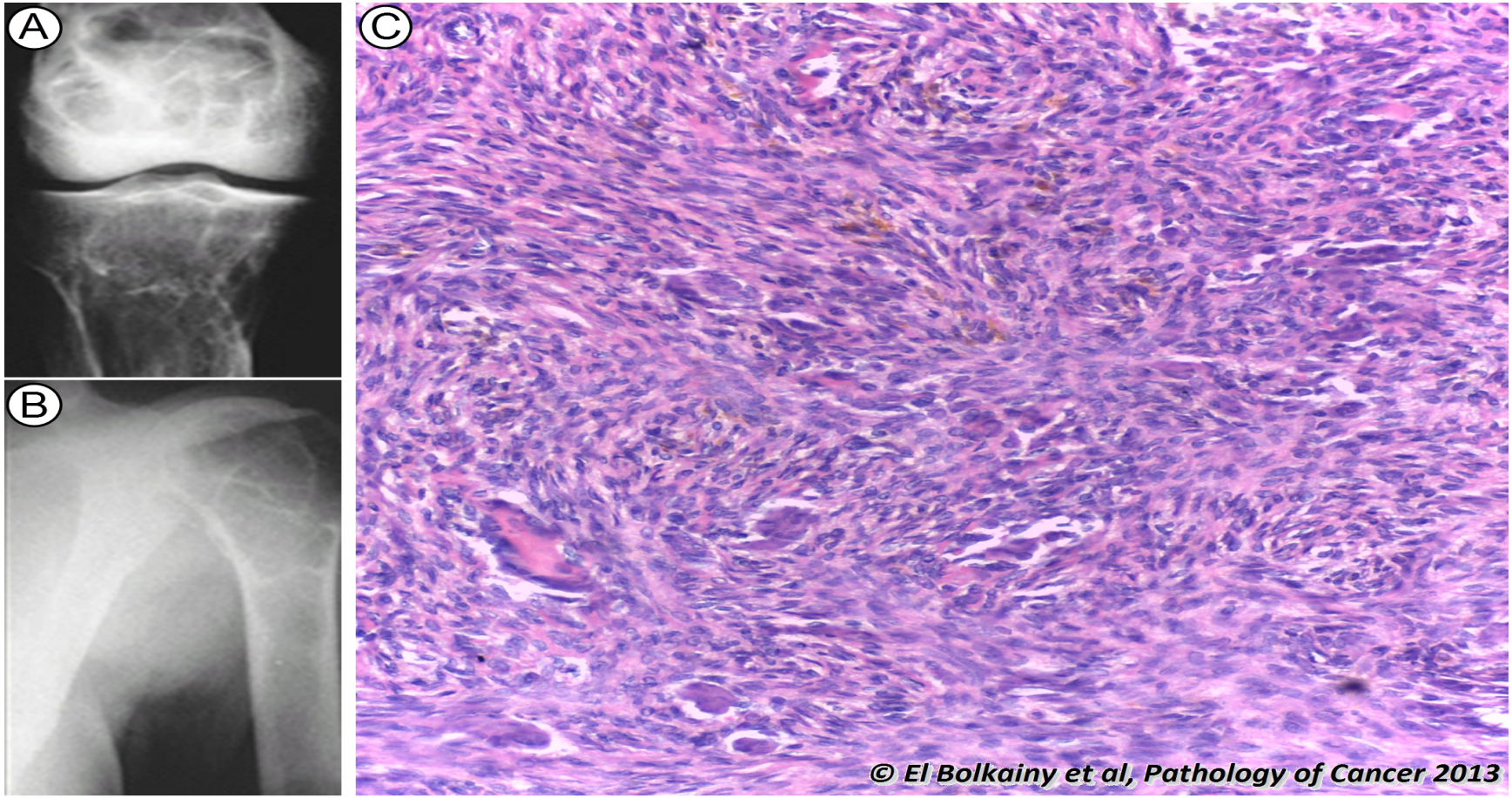
Picture 20-38 **Giant cell tumor of distal end of femur. A** Radiography, solitary epiphyseal location is characteristic, but, may partially spread to metaphysis. **B** Gross features, an expansile, well-demarcated epiphyseal tumor.

