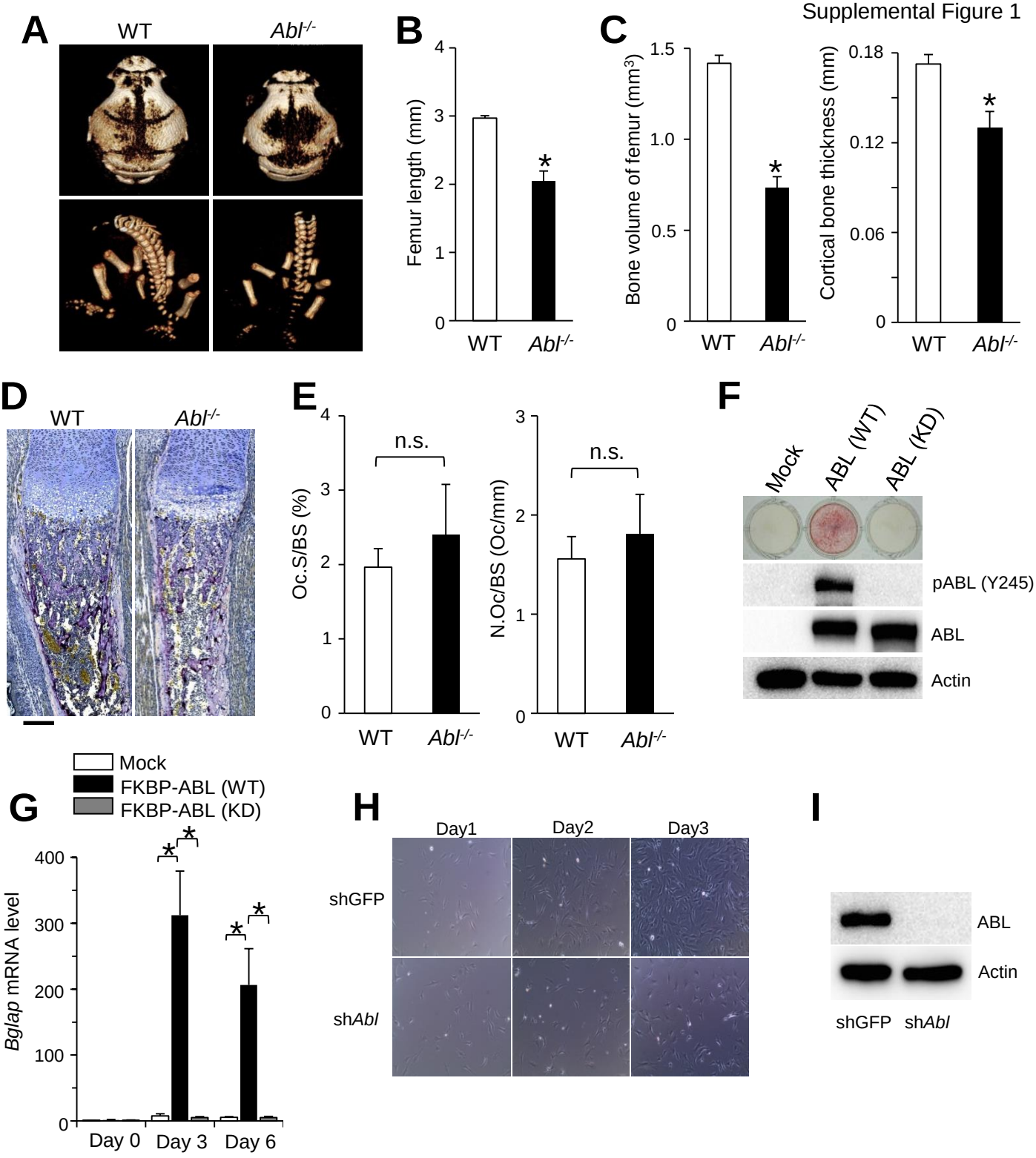
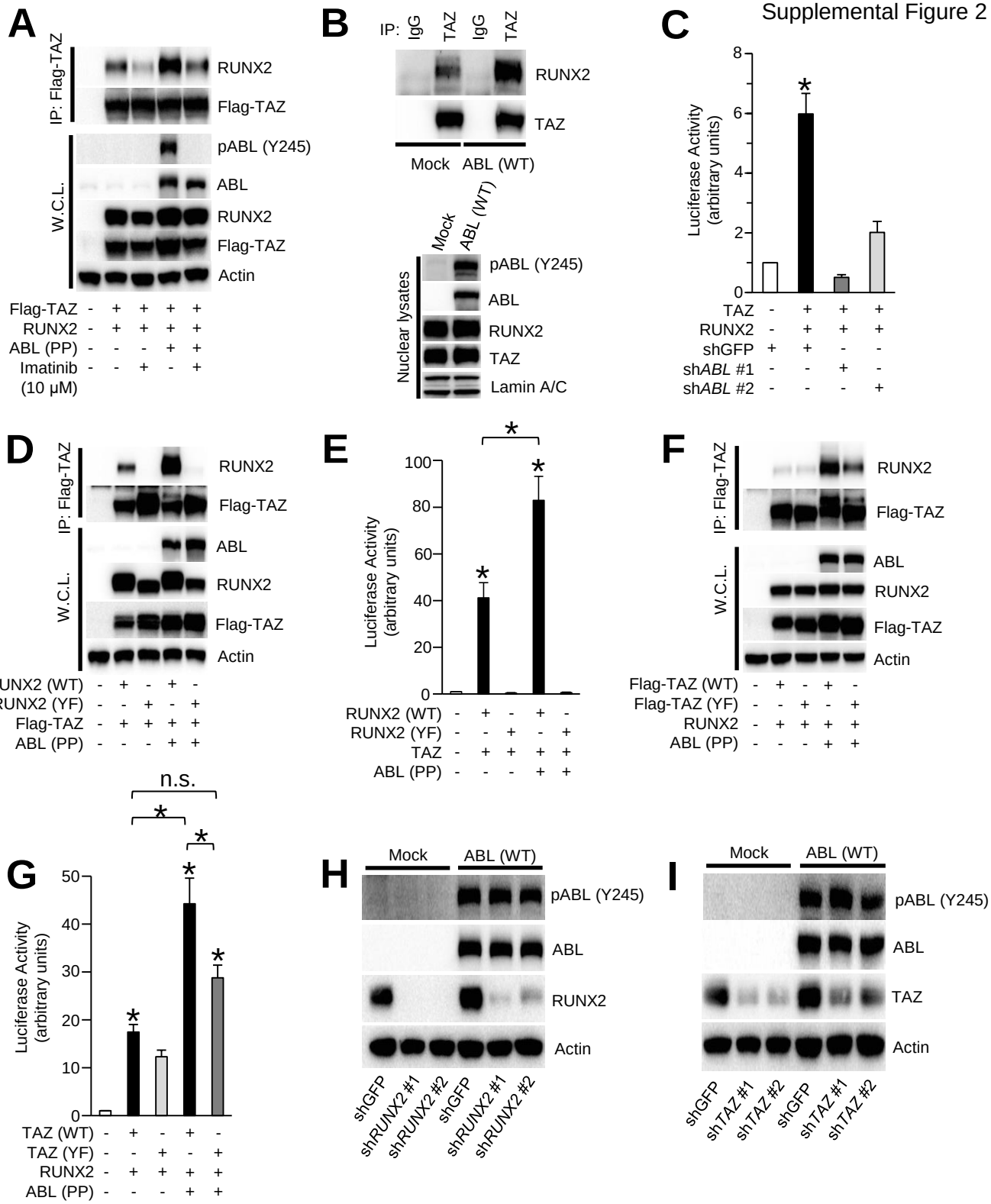
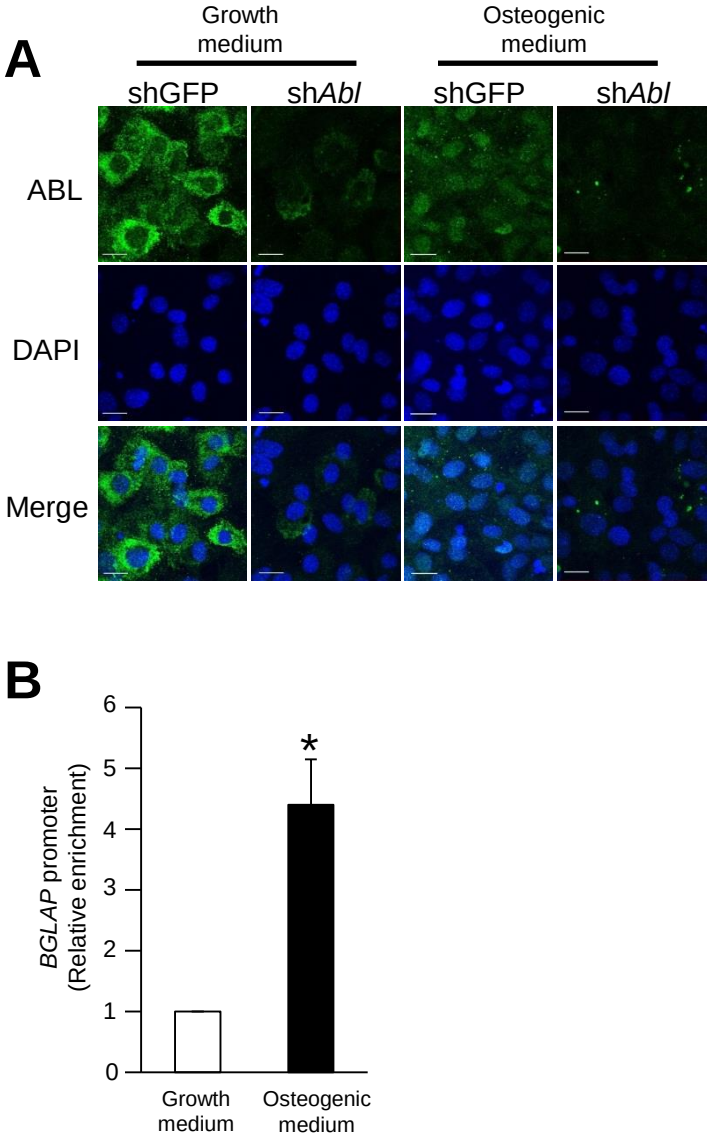


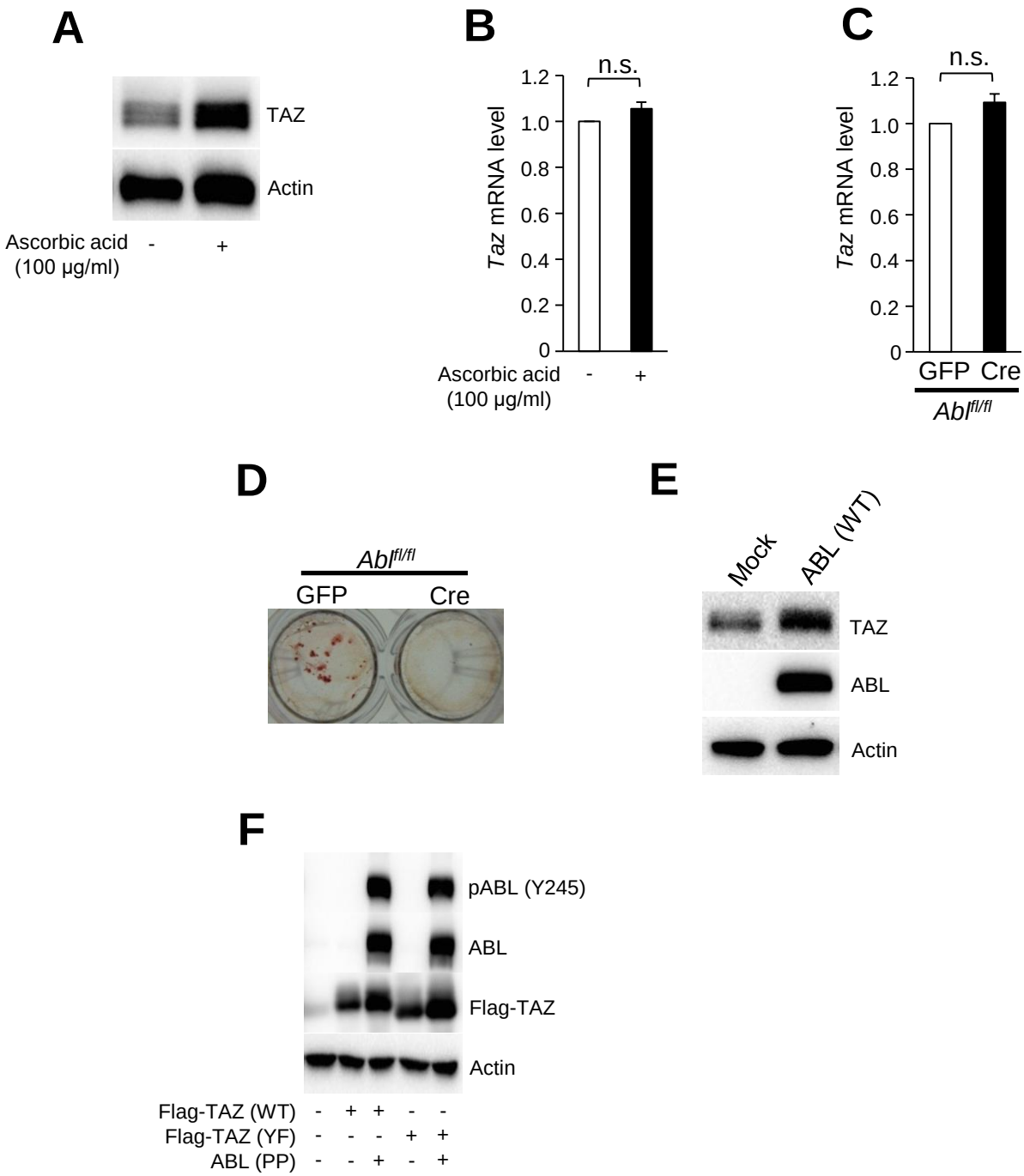
Supplemental Figure 1. ABL is required for osteoblast expansion, differentiation and embryonic skeletal development. (A) μCT reconstruction of calvarium (upper panel) or limbs (lower panel) of wild-type (WT) and *Abl* knockout (*Abl*$^{-/-}$) newborn pups. (B and C) μCT-derived measurements of femur length (B), bone volume of femur (C, left panel) and cortical bone thickness (C, right panel) of WT and *Abl*$^{-/-}$ newborn pups. n = 4. (D) TRAP staining of tibias from WT and *Abl*$^{-/-}$ newborn pups. Scale bars, 200 μm. (E) Histomorphometric analysis of osteoclast surface per bone surface (left panel, Oc.S/BS) and osteoclast number per bone surface (right panel, N.Oc/BS) in WT and *Abl*$^{-/-}$ newborn pups. n = 5. (F) Saos-2 cells infected with an empty vector control or FKBP-ABL (WT or KD) expressing retroviral vector were cultured in growth medium containing 50 nM FK1012 and stained with Alizarin Red-S solution. n = 3. Whole cell lysates were probed with the indicated antibodies for western blot analysis. (G) qPCR analysis of *Bglap* mRNA expression in cells in F cultured for 3-6 days. n = 3. (H) Bright-field images of cells in Figure 1H cultured for 3 days. (I) Whole cell lysates from cells in Figure 1H were probed with the indicated antibodies for western blot analysis. P values were determined by ANOVA with Tukey–Kramer's post hoc test (G) or unpaired t-test (B, C and E). Data are presented as mean ± SEM. *P < 0.05.



