SUPPLEMENTAL MATERIAL

Helmink et al., http://www.jem.org/cgi/content/full/jem.20081326/DC1

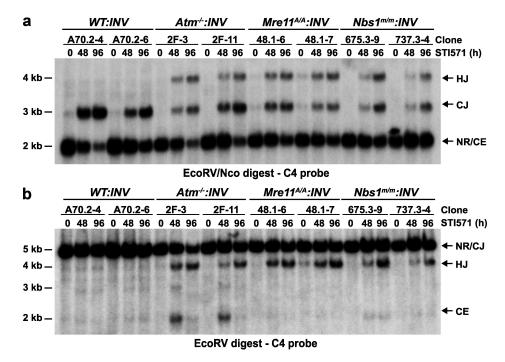


Figure S1. Southern blot analyses of pMX-INV rearrangement on additional abl pre-B cell clones. Analyses were carried out as described in Fig. 1 b (a) and Fig. 1 c (b) on additional abl pre-B cell clones not shown in Fig. 1.

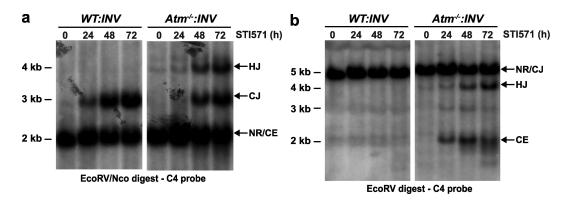


Figure S2. Longer exposure of the WT://NV and Atm^{-/-}://NV Southern blot analyses. The lighter exposure is shown in Fig. 1 d (a) and Fig. 1 e (b).