20.39 Giant cell tumor, histology.



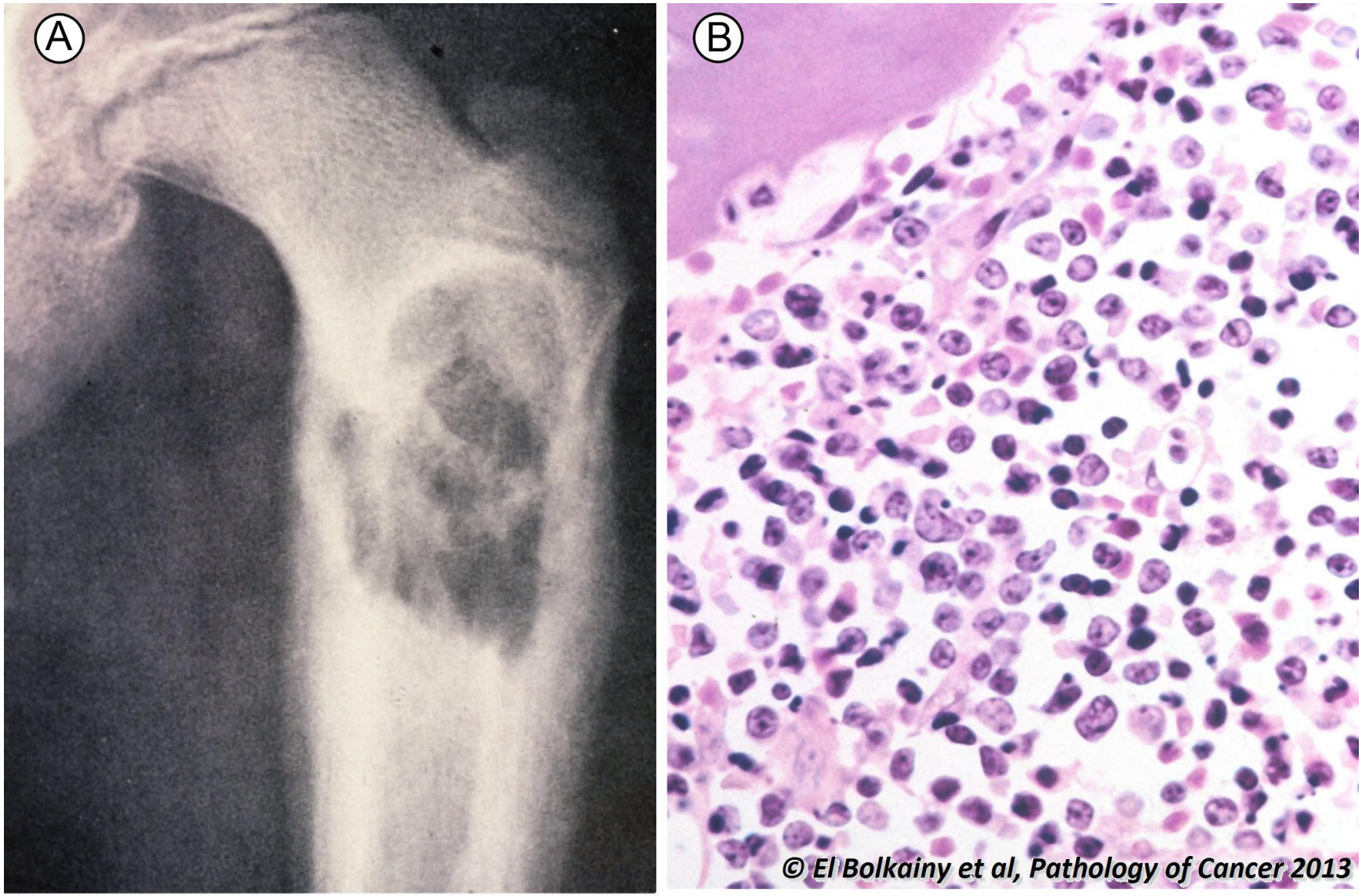
Picture 20-39 **Giant cell tumor, histology.** The neoplastic component of the tumor is the ovoid mononuclear cells (show mitosis and p63+), whereas, the multinucleated osteoclast-like giant cells are numerous and evenly distributed.