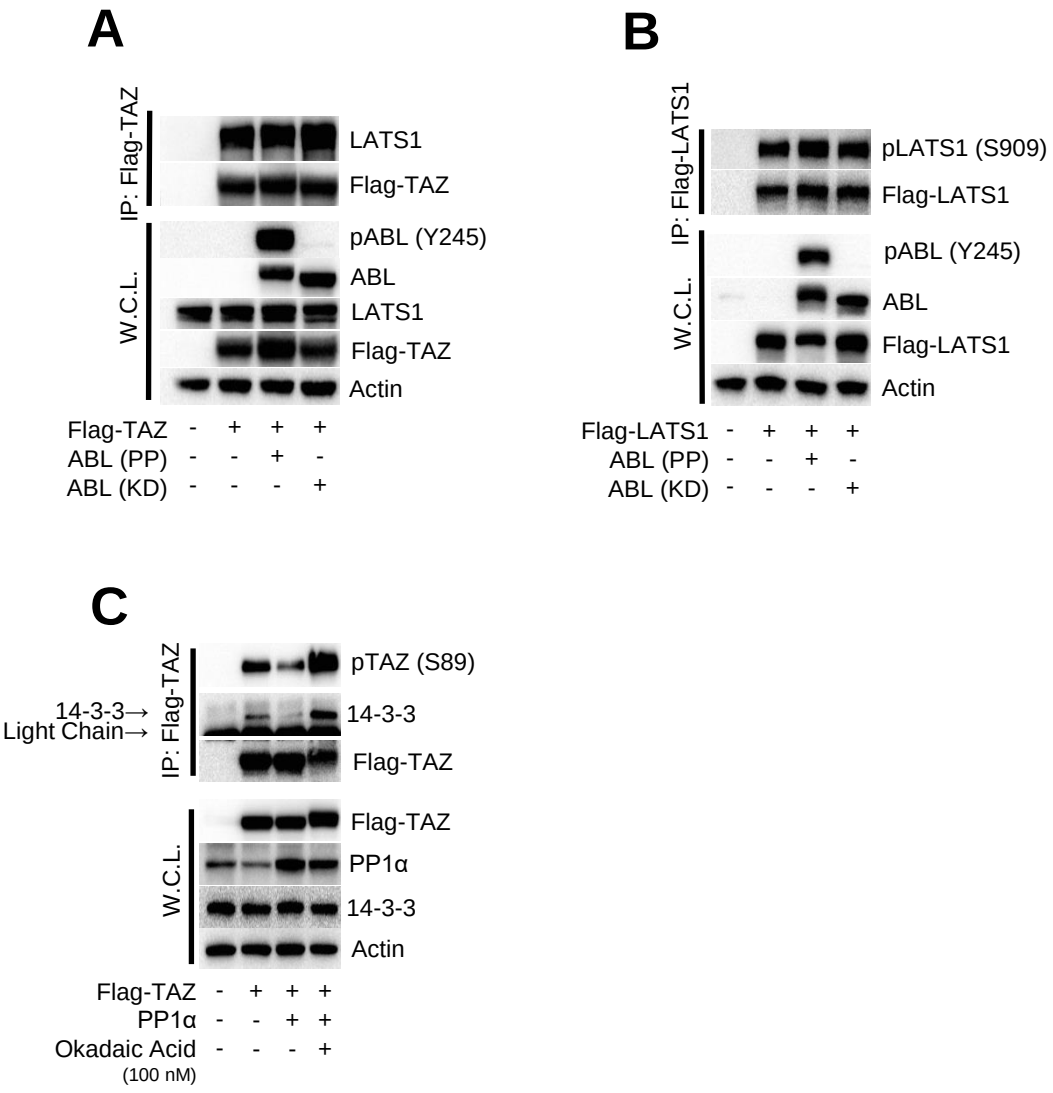
Supplemental Figure 2. Active ABL assembles the RUNX2-TAZ transcription factor complex required for osteoblast differentiation. (A) HEK293T cells co-transfected with Flag-TAZ and RUNX2 with or without ABL (PP) were cultured in the presence or absence of 10 μM imatinib for 24 hours. Flag-TAZ immune complexes were probed with an anti-RUNX2 antibody. (B) Saos-2 cells infected with an empty vector control or FKBP-ABL (WT) expressing retroviral vector were cultured in growth medium containing 50 nM FK1012. The nuclear compartment was extracted from the cells, and TAZ immune complexes were probed with an anti-RUNX2 antibody. (C) Luciferase activity from a *BGLAP* reporter assay in HEK293T cells co-transfected with the indicated constructs in the presence of shGFP or sh*ABL*. n = 3. (D and F) HEK293T cells were co-transfected with the indicated constructs, and Flag-TAZ immune complexes were probed with an anti-RUNX2 antibody. (E and G) Luciferase activity from a *BGLAP* reporter assay in HEK293T cells co-transfected with the indicated constructs. n = 3. (H and I) Whole cell lysates from cells in Figure 2, K and L were probed with the indicated antibodies for western blot analysis. P values were determined by ANOVA with Tukey–Kramer's post hoc test. Data are presented as mean ± SEM. *P < 0.05.