| | pMX-INV 5'CE | | | pMX-INV 3'CE | | C Mre11A/A | | | | | |
|---|--|-------------------------------------|------------------------|--|----------------------------------|--|------|--|------------------------|--|---|
| _ | tgtcaaaaataataggaacgtctg | | | cagectacaatteegeeeeeeeeta | | pMX-INV 5'CE | P | N | P | pMX-INV 3'CE | Frequency |
| g | tgtcaaaaataataggaacgtctg | | | cagectacaatteegeceeeeceta | | gtgtcaaaaataataggaacgtctg | _ | | _ | cagcctacaattccgcccccccccta | 19 |
| аит | | | | | | gtgtcaaaaataataggaacgtct | | | G | gcctacaattccgcccccccccta | 7 |
| a wr | -107 TWY E' CD | P N | P | -MT TWT 2 0 | | gtgtcaaaaataataggaacgt gtgtcaaaaataataggaacgt | | | G | cagcctacaattccgcccccccccta cagcctacaattccgcccccccccta | 4 |
| | | P N | P | pMX-INV 3'CE caqcctacaattccqccccccccta | Frequency | gtgtcaaaaataataggaacgtct | | | | agcctacaattccgcccccccccta | 3 |
| g. | tgtcaaaaataataggaacgtctg tgtcaaaaataataggaacgt | | G | cagcotacaattccgcccccccccta | 20 8 | gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacg | | | G | caattccgccccccccta cagcctacaattccgccccccccta | 3 |
| g | tgtcaaaaataataggaacgtct | | - | gcctacaattccgcccccccccta | 6 | gtgtcaaaaataataggaacg | | | ď | cagoctacaattccgcccccccccta | 2 |
| g | tgtcaaaaataataagaacgt | | | ctacaattccgccccccccta | 3 | gtgtcaaaaataataggaacgtc | | | G | cagoctacaattccgcccccccccta | 2 |
| | tgtcaaaaataataggaacg tgtcaaaaataataggaacg | CCCC | CTG TG | cagoctacaattccgccccccccta cagoctacaattccgccccccccta | 2 2 | gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacgtctg | | A | | agcctacaattccgcccccccccta agcctacaattccgcccccccccta | 2 |
| | tgtcaaaaataataggaacg | ccci | G | cagcctacaattccgcccccccccta | 2 | gtgtcaaaaataataggaac | | | | gcctacaattccgcccccccccta | 2 |
| g | tgtcaaaaataataggaacgtctg | | | agcctacaattccgcccccccccta | 2 | gtgtcaaaaataataggaacgt | | | _ | ctacaattccgcccccccccta | 2 |
| | tgtcaaaaataataggaacgtct | | | agcctacaattccgcccccccccta | 2 | gtgtcaaaaataataggaacg gtgtcaaaaataataggaacg | | CT | G | cagcctacaatttcgcccccccccta cagcctacaattccgcccccccccta | 1 |
| g | tgtcaaaaataataggaacg tgtcaaaaataataggaacgtct | G AG | G G | cagcctgcaattccgcccccccccta cagcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtc | | c | G | cagcctacaattccgcccccccccta | î |
| g. | tgtcaaaaataataggaacgtct tgtcaaaaataataggaacgtc | CCCG | G | cagoctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtct | | Tro | | cagcctacaattccgcccccccccta | 1 |
| g | tgtcaaaaataataggaacgtc | c | Ğ | cagcctacaattccgcccccccccta | ī | gtgtcaaaaataataggaacgt gtgtcaaaaataataggaacgtctg | | TCG GG | TG | cagectacaatteegeeeeeeeeta geetacaatteegeeeeeeeeta | 1 |
| g | tgtcaaaaataataggaacgt | | | cagcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtct | | AGG | | gcctacaattccgcccccccccta | ī |
| | tgtcaaaaataataggaacg tgtcaaaaataataggaacg | A | TG | cagectacaatteegeeeeeeeeeta cagectacaatteegeeeeeeeeeta | 1 | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtc | | CACTCTGCAA | | cctaccattccgcccccccccta | 1 |
| g | tqtcaaaaataataqqaacq | GG | TG | cagoctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtc gtgtcaaaaataataggaacgtctg | | GAA | | cctacaattccgcccccccccta | 1 |
| q | tgtcaaaaataataggaacg | G | TG | cagcctacaattccgcccccccccta | 1 | gtgtcgaaaataataggaacgtctg | CAGA | | | ctacgattccgcccccccccta | 1 |
| g | tgtcaaaaataataggaacgtctg | G | | agcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacg gtgtcaaaaataataggaacg | | | | ctacaattccgcccccccccta tacaattccgcccccccccta | 1 |
| g | tgtcaaaaataataggaacgtctg tgtcaaaaataataggaacgtctg 3 | AG AGG | | gcctacaattccgcccccccccta gcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacg gtgtcaaaaataataggaac | | A | | tacaattccgccccccccta | 1 |
| a. | tgtcaaaaataataggaacgtctg | G G | | gcctacaattccgccccccccta | î | gtgtcaaaaataataggaacgt | | | | tacaattccgcccccccccta | 1 |
| q. | tgtcaaaaataataggaacg | CCGGGTGCG | | gcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacg | CA | ACT GCCG | | tacaattccgcccccccccta acaattccgcccccccccta | 1 |
| g. | tgtcaaaaataataggaacgtctg | GGT | | gcctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtct | | C | | acaattccgccccccccta | i |
| | tgtcaaaaataataggaacgt tgtcaaaaataataggaacgt | GCAA GCAT | | cctacaatttcgcccccccccta cctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacg | | ccc | | caattccgccccccccta | 1 |