20.40 Giant cell lesion of hyperparathyroidism (osteitis fibrosa cystica).



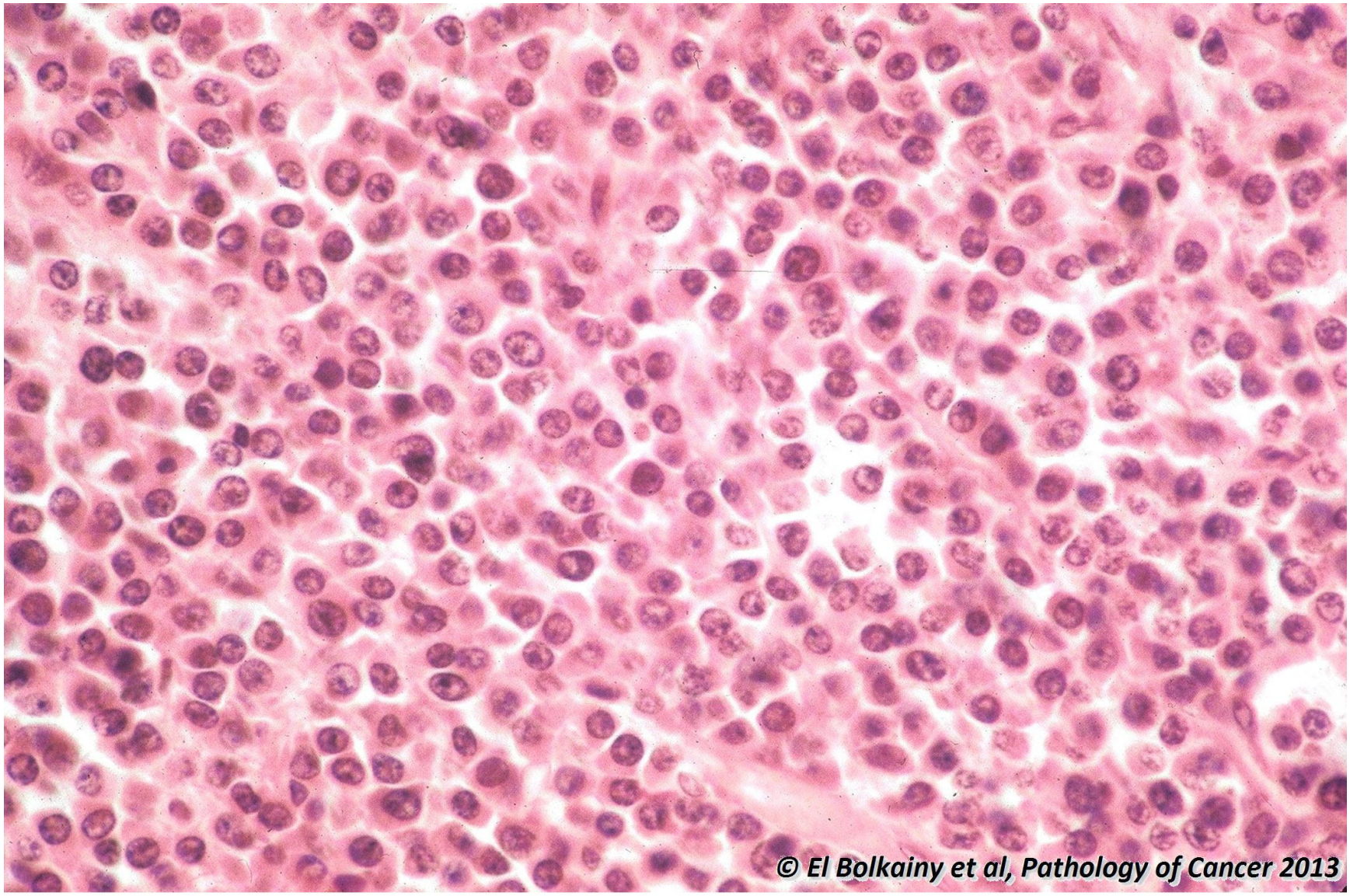
Picture 20-40 **Giant cell lesion of hyperparathyroidism (osteitis fibrosa cystica). A** and **B** Radiography, multiple lytic bone lesions are characteristic with high serum parathormone. **C** Histology, stromal cells are more fibrous in appearance and giant cells have a focal distribution.