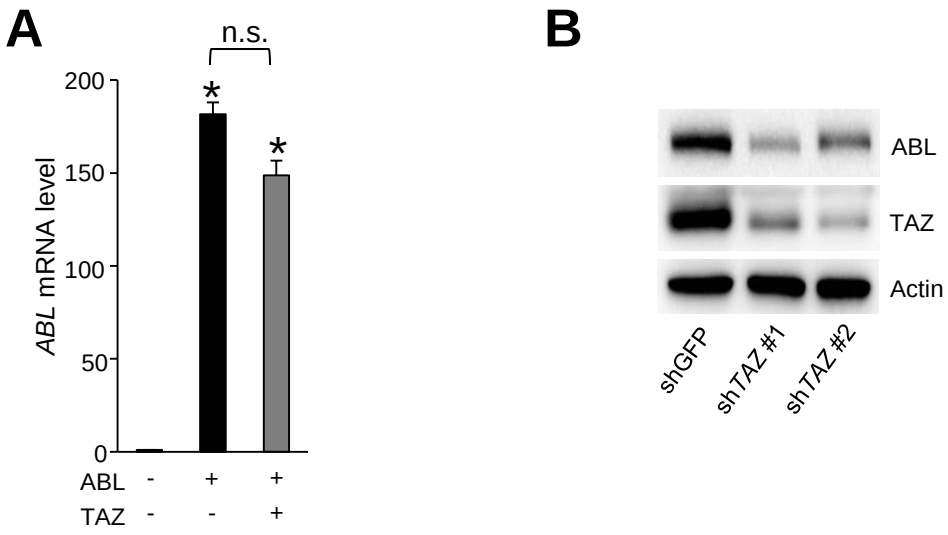
Supplemental Figure 3. Nuclear ABL is required for the RUNX2-TAZ complex transcriptional activity. (A) Primary murine osteoblasts infected with shGFP or sh*Abl* were cultured in growth medium or osteogenic medium and stained by immunofluorescence. Scale bars, 20 μm. The images of intracellular ABL (green) and nuclei (blue) are representative of three independent experiments. (B) qPCR of chromatin immunoprecipitates from Saos-2 cells cultured in growth medium or osteogenic medium. Amplicons were designed flanking the RUNX2 binding site within the *BGLAP* promoter. n = 3. P values were determined by unpaired t-test. Data are presented as mean ± SEM. *P < 0.05.



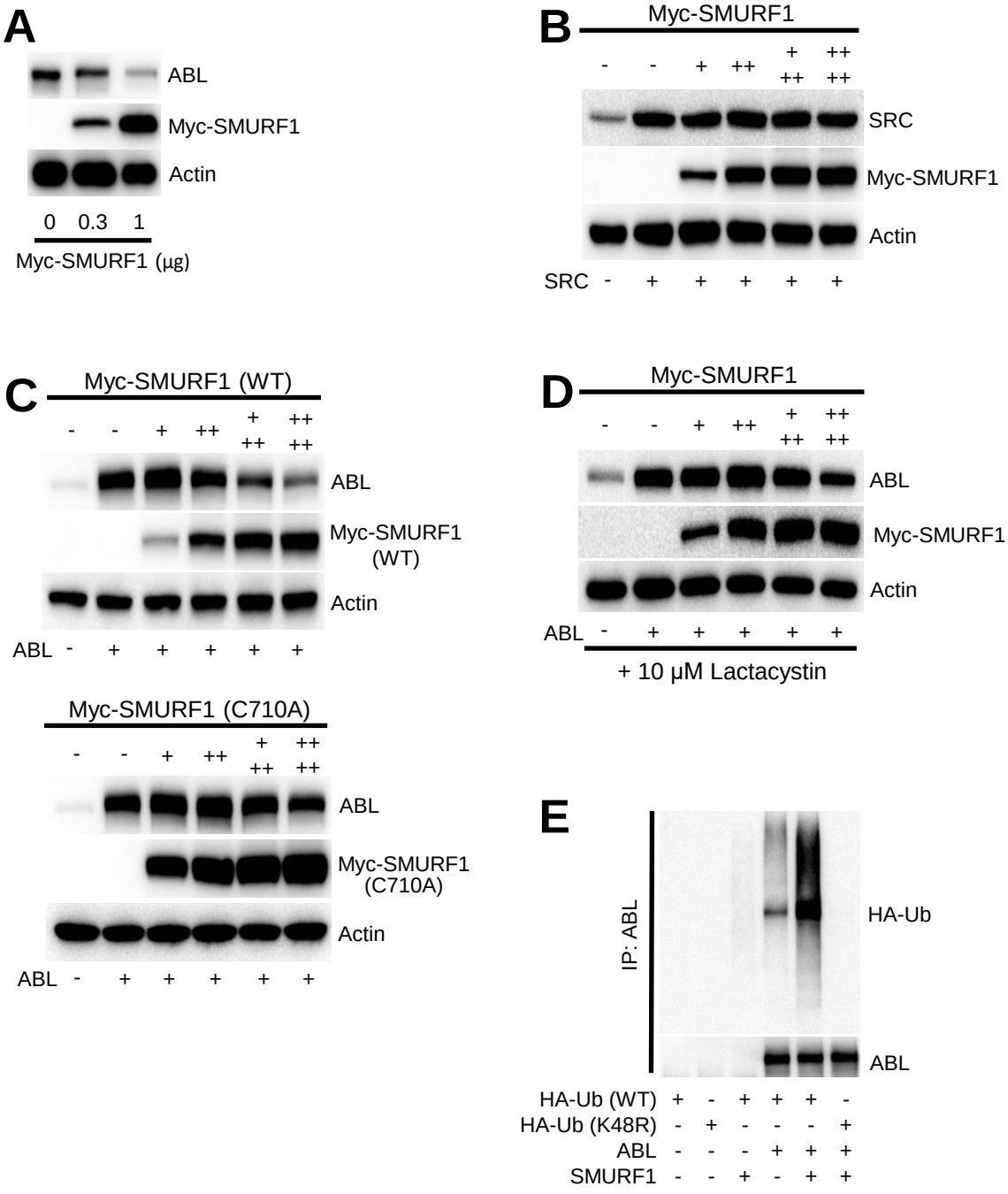
Supplemental Figure 4. ABL stabilizes TAZ through the suppression of a ubiquitin-mediated degradation pathway. (A) MC3T3 cells were cultured in growth medium or growth medium supplemented with 100 μg/ml ascorbic acid. Whole cell lysates were probed with the indicated antibodies for western blot analysis. (B) qPCR analysis of *Taz* mRNA expression in cells in A. n = 3. (C) qPCR analysis of *Taz* mRNA expression in cells in Figure 4B. n = 