| d. | tqtcaaaaataataqqaacqtct | C | | cctacaattccqccccccccta | î | gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacgt | | | | aattoogoccoccccta aattoogoccocccccta | 1 |
| q | tgtcaaaaataataagaacgtct | CAT | | cctacaattccqcccccccccta | 1 | gtgtcaaaaataataggaacgtctg | | AAG | | ttccgccccccccta | 1 |
| g | tgtcaaaaataataggaacgt | G | | ctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgtctg | | GCACCCTACTT | | ttccgccccccccta | 1 |
| | tgtcaaaaataataggaacg tgtcaaaaataataggaacgtctg | AGAA | | ctacaattccgcccccccccta ctacaattccgcccccccccta | 1 | gtgtcaaaaataataggaacgt gtgtcaaaaataataggaacgtctg | | ATCGC TCCG | | ccccccccta | 1 |
| d. | tgtcaaaaataataggaacgtctg | north | | acaattccgccccccccta | 1 | gtgtcaaaaataataggaacgtctg | c | TCCG | | cccccccta | 1 |
| g | tgtcaaaaataataggaacgtct | | | caattccgccccccccta | 1 | | | | | | 82 |
| | tgtcaaaaataataggaacgt tgtca | TT | | caatteegeceeeeceeta aatteegeceeeeeeta | 1 | | | | | | |
| g. | tgtca tgtcaaaaataataggaacgtctg | AT | | aatteegeeeeeeeta | 1 | C Nbs ^{n/n} | | | | | |
| g | tgtcaaaaataataggaacgt | GCAACCTATC | | attccgccccccccta | ī | pMX-INV 5'CE | P | N | P | pMX-INV 3'CE | Frequency |
| g | tgtcaaaaataataggaacg | G | | attccgccccccccta | 1 | gtgtcgaaaataataggaacgtctg | | | | cagoctactattccgcccccccccta | 13 |
| | | | | | 76 | gtgtcaaaaataataggaacgt | | | G | cagcctacaattccgcccccccccta | 10 |
| | | | | | , , | gtgtcaaaaataataggaacgtct | | | | | |
| _ | | | | | ,, | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg | | | | agcctacaattccgcccccccccta agcctacaattccgcccccccccta | 6 4 |
| b a+m | -/- | | | | 70 | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacg | | | | agcctacaattccgcccccccccta cagcctacaattccgcccccccccta | 6 4 2 |
| b Atm | | P N | р | DMX-INV 3'CE | | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacg gtgtcaaaaataataggaacgtct | | +108 bp insert from J kappa | | agectacaatteegeeeeeeeeta cagectacaatteegeeeeeeeeta geetacaatteegeeeeeeeta | 6 4 2 2 |
| | pMX-INV 5'CE | P N | P | pMX-INV 3'CE | Frequency | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacg gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg gtgtcaaaaataatag | | +108 bp insert from J kappa CA | G | agectacaatteegeceeececta cagectacaatteegeceeececta gectacaatteegeceeececeta tteegeceeececeta cagectactatteegeceeececeta | 6 4 2 2 1 |
| a. | pMX-INV 5'CE 1 tgtcaaaaataataggaacgtctg tgtcaaaaataataggaacgt | P N | P | cagcctacaattccgcccccccccta cagcctacaattccgccccccccta | Frequency | gigtcaaaatatataggaacgict gigtcaaaaataataggaacgict gigtcaaaaataataggaacgict gigtcaaaaataataggaacgict gigtcaaaaataataggaacgictg gigtcaaaaataatag gigtcaaaaataatag | c | +108 bp insert from J kappa CA CCT | TG | agoctacaattcogoccoccoccta cagoctacaattcogoccoccoccta goctacaattcogoccoccoccta ttcogoccoccoccta cagoctactattcogoccoccoccta cagoctacaattcogoccoccoccta | 6 4 2 2 1 1 |
| a. a. a. | pMX-INV 5'CE tgtcaaaaataataggaacgtctg tgtcaaaaataataggaacgt tgtcaaaaataataggaacgt tgtcaaaaataataggaacgt | P N | | cagoctacaattccgccccccccta cagoctacaattccgccccccccta cagoctacaattccgccccccccta | Frequency 18 6 5 | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacgtctg gtgtcaaaaataataggaacgtc gtgtcaaaaataataggaacgtc | | CA | | agoctacaattcogoccoccocta cagoctacaattcogoccoccocta goctacaattcogoccoccocta ttcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta | 6 4 2 2 1 1 1 |
| a. a. a. | pMX-INV 5'CE tgtcaaaaataataggaacgtctg tgtcaaaaataataggaacgt tgtcaaaaataataggaacgt tgtcaaaaataataggaacgt | P N | | cagcctacaattccgccccccccta cagcctacaattccgccccccccta cagcctacaattccgccccccccta cagcctacaattccgccccccccta | Frequency 18 6 5 3 | gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgt gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtct gtgtcaaaaataatag gtgtcaaaaataataggaacgtct gtgtcaaaaataataggaacgtc gtgtcaaaaataataggaacg gtgtcaaaaataataggaacg gtgtcaaaaataataggaacg | | CA CCT G | TG G G G | agoctacaattcogoccoccocta cagoctacaattcogoccoccocta goctacaattcogoccoccocta ttcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccocta cagoctacaattcogoccoccoccta cagoctacaattcogoccoccoccta cagoctacaattcogoccoccoccta | 6 4 2 2 1 1 1 1 |