20.41 Primary non-Hodgkin lymphoma of femur.



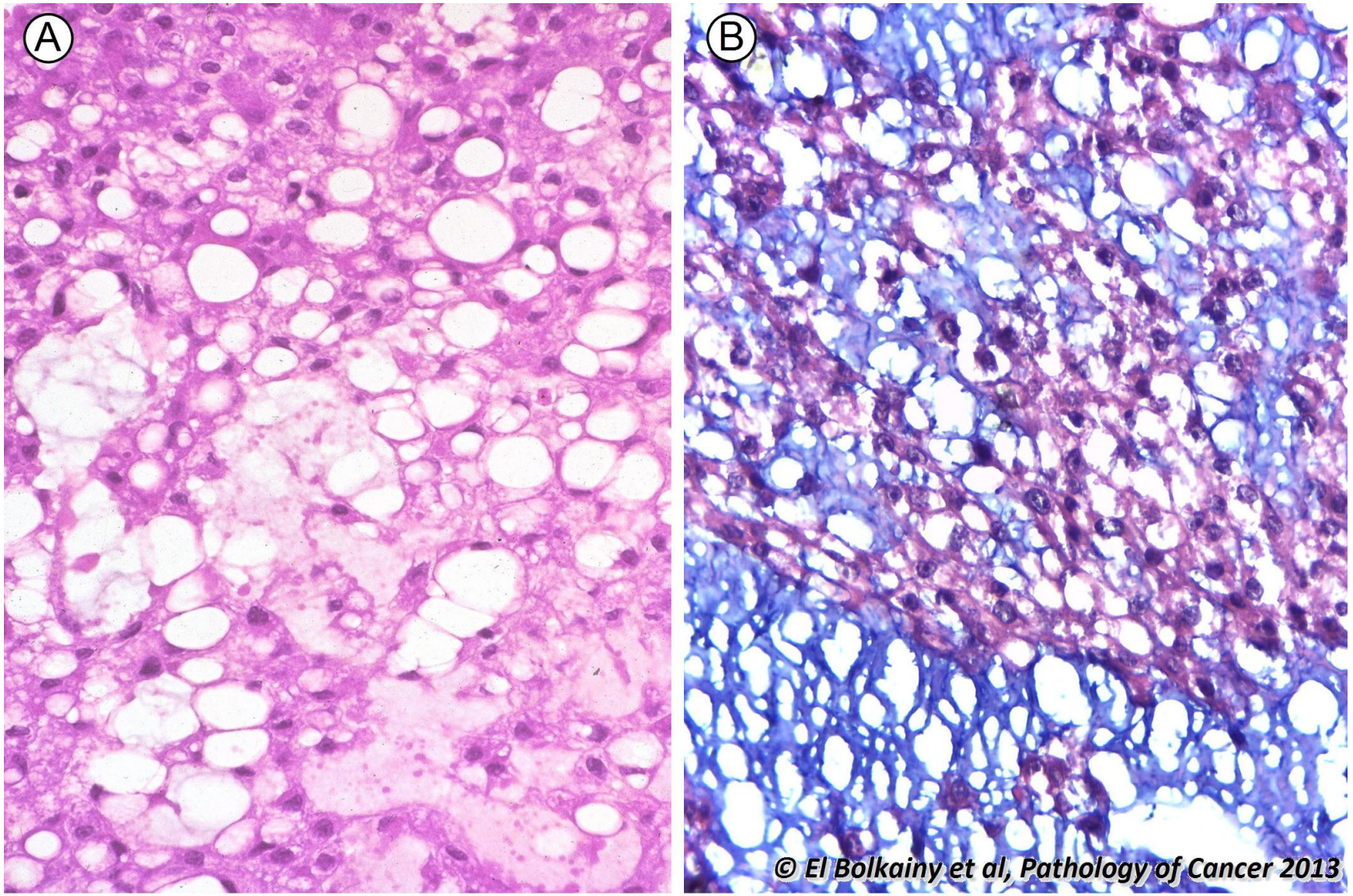
Picture 20-41 **Primary non-Hodgkin lymphoma of femur. A** Radiography, presents as a lytic lesion in metaphysis with irregular margin. **B** Histology, large cell or mixed cell lymphoma, always B phenotype.

20.42 Plasmacytoma, histology.



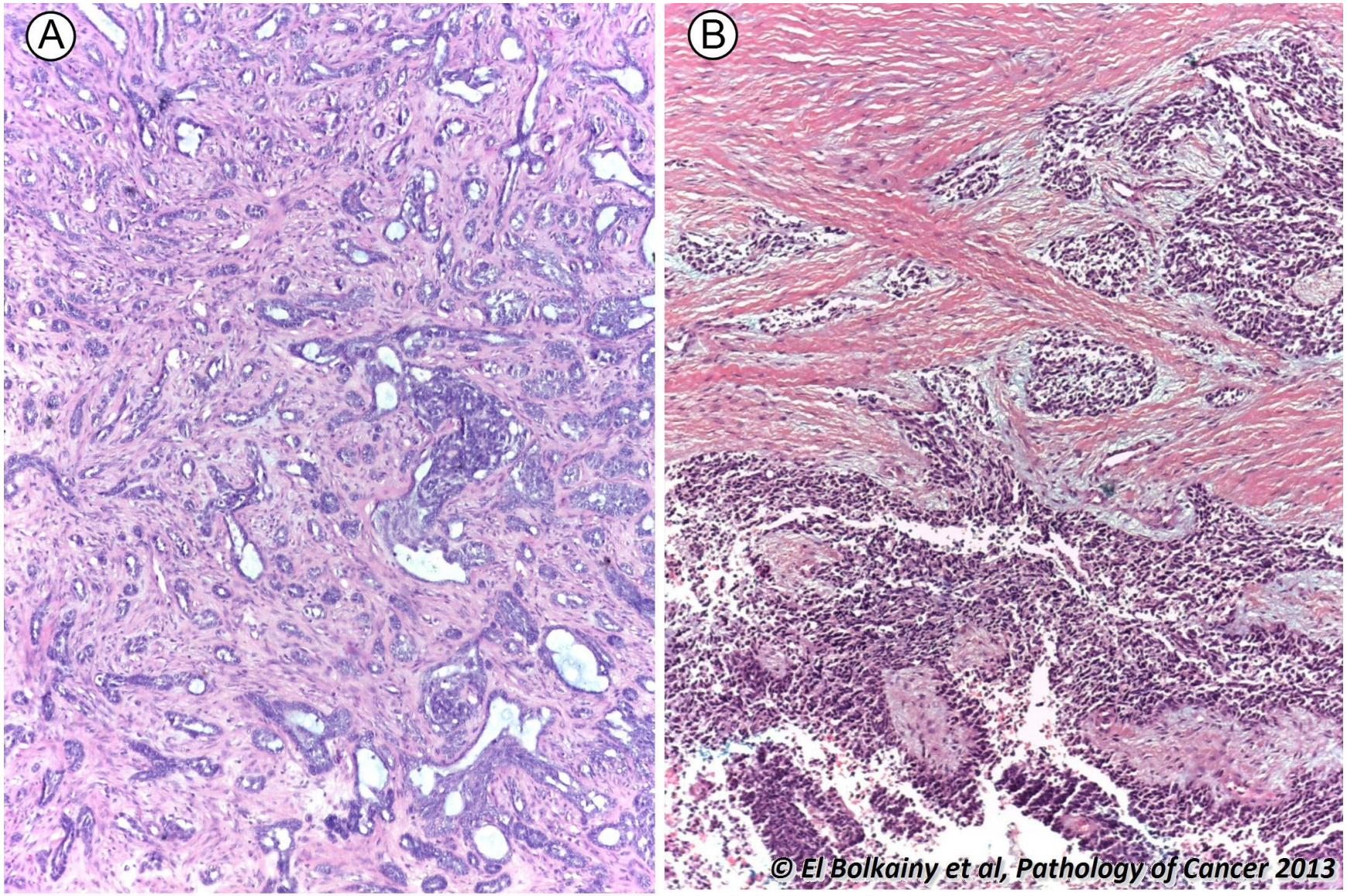
Picture 20-42 **Plasmacytoma, histology.** Solitary extramedullary myeloma is composed of a pure population of plasma cells including atypical binucleated forms. Immunostains: CD38+ and CD138+. There is a risk of progression to multiple myeloma.