3. (D) Osteoblasts in Figure 4B were cultured in osteogenic medium and stained with Alizarin Red-S solution. n = 3. (E) Saos-2 cells infected with an empty vector control or FKBP-ABL expressing retroviral vector were cultured in growth medium containing 50 nM FK1012. Whole cell lysates were probed with the indicated antibodies for western blot analysis. (F) HEK293T cells were co-transfected with Flag-TAZ (WT or YF) with or without ABL (PP). Whole cell lysates were probed with the indicated antibodies for western blot analysis. P values were determined by unpaired t-test (B and C). Data are presented as mean ± SEM. *P < 0.05.



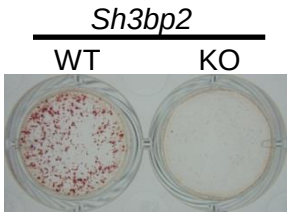
Supplemental Figure 5. ABL stabilizes the TAZ-TEAD complex required for osteoblast expansion. (A and B) HEK293T cells were co-transfected with Flag-TAZ (A) or Flag-LATS1 (B) with or without ABL (PP or KD). Flag immune complexes were probed with an anti-LATS1 (A) or anti-pLATS1 (S909) (B) antibody. (C) HEK293T cells co-transfected with Flag-TAZ with or without PP1α were cultured in the presence or absence of Okadaic Acid (100 nM, 4 hours). Flag-TAZ immune complexes were probed with an anti-pYAP (S127) or anti-14-3-3 antibody.