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| | pMX-INV 5 °CE 1 tyticanaantataggaacytty tyticanaantataggaacyty tyticanaantataggaacyty tyticanaantataggaacyt tyticanaantaggaacyt tyticanaantataggaacyt tyticanaatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaat | AG CCT CCC CA CCC GT AAC CTCCCC CAA | G G G G TG | cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogocococococococo cagot-kacaattogococococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo coco-kacaattogococococococo coco-kacaattogococococococo coco-kacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogocococococococo catacaattogocococococococo catacaattogocococococococo catacaattogocococococococo catacaattogococococococococo catacaattogococococococococo catacaattogococococococococo catacaattogococococococococococococococococococ | 18 6 5 3 3 2 2 2 2 | gtgtcasaaatataggaacgtctg gtgtcasaaataataggaacgtctg gtgtcasaaaataataggaacgtctg gtgtcasaaaataataggaacgtctg gtgtcasaaaataataggaacg | c c | CA CCT G CCT CCCT G CCCT CCCCCCCCCCCCCCC | TG G G G G | agoctanaattoogocococococococococococococococococo | 642211111111111111111111111111111111111 |
| | pMX-INV 5 °CE 1 tytonanatantaggancytt tytonanatantaggancyt tytonanatantaggancy tytonanatantagg | AG CCT CCC CA CCC GT AAC CTCCCC CAA | G G G G TG | cagot-kacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha agotacaattogoccoccoccoccha cagotacaattogoccoccoccoccha caccoccoccoccha coccoccoccoccha coccoccoccoccha coccoccoccoccha coccoccoccoccha coccoccoccoccha coccoccoccoccha coccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccha coccoccoccoccoccha coccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccoccoccha coccoccoccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccoccha coccoccoccoccoccha coccoccoccoccoccoccoccha coccoccoccoccoccoccoccoccoccoccoccoccoc | 18 6 5 3 3 2 2 2 2 | gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtctg gtgtcasaaatataggaacgtc gtgtcasaaatataggaacg gtgtcasaaataataggaacg gtgtcasaaataataggaacg gtgtcasaaataataggaacg gtgtcasaaataataggaacg gtgtcasaaataataggaacg gtgtcasaaataataggaacgtct gtgtcasaaataataggaacgtctg gtgtcasaaataataggaacgtcg gtgtcasaaataataggaacgtcg gtgtcasaaataataggaacgtcg gtgtcasaaataataggaacgtcg gtgtcasaaataataggaacg | c | CA CCT G CCT CCCT CCCT CCCT CCCCG CC CC CC AA T CAA AAGGCAC TTCC CCAC CCA | TG G G G G | agoctanaattongencencoccota agoctanaattongencencoccota agoctanattongencencoccota agoctanattongencencoccota agoctanattongencencoccota agoctanattongencencoccota agoctanattongencencoccota agoctanattongencencoccota agoctanaattongencencoccota cotanaattongencencoccocca cotanaattongencencoccocca actanaattongencencoccocca cotanaattongencencoccocca cotanaattongencencoccocca cotanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca actanaattongencencoccocca aattongencencoccocca aattongencencoccca attongencencoccca attongencencoccca attongencencoccca attongencencoccca attongencencoccca actongencencoccca act | 642211111111111111111111111111111111111 |
| | pMX-INV 5 °CE 1 tyticanaantataggaacytty tyticanaantataggaacyty tyticanaantataggaacyty tyticanaantataggaacyt tyticanaantaggaacyt tyticanaantataggaacyt tyticanaatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaatatataggaacyt tyticanaat | AG CCT CCC CA CCC GT AAC CTCCCC CAA | G G G G TG | cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogocococococococo cagot-kacaattogococococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogocococococo cagot-kacaattogococococococo cagot-kacaattogococococococo cagot-kacaattogococococococo coco-kacaattogococococococo coco-kacaattogococococococo coco-kacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogococococococo catacaattogocococococococo catacaattogocococococococo catacaattogocococococococo catacaattogocococococococo catacaattogococococococococo catacaattogococococococococo catacaattogococococococococo catacaattogococococococococococococococococococ | 18 6 5 3 3 2 2 2 2 | gtgtcasaaatataggaacgtctg gtgtcasaaataataggaacgtctg gtgtcasaaaataataggaacgtctg gtgtcasaaaataataggaacgtctg gtgtcasaaaataataggaacg | c c | CA CCT G CCT CCCT G CCCT CCCCCCCCCCCCCCC | TG G G G G | agoctanaattoogocococococococococococococococococo | 642211111111111111111111111111111111111 |