20.43 Chordoma, histology.



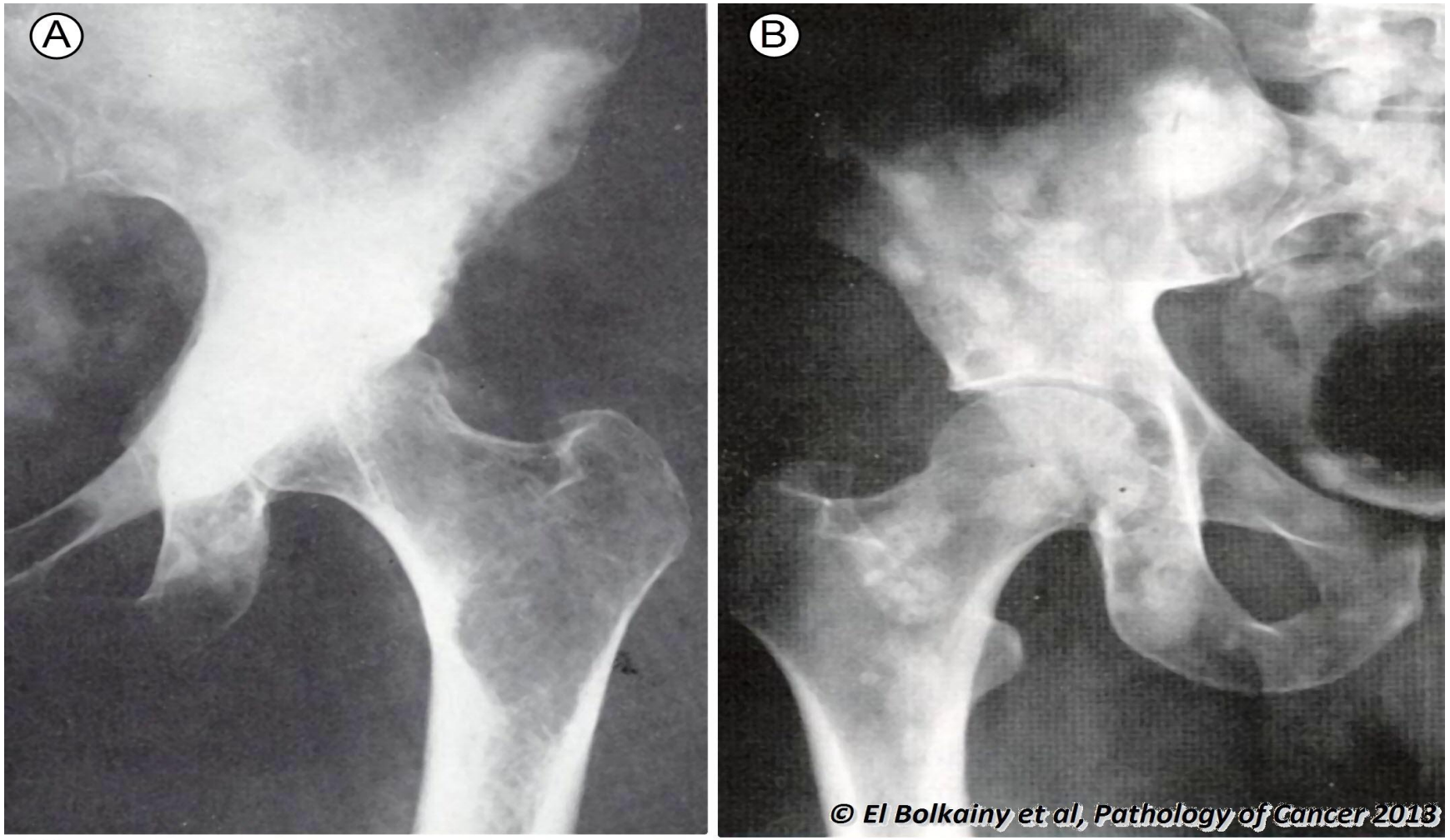
Picture 20-43 **Chordoma, histology. A** Hematoxylin and eosin, groups of cells with multiple cytoplasmic vacuoles (physalliferous cells), CK+, with myxoid stroma. **B** Alcian blue stain, markedly positive in the stroma.