Supplemental Figure 6. TAZ reciprocally stabilizes and activates ABL through the suppression of a ubiquitin-mediated degradation pathway. (A) qPCR analysis of *ABL* mRNA expression in cells in Figure 6A. n = 3. P values were determined by ANOVA with Tukey–Kramer's post hoc test. Data are presented as mean ± SEM. *P < 0.05. (B) Saos-2 cells were infected with shGFP or sh*TAZ*. Whole cell lysates were probed with the indicated antibodies for western blot analysis.



Supplemental Figure 7. TAZ regulates ABL protein stability by the competitive displacement of the ABL E3-ubiquitin ligase SMURF1. (A) Saos-2 cells were transfected with Myc-SMURF1 (0-1 μg/well). Whole cell lysates were probed with the indicated antibodies for western blot analysis. (B) HEK293T cells were co-transfected with SRC with or without Myc-SMURF1 (0-0.5 μg/well). Whole cell lysates were probed with the indicated antibodies for western blot analysis. (C) HEK293T cells were co-transfected with ABL with or without Myc-SMURF1 (WT or C710A mutant (C710A), 0-0.5 μg/well). Whole cell lysates were probed with the indicated antibodies for western blot analysis. (D) HEK293T cells co-transfected with ABL with or without Myc-SMURF1 (0-0.5 μg/well) were cultured in the presence of lactacystin (10 μM, overnight). Whole cell lysates were probed with the indicated antibodies for western blot analysis. (E) HEK293T cells co-transfected with the indicated constructs were treated with 10 μM MG132 for 4 hours prior to collection of cell lysate. ABL immune complexes were probed with an anti-HA or anti-ABL antibody.



Supplemental Figure 8. The ABL-TAZ amplification loop required for osteoblastogenesis is regulated by the adapter protein 3BP2. Osteoblasts in Figure 8A were cultured in osteogenic medium and stained with Alizarin Red-S solution. n = 3.

Supplemental Methods

Primers.

The sequences of primers are as follows: for human *BGLAP* (forward primer, 5'-CAT GAG AGC CCT CAC ACT CC-3'; reverse primer, 5'-CAG CAG AGC GAC ACC CTA GAC C-3'), mouse *BGLAP* (forward primer, 5'-CTG ACA AAG CCT TCA TGT CCA A-3'; reverse primer, 5'-GCG CCG GAG TCT GTT CAC TA-3'), human *ABL* (forward primer, 5'-TAA TCA CAA TGG GGA ATG GTG-3'; reverse primer, 5'-GTG TTG AAG CGG CTC TCG GAG G-3'), human *CTGF* (forward primer, 5'-CGA CTG GAA GAC ACG TTT GG-3'; reverse primer, 5'-AGG CTT GGA GAT TTT GGG AG-3'), mouse *CTGF* (forward primer, 5'-ACT GGA AGA CAC ATT TGG CC-3'; reverse primer, 5'-GTC TTC ACA CTG GTG CAG CC-3'), mouse *TAZ* (forward primer, 5'-CAG CCT CTG AAT CAT GTG AAC CTC-3'; reverse primer, 5'-GGC TAG TGG CCA CGA CTT GCT GGT-3'), mouse *aP2* (forward primer, 5'-GTG GGA ACC TGG AAG CTT GTC-3'; reverse primer, 5'-CTT CAC CTT CCT GTC GTC TGC-3'), human *RPL19* (forward primer, 5'-GAA GAT CGA TCG CCA CAT GT-3'; reverse primer, 5'-GCG CTC TTC ACG GCG CTT GC-3'), mouse *RPL19* (forward primer, 5'-CTG AAG GTC AAA GGG AAT GTG-3'; reverse primer, 5'-GGA CAG AGT CTT GAT GAT CTC-3').