Figure S3. Sequences of pMX-INV coding joints from WT:INV, Atm^{-/-}:INV, Mre11^{A/A}:INV, and Nbs1^{m/m}:INV abl pre-B cells. N and P nucleotides are indicated, as are potential microhomologies (red). Complete coding end sequence is noted at the top of the figure.

| | pMX-DEL ^{SJ} 5'SE | | pMX-DEL ^{sj} 3'SE | |
|----------------|--|---|--|---|
| | ttttgttccagtctgtagcactgtg | • | cacagtggtagtactccactgtctggc | |
| ам | T | | | |
| | pMX-DEL ^{sj} 5'SE | N | pMX-DEL ^{sj} 3'SE | Frequency |
| | ttttgttccagtctgtagcactgtg | 0 | cacagtggtagtactccactgtctggc | 56 |
| | ttttgttccagtctgtagcactgtg | GAG | cacagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | AG | cagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | GGCACAGTG | ggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | TGTG | ggtagtactccactgtctggc | 1 |
| | | | | 60 |
| b A | tm ^{-/-} | | 67 | |
| | pMX-DEL ^{sj} 5'SE | N | pMX-DEL st 3'SE | Frequency |
| | ttttgttccagtctgtagcactgtg | 0 | cacagtggtagtactccactgtctggc | 69 |
| | ttttgttccagtctgtagcactgtg | GGG | acagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | G | cacagtggtagtactccactgtctggc | 1 |
| _ | - 4- | | | 71 |
| См | Ire11 ^{A/A} pMX-DEL ^{SJ} 5'SE | N | pMX-DEL ^{sj} 3'SE | Evoguengu |
| | | | | Frequency |
| | ttttgttccagtctgtagcactgtg | 0 | cacagtggtagtactccactgtctggc | 84 1 |
| | ttttgttccagtctgtagcactgtg | AG CGTG | cacagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcac ttttgttccagtctgtagcactgtg | 0 | cacagtggtagtactccactgtctggc agtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | 0 | cagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactg | CG | cacagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | GA | cacagtggtagtactccactgtctggc | 1 |
| | | | | 90 |
| d _N | $bs^{m/m}$ | | | |
| | pMX-DEL ^{sj} 5'SE | N | pMX-DEL ^{sj} 3'SE | Frequency |
| | ttttgttccagtctgtagcactgtg | | cacagtggtagtactccactgtctggc | 61 |
| | ttttgttccagtctgtagcactgtg | A | agtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | GCC | cacagtggtagtactccactgtctggc | 1 |
| | *** | AGCA | ananataat nat nat annat at at at | |
| | ttttgttccagtctgtagcactg | | cacagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg | GCCCTG | cacagtggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc | 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G CC | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G CC AT | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg -67 ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG A | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc gtctggc | 1 1 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg -67 ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG A CC | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc gtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg -67 ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgt | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG A CC TCCGCCCCCCCCTGTG | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc gtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg -67 ttttgttccagtctgtagcactgt ttttgttccagtctgtagcactgt | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG A CC TCCGCCCCCCCCCTGTG AAGGG | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 1 1 1 1 1 |
| | ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg -67 ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgtg ttttgttccagtctgtagcactgt | GCCCTG GTCCACG G CC AT CTCTGTTCCACTGTG A CC TCCGCCCCCCCCTGTG | cacagtggtagtactccactgtctggc tggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc gtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc cacagtggtagtactccactgtctggc | 1 1 1 1 1 1 1 1 |