20.44 Adamantinoma of tibia, histology.



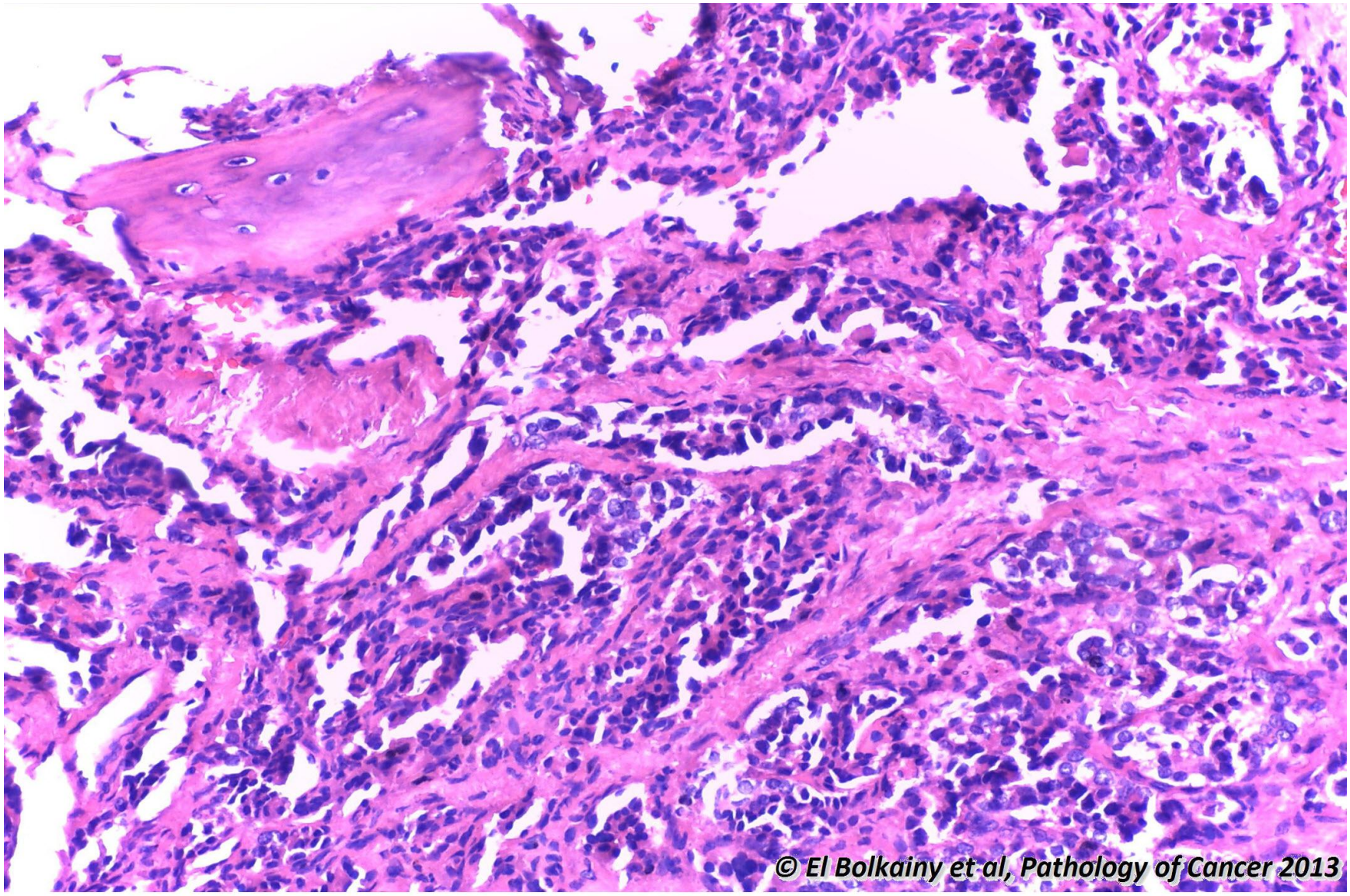
Picture 20-44 **Adamantinoma of tibia, histology.** Nests of epithelial cells in fibrous stroma. Four patterns are recognized: **A** tubular and **B** basaloid. Other 2 patterns (not shown): squamous with stellate reticulum and spindle cell. Immunostain: positive for pancytokeratin.

20.45 Bone metastases, radiography.



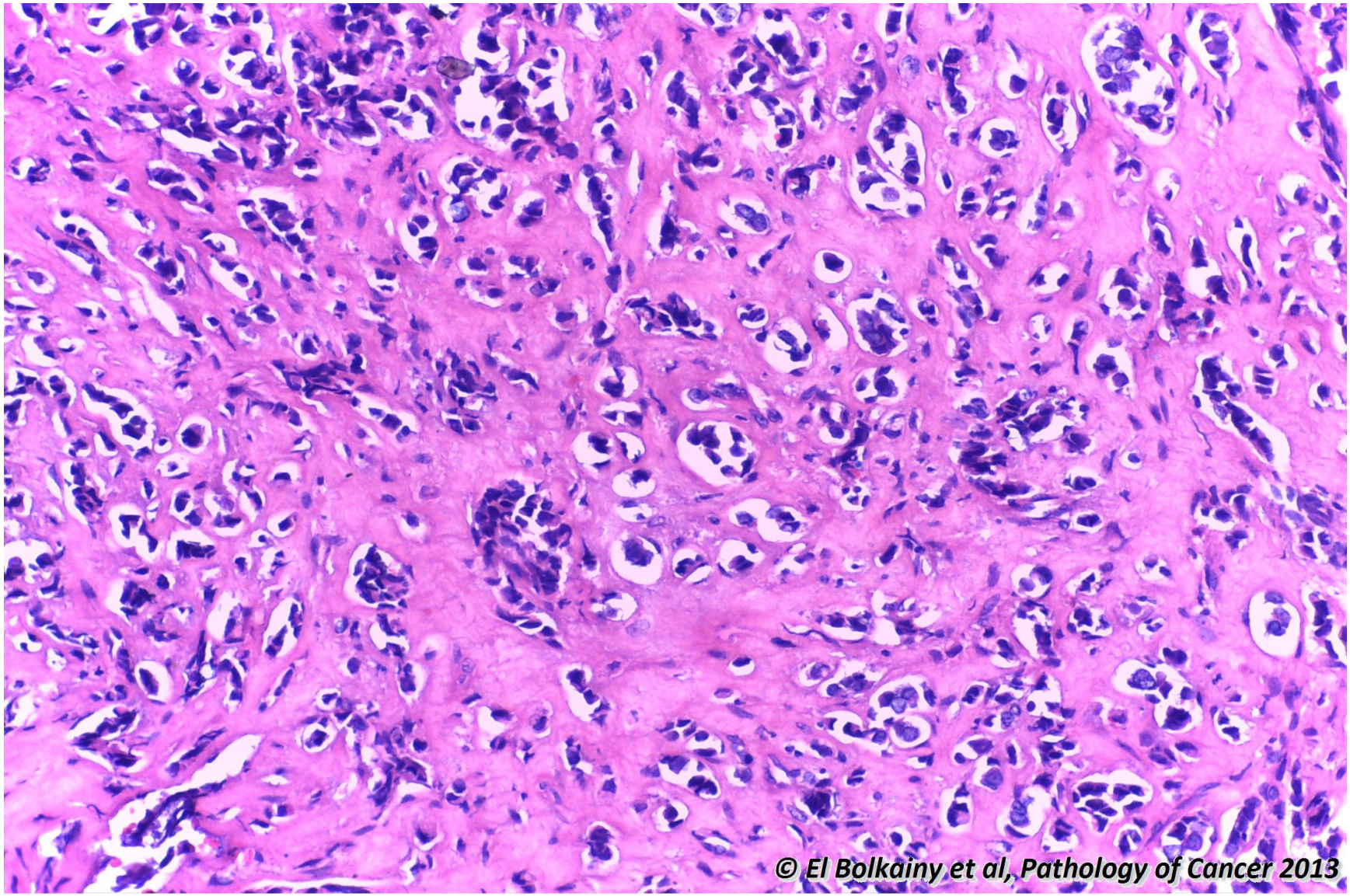
Picture 20-45 **Bone metastases, radiography. A** From breast carcinoma, mixed lytic and sclerotic metastases in femur and pelvis. **B** From prostatic carcinoma, multiple sclerotic metastases in pelvis and femur.