Figure S4. Sequences of pMX-DEL^{SJ} signal joints from WT:DEL^{SJ}, Atm-J-:DEL^{SJ}, Mre11^{A/A}:DEL^{SJ}, and Nbs1^{m/m}:DEL^{SJ} abl pre-B cells. The complete signal end sequences are noted at the top of the figure.

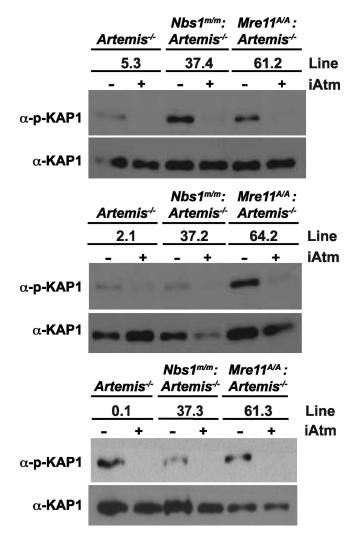


Figure S5. Analysis of KAP-1 phosphorylation carried out as described in Fig. 4 a on additional *Artemis*-/-, *Artemis*-/-:*Nbs*1^{m/m}, and *Artemis*-/-:*Mre*11^{A/A} abl pre-B cell lines.

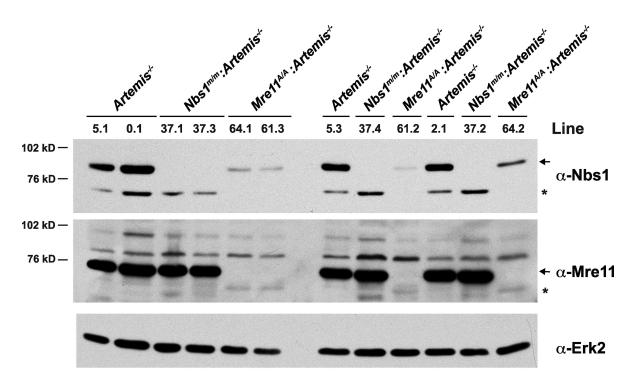


Figure S6. Nbs1 and Mre11 western blot analyses in the different *Artemis-/-*. *Artemis-/-:Nbs1*^{m/m}, and *Artemis-/-:Mre11*^{A/A} abl pre-B cells analyzed. Erk2 is shown as a protein loading control. The arrows indicate the native WT Nbs1 and Mre11 proteins. The asterisks indicate bands of expected size for the hypomorphic Nbs1 and Mre11 proteins. The identity of the band in the *Artemis-/-* abl pre-B cells that is of similar size to that expected for the Nbs1^m hypomorphic protein is not known.

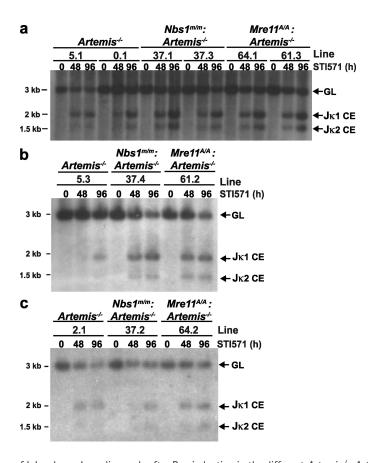


Figure S7. Southern blot analyses of IgL- κ locus J κ coding ends after Rag induction in the different Artemis-/-, Artemis-

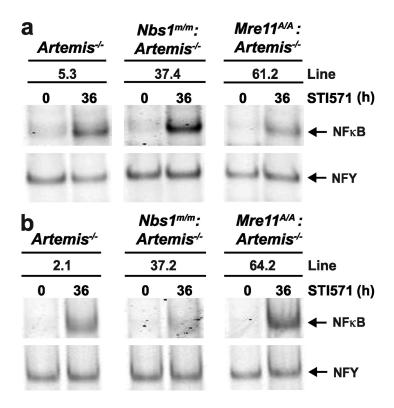


Figure S8. EMSA analyses of NF- κ B translocation to the nucleus in the additional *Artemis*-/-, *Artemis*-/-:*Nbs1*^{m/m}, and *Artemis*-/-:*Mre11*^{A/A} abl pre-B cells not analyzed in Fig. 4 c. Analyses were carried out as described in Fig. 4 c.