20.46 Sclerotic metastases from duct carcinoma of breast, histology.



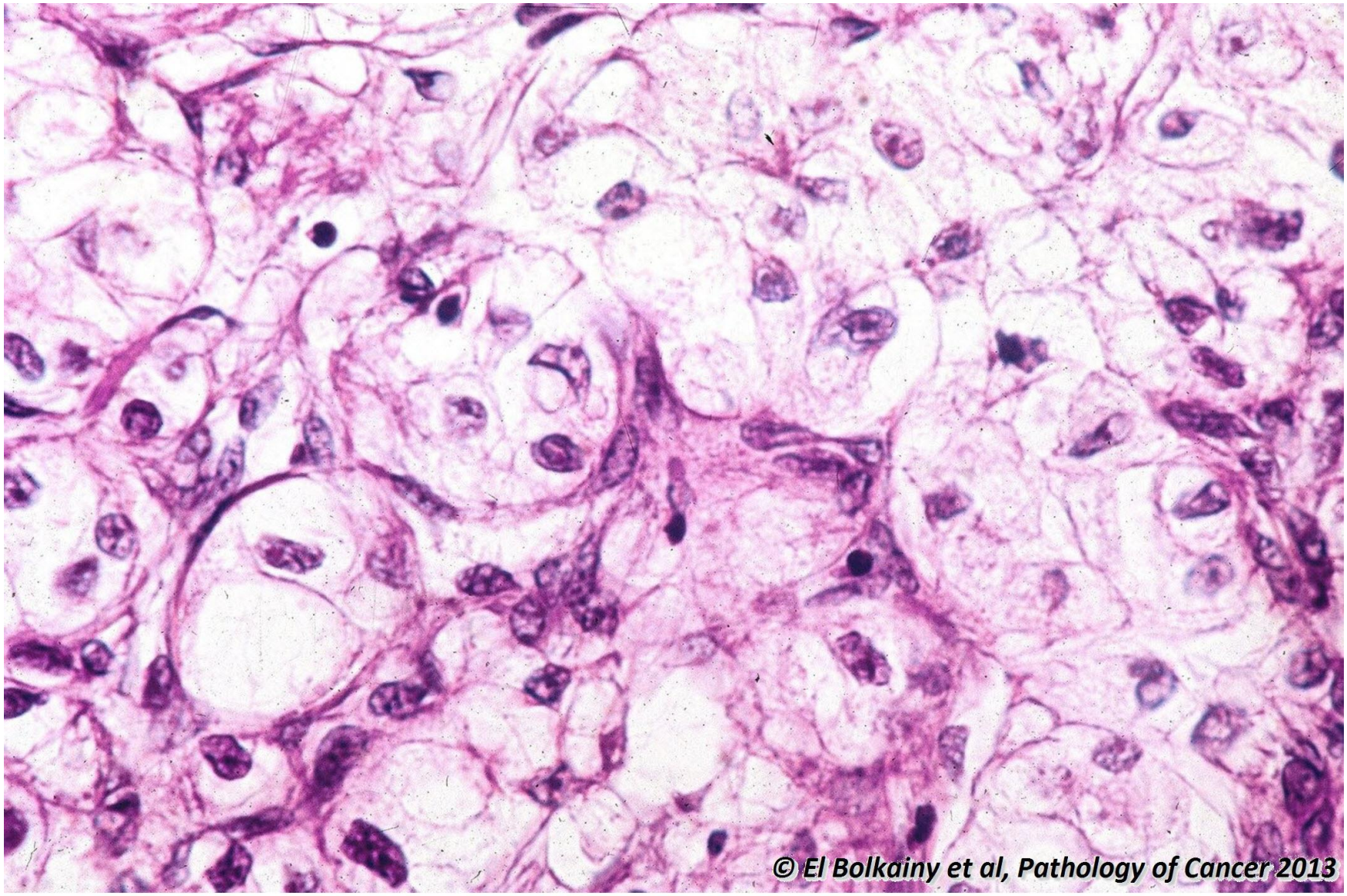
Picture 20-46 **Sclerotic metastases from duct carcinoma of breast, histology.** A high grade duct carcinoma with fine osteoid reaction in the stroma. Immunoreactivity to cytokeratin and radiographic picture help to avoid the misdiagnosis of osteosarcoma.

20.47 Sclerotic metastases from lobular carcinoma of breast, histology.



Picture 20-47 **Sclerotic metastases from lobular carcinoma of breast, histology.** Marked osteosclerotic bone reaction to lobular carcinoma, simulating small cell osteosarcoma.

20.48 Osteolytic bone metastases from renal carcinoma, clear cell type.



Picture 20-48 **Osteolytic bone metastases from renal carcinoma, clear cell type.** This tumor type is osteolytic and should not be confused with clear cell chondrosarcoma. Immunostain: CK+ and abdominal CT will reveal a renal